

Amazon Fine Food Reviews Analysis

Data Source: <https://www.kaggle.com/snap/amazon-fine-food-reviews> (<https://www.kaggle.com/snap/amazon-fine-food-reviews>).

EDA: <https://nycdatascience.com/blog/student-works/amazon-fine-foods-visualization/>
(<https://nycdatascience.com/blog/student-works/amazon-fine-foods-visualization/>).

The Amazon Fine Food Reviews dataset consists of reviews of fine foods from Amazon.

Number of reviews: 568,454

Number of users: 256,059

Number of products: 74,258

Timespan: Oct 1999 - Oct 2012

Number of Attributes/Columns in data: 10

Attribute Information:

1. Id
2. ProductId - unique identifier for the product
3. UserId - unique identifier for the user
4. ProfileName
5. HelpfulnessNumerator - number of users who found the review helpful
6. HelpfulnessDenominator - number of users who indicated whether they found the review helpful or not
7. Score - rating between 1 and 5
8. Time - timestamp for the review
9. Summary - brief summary of the review
10. Text - text of the review

Objective:

Given a review, determine whether the review is positive (rating of 4 or 5) or negative (rating of 1 or 2).

[Q] How to determine if a review is positive or negative?

[Ans] We could use Score/Rating. A rating of 4 or 5 can be considered as a positive review. A rating of 1 or 2 can be considered as negative one. A review of rating 3 is considered neutral and such reviews are ignored from our analysis. This is an approximate and proxy way of determining the polarity (positivity/negativity) of a review.

[1]. Reading Data

[1.1] Loading the data

The dataset is available in two forms

1. .csv file
2. SQLite Database

In order to load the data, We have used the SQLITE dataset as it is easier to query the data and visualise the data efficiently.

Here as we only want to get the global sentiment of the recommendations (positive or negative), we will purposefully ignore all Scores equal to 3. If the score is above 3, then the recommendation will be set to "positive". Otherwise, it will be set to "negative".

```
In [4]: %matplotlib inline
import warnings
warnings.filterwarnings("ignore")

import sqlite3
import pandas as pd
import numpy as np
import nltk
import string
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.feature_extraction.text import TfidfVectorizer

from sklearn.feature_extraction.text import CountVectorizer
from sklearn.metrics import confusion_matrix
from sklearn import metrics
from sklearn.metrics import roc_curve, auc
from nltk.stem.porter import PorterStemmer

import re
# Tutorial about Python regular expressions: https://pymotw.com/2/re/
import string
from nltk.corpus import stopwords
from nltk.stem import PorterStemmer
from nltk.stem.wordnet import WordNetLemmatizer

from gensim.models import Word2Vec
from gensim.models import KeyedVectors
import pickle

from tqdm import tqdm
import os
```

```
In [2]: # using SQLite Table to read data.
con = sqlite3.connect('database.sqlite')

# filtering only positive and negative reviews i.e.
# not taking into consideration those reviews with Score=3
# SELECT * FROM Reviews WHERE Score != 3 LIMIT 500000, will give top 500000
data points
# you can change the number to any other number based on your computing power

# filtered_data = pd.read_sql_query(""" SELECT * FROM Reviews WHERE Score != 3 LIMIT 500000""", con)
# for tsne assignment you can take 5k data points

filtered_data = pd.read_sql_query(""" SELECT * FROM Reviews WHERE Score != 3 LIMIT 5000""", con)

# Give reviews with Score>3 a positive rating(1), and reviews with a score<3 a negative rating(0).
def partition(x):
    if x < 3:
        return 0
    return 1

#changing reviews with score less than 3 to be positive and vice-versa
actualScore = filtered_data['Score']
positiveNegative = actualScore.map(partition)
filtered_data['Score'] = positiveNegative
print("Number of data points in our data", filtered_data.shape)
filtered_data.head(3)
```

Number of data points in our data (5000, 10)

Out[2]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	Helpfulne
0	1	B001E4KFG0	A3SGXH7AUHU8GW	delmartian	1	1
1	2	B00813GRG4	A1D87F6ZCVE5NK	dll pa	0	0
2	3	B000LQOCH0	ABXLMWJIXXAIN	Natalia Corres "Natalia Corres"	1	1

In [3]:

```
display = pd.read_sql_query("""
SELECT UserId, ProductId, ProfileName, Time, Score, Text, COUNT(*)
FROM Reviews
GROUP BY UserId
HAVING COUNT(*)>1
""", con)
```

```
In [4]: print(display.shape)
display.head()
```

```
(80668, 7)
```

```
Out[4]:
```

	UserId	ProductId	ProfileName	Time	Score	Text	COU
0	#oc-R115TNMSPFT9I7	B007Y59HVM	Breyton	1331510400	2	Overall its just OK when considering the price...	2
1	#oc-R11D9D7SHXJB9	B005HG9ET0	Louis E. Emory "hoppy"	1342396800	5	My wife has recurring extreme muscle spasms, u...	3
2	#oc-R11DNU2NBKQ23Z	B007Y59HVM	Kim Cieszykowski	1348531200	1	This coffee is horrible and unfortunately not ...	2
3	#oc-R11O5J5ZVQE25C	B005HG9ET0	Penguin Chick	1346889600	5	This will be the bottle that you grab from the...	3
4	#oc-R12KPBODL2B5ZD	B007OSBE1U	Christopher P. Presta	1348617600	1	I didnt like this coffee. Instead of telling y...	2



```
In [5]: display[display['UserId']=='AZY10LLTJ71NX']
```

```
Out[5]:
```

	UserId	ProductId	ProfileName	Time	Score	Text
80638	AZY10LLTJ71NX	B006P7E5ZI	undertheshrine "undertheshrine"	1334707200	5	I was recommended to try green tea extract to ...



```
In [6]: display['COUNT(*)'].sum()
```

```
Out[6]: 393063
```

[2] Exploratory Data Analysis

[2.1] Data Cleaning: Deduplication

It is observed (as shown in the table below) that the reviews data had many duplicate entries. Hence it was necessary to remove duplicates in order to get unbiased results for the analysis of the data. Following is an example:

```
In [7]: display= pd.read_sql_query("""
SELECT *
FROM Reviews
WHERE Score != 3 AND UserId="AR5J8UI46CURR"
ORDER BY ProductID
""", con)
display.head()
```

Out[7]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	Helpful
0	78445	B000HDL1RQ	AR5J8UI46CURR	Geetha Krishnan	2	2
1	138317	B000HDOPYC	AR5J8UI46CURR	Geetha Krishnan	2	2
2	138277	B000HDOPYM	AR5J8UI46CURR	Geetha Krishnan	2	2
3	73791	B000HDOPZG	AR5J8UI46CURR	Geetha Krishnan	2	2
4	155049	B000PAQ75C	AR5J8UI46CURR	Geetha Krishnan	2	2

As it can be seen above that same user has multiple reviews with same values for HelpfulnessNumerator, HelpfulnessDenominator, Score, Time, Summary and Text and on doing analysis it was found that

ProductId=B000HDOPZG was Loacker Quadratini Vanilla Wafer Cookies, 8.82-Ounce Packages (Pack of 8)

ProductId=B000HDL1RQ was Loacker Quadratini Lemon Wafer Cookies, 8.82-Ounce Packages (Pack of 8) and so on

It was inferred after analysis that reviews with same parameters other than ProductId belonged to the same product just having different flavour or quantity. Hence in order to reduce redundancy it was decided to eliminate the rows having same parameters.

The method used for the same was that we first sort the data according to ProductId and then just keep the first similar product review and delete the others. for eg. in the above just the review for ProductId=B000HDL1RQ remains. This method ensures that there is only one representative for each product and deduplication without sorting would lead to possibility of different representatives still existing for the same product.

```
In [8]: #Sorting data according to ProductId in ascending order
sorted_data=filtered_data.sort_values('ProductId', axis=0, ascending=True,
inplace=False, kind='quicksort', na_position='last')
```

```
In [9]: #Deduplication of entries
final=sorted_data.drop_duplicates(subset={"UserId","ProfileName","Time","Text"}, keep='first', inplace=False)
final.shape
```

```
Out[9]: (4986, 10)
```

```
In [10]: #Checking to see how much % of data still remains
(final['Id'].size*1.0)/(filtered_data['Id'].size*1.0)*100
```

```
Out[10]: 99.72
```

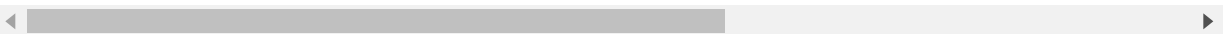
Observation:- It was also seen that in two rows given below the value of HelpfulnessNumerator is greater than HelpfulnessDenominator which is not practically possible hence these two rows too are removed from calculations


```
In [11]: display= pd.read_sql_query("""
SELECT *
FROM Reviews
WHERE Score != 3 AND Id=44737 OR Id=64422
ORDER BY ProductID
""", con)

display.head()
```

Out[11]:

	Id	ProductId	UserId	ProfileName	HelpfulnessNumerator	Helpful
0	64422	B000MIDROQ	A161DK06JJMCYF	J. E. Stephens "Jeanne"	3	1
1	44737	B001EQ55RW	A2V0I904FH7ABY	Ram	3	2



```
In [12]: final=final[final.HelpfulnessNumerator<=final.HelpfulnessDenominator]
```

```
In [13]: #Before starting the next phase of preprocessing Lets see the number of ent
ries left
print(final.shape)

#How many positive and negative reviews are present in our dataset?
final['Score'].value_counts()

(4986, 10)
```

```
Out[13]: 1    4178
0     808
Name: Score, dtype: int64
```

[3] Preprocessing

[3.1]. Preprocessing Review Text

Now that we have finished deduplication our data requires some preprocessing before we go on further with analysis and making the prediction model.

Hence in the Preprocessing phase we do the following in the order below:-

1. Begin by removing the html tags
2. Remove any punctuations or limited set of special characters like , or . or # etc.
3. Check if the word is made up of english letters and is not alpha-numeric
4. Check to see if the length of the word is greater than 2 (as it was researched that there is no adjective in 2-letters)
5. Convert the word to lowercase
6. Remove Stopwords
7. Finally Snowball Stemming the word (it was observed to be better than Porter Stemming)

After which we collect the words used to describe positive and negative reviews

```
In [14]: # printing some random reviews
sent_0 = final['Text'].values[0]
print(sent_0)
print("="*50)

sent_1000 = final['Text'].values[1000]
print(sent_1000)
print("="*50)

sent_1500 = final['Text'].values[1500]
print(sent_1500)
print("="*50)

sent_4900 = final['Text'].values[4900]
print(sent_4900)
print("="*50)
```

Why is this \$[...] when the same product is available for \$[...] here?
<http://www.amazon.com/VICTOR-FLY-MAGNET-BAIT-REFILL/dp/B00004RBDY>

The Victor M380 and M502 traps are unreal, of course -- total fly genocide. Pretty stinky, but only right nearby.

=====

I recently tried this flavor/brand and was surprised at how delicious these chips are. The best thing was that there were a lot of "brown" chips in the bag (my favorite), so I bought some more through amazon and shared with family and friends. I am a little disappointed that there are not, so far, very many brown chips in these bags, but the flavor is still very good. I like them better than the yogurt and green onion flavor because they do not seem to be as salty, and the onion flavor is better. If you haven't eaten Kettle chips before, I recommend that you try a bag before buying bulk. They are thicker and crunchier than Lays but just as fresh out of the bag.

=====

Wow. So far, two two-star reviews. One obviously had no idea what they were ordering; the other wants crispy cookies. Hey, I'm sorry; but these reviews do nobody any good beyond reminding us to look before ordering.

These are chocolate-oatmeal cookies. If you don't like that combination, don't order this type of cookie. I find the combo quite nice, really. The oatmeal sort of "calms" the rich chocolate flavor and gives the cookie sort of a coconut-type consistency. Now let's also remember that tastes differ; so, I've given my opinion.

Then, these are soft, chewy cookies -- as advertised. They are not "crispy" cookies, or the blurb would say "crispy," rather than "chewy." I happen to like raw cookie dough; however, I don't see where these taste like raw cookie dough. Both are soft, however, so is this the confusion? And, yes, they stick together. Soft cookies tend to do that. They aren't individually wrapped, which would add to the cost. Oh yeah, chocolate chip cookies tend to be somewhat sweet.

So, if you want something hard and crisp, I suggest Nabisco's Ginger Snaps. If you want a cookie that's soft, chewy and tastes like a combination of chocolate and oatmeal, give these a try. I'm here to place my second order.

=====

I love to order my coffee on amazon. easy and shows up quickly.
This cup is great coffee. dcaf is very good as well

=====

```
In [15]: # remove urls from text python: https://stackoverflow.com/a/40823105/4084039
sent_0 = re.sub(r"http\S+", "", sent_0)
sent_1000 = re.sub(r"http\S+", "", sent_1000)
sent_150 = re.sub(r"http\S+", "", sent_1500)
sent_4900 = re.sub(r"http\S+", "", sent_4900)

print(sent_0)
```

Why is this \$[...] when the same product is available for \$[...] here?
 />
The Victor M380 and M502 traps are unreal, of course -- total fly genocide. Pretty stinky, but only right nearby.

```
In [16]: # https://stackoverflow.com/questions/16206380/python-beautifulsoup-how-to-  
remove-all-tags-from-an-element  
from bs4 import BeautifulSoup  
  
soup = BeautifulSoup(sent_0, 'lxml')  
text = soup.get_text()  
print(text)  
print("="*50)  
  
soup = BeautifulSoup(sent_1000, 'lxml')  
text = soup.get_text()  
print(text)  
print("="*50)  
  
soup = BeautifulSoup(sent_1500, 'lxml')  
text = soup.get_text()  
print(text)  
print("="*50)  
  
soup = BeautifulSoup(sent_4900, 'lxml')  
text = soup.get_text()  
print(text)
```

Why is this \$[...] when the same product is available for \$[...] here? />The Victor M380 and M502 traps are unreal, of course -- total fly genocide. Pretty stinky, but only right nearby.

=====

I recently tried this flavor/brand and was surprised at how delicious these chips are. The best thing was that there were a lot of "brown" chips in the bsg (my favorite), so I bought some more through amazon and shared with family and friends. I am a little disappointed that there are not, so far, very many brown chips in these bags, but the flavor is still very good. I like them better than the yogurt and green onion flavor because they do not seem to be as salty, and the onion flavor is better. If you haven't eaten Kettle chips before, I recommend that you try a bag before buying bulk. They are thicker and crunchier than Lays but just as fresh out of the bag.

=====

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=====

love to order my coffee on amazon. easy and shows up quickly. This k cup is great coffee. dcaf is very good as well

In [17]: `# https://stackoverflow.com/a/47091490/4084039`
`import re`

```
def decontracted(phrase):
    # specific
    phrase = re.sub(r"won't", "will not", phrase)
    phrase = re.sub(r"can't", "can not", phrase)

    # general
    phrase = re.sub(r"n't", " not", phrase)
    phrase = re.sub(r"\'re", " are", phrase)
    phrase = re.sub(r"\'s", " is", phrase)
    phrase = re.sub(r"\'d", " would", phrase)
    phrase = re.sub(r"\'ll", " will", phrase)
    phrase = re.sub(r"\'t", " not", phrase)
    phrase = re.sub(r"\'ve", " have", phrase)
    phrase = re.sub(r"\'m", " am", phrase)
    return phrase
```

```
In [18]: sent_1500 = decontracted(sent_1500)
print(sent_1500)
print("="*50)
```

Wow. So far, two two-star reviews. One obviously had no idea what they were ordering; the other wants crispy cookies. Hey, I am sorry; but these reviews do nobody any good beyond reminding us to look before ordering.
These are chocolate-oatmeal cookies. If you do not like that combination, do not order this type of cookie. I find the combo quite nice, really. The oatmeal sort of "calms" the rich chocolate flavor and gives the cookie sort of a coconut-type consistency. Now let us also remember that tastes differ; so, I have given my opinion.
Then, these are soft, chewy cookies -- as advertised. They are not "crispy" cookies, or the blurb would say "crispy," rather than "chewy." I happen to like raw cookie dough; however, I do not see where these taste like raw cookie dough. Both are soft, however, so is this the confusion? And, yes, they stick together. Soft cookies tend to do that. They are not individually wrapped, which would add to the cost. Oh yeah, chocolate chip cookies tend to be somewhat sweet.
So, if you want something hard and crisp, I suggest Nabisco is Ginger Snaps. If you want a cookie that is soft, chewy and tastes like a combination of chocolate and oatmeal, give these a try. I am here to place my second order.

=====

```
In [19]: #remove words with numbers python: https://stackoverflow.com/a/18082370/4084039
sent_0 = re.sub("\S*\d\S*", "", sent_0).strip()
print(sent_0)
```

Why is this \$[...] when the same product is available for \$[...] here?
The Victor and traps are unreal, of course -- total fly genocide. Pretty stinky, but only right nearby.

```
In [20]: #remove spacial character: https://stackoverflow.com/a/5843547/4084039
sent_1500 = re.sub('[^A-Za-z0-9]+', ' ', sent_1500)
print(sent_1500)
```

Wow So far two two star reviews One obviously had no idea what they were ordering the other wants crispy cookies Hey I am sorry but these reviews do nobody any good beyond reminding us to look before ordering
br br These are chocolate oatmeal cookies If you do not like that combination do not order this type of cookie I find the combo quite nice really The oatmeal sort of calms the rich chocolate flavor and gives the cookie sort of a coconut type consistency Now let us also remember that tastes differ so I have given my opinion
br br Then these are soft chewy cookies as advertised They are not crispy cookies or the blurb would say crispy rather than chewy I happen to like raw cookie dough however I do not see where these taste like raw cookie dough Both are soft however so is this the confusion And yes they stick together Soft cookies tend to do that They are not individually wrapped which would add to the cost Oh yeah chocolate chip cookies tend to be somewhat sweet
br br So if you want something hard and crisp I suggest Nabisco is Ginger Snaps If you want a cookie that is soft chewy and tastes like a combination of chocolate and oatmeal give these a try I am here to place my second order

```
In [21]: # https://gist.github.com/sebleier/554280
# we are removing the words from the stop words list: 'no', 'nor', 'not'
# <br /><br /> ==> after the above steps, we are getting "br br"
# we are including them into stop words list
# instead of <br /> if we have <br/> these tags would have revmoved in the
# 1st step

stopwords= set(['br', 'the', 'i', 'me', 'my', 'myself', 'we', 'our', 'ours',
, 'ourselves', 'you', "you're", "you've",\
    "you'll", "you'd", 'your', 'yours', 'yourself', 'yourselves',
'he', 'him', 'his', 'himself', \
    'she', "she's", 'her', 'hers', 'herself', 'it', "it's", 'its',
'itself', 'they', 'them', 'their',\
    'theirs', 'themselves', 'what', 'which', 'who', 'whom', 'this',
'that', "that'll", 'these', 'those', \
    'am', 'is', 'are', 'was', 'were', 'be', 'been', 'being', 'have'
, 'has', 'had', 'having', 'do', 'does', \
    'did', 'doing', 'a', 'an', 'the', 'and', 'but', 'if', 'or', 'be
cause', 'as', 'until', 'while', 'of', \
    'at', 'by', 'for', 'with', 'about', 'against', 'between', 'int
o', 'through', 'during', 'before', 'after',\
    'above', 'below', 'to', 'from', 'up', 'down', 'in', 'out', 'on'
, 'off', 'over', 'under', 'again', 'further',\
    'then', 'once', 'here', 'there', 'when', 'where', 'why', 'how',
'all', 'any', 'both', 'each', 'few', 'more',\
    'most', 'other', 'some', 'such', 'only', 'own', 'same', 'so',
'than', 'too', 'very', \
    's', 't', 'can', 'will', 'just', 'don', "don't", 'should', "sho
uld've", 'now', 'd', 'll', 'm', 'o', 're', \
    've', 'y', 'ain', 'aren', "aren't", 'couldn', "couldn't", 'did
n', "didn't", 'doesn', "doesn't", 'hadn',\
    "hadn't", 'hasn', "hasn't", 'haven', "haven't", 'isn', "isn't",
'ma', 'mightn', "mightn't", 'mustn',\
    "mustn't", 'needn', "needn't", 'shan', "shan't", 'shouldn', "sh
ouldn't", 'wasn', "wasn't", 'weren', "weren't", \
    'won', "won't", 'wouldn', "wouldn't"])
```

```
In [22]: # Combining all the above stundents
from tqdm import tqdm
preprocessed_reviews = []
# tqdm is for printing the status bar
for sentence in tqdm(final['Text'].values):
    sentence = re.sub(r"http\S+", "", sentence)
    sentence = BeautifulSoup(sentence, 'lxml').get_text()
    sentence = decontracted(sentence)
    sentence = re.sub("\S*\d\S*", "", sentence).strip()
    sentence = re.sub('[^A-Za-z]+', ' ', sentence)
    # https://gist.github.com/sebleier/554280
    sentence = ' '.join(e.lower() for e in sentence.split() if e.lower() no
t in stopwords)
    preprocessed_reviews.append(sentence.strip())
```

```
100%|████████████████████████████████████████████████████████████████████████████████| 4986/4986 [00:01<00:00, 3137.37it/s]
```



```
In [23]: preprocessed_reviews[1500]
```

```
Out[23]: 'wow far two two star reviews one obviously no idea ordering wants crispy c
cookies hey sorry reviews nobody good beyond reminding us look ordering choc
olate oatmeal cookies not like combination not order type cookie find combo
quite nice really oatmeal sort calms rich chocolate flavor gives cookie sor
t coconut type consistency let also remember tastes differ given opinion so
ft chewy cookies advertised not crispy cookies blurb would say crispy rathe
r chewy happen like raw cookie dough however not see taste like raw cookie
dough soft however confusion yes stick together soft cookies tend not indiv
idually wrapped would add cost oh yeah chocolate chip cookies tend somewhat
sweet want something hard crisp suggest nabiso ginger snaps want cookie sof
t chewy tastes like combination chocolate oatmeal give try place second ord
er'
```

[3.2] Preprocessing Review Summary

```
In [6]: ## Similarly you can do preprocessing for review summary also.
```

[4] Featurization

[4.1] BAG OF WORDS

```
In [25]: #BoW
count_vect = CountVectorizer() #in scikit-learn
count_vect.fit(preprocessed_reviews)
print("some feature names ", count_vect.get_feature_names()[:10])
print('='*50)

final_counts = count_vect.transform(preprocessed_reviews)
print("the type of count vectorizer ",type(final_counts))
print("the shape of out text BOW vectorizer ",final_counts.get_shape())
print("the number of unique words ", final_counts.get_shape()[1])

some feature names  ['aa', 'aahhhs', 'aback', 'abandon', 'abates', 'abbot
t', 'abby', 'abdominal', 'abiding', 'ability']
=====
the type of count vectorizer  <class 'scipy.sparse.csr.csr_matrix'>
the shape of out text BOW vectorizer  (4986, 12997)
the number of unique words  12997
```

[4.2] Bi-Grams and n-Grams.

```
In [26]: #bi-gram, tri-gram and n-gram

#removing stop words like "not" should be avoided before building n-grams
# count_vect = CountVectorizer(ngram_range=(1,2))
# please do read the CountVectorizer documentation http://scikit-learn.org/stable/modules/generated/sklearn.feature\_extraction.text.CountVectorizer.html

# you can choose these numebrs min_df=10, max_features=5000, of your choice
count_vect = CountVectorizer(ngram_range=(1,2), min_df=10, max_features=5000)
final_bigram_counts = count_vect.fit_transform(preprocessed_reviews)
print("the type of count vectorizer ",type(final_bigram_counts))
print("the shape of out text BOW vectorizer ",final_bigram_counts.get_shape())
print("the number of unique words including both unigrams and bigrams ", final_bigram_counts.get_shape()[1])

the type of count vectorizer <class 'scipy.sparse.csr.csr_matrix'>
the shape of out text BOW vectorizer (4986, 3144)
the number of unique words including both unigrams and bigrams 3144
```

[4.3] TF-IDF

```
In [27]: tf_idf_vect = TfidfVectorizer(ngram_range=(1,2), min_df=10)
tf_idf_vect.fit(preprocessed_reviews)
print("some sample features(unique words in the corpus)",tf_idf_vect.get_feature_names()[0:10])
print('='*50)

final_tf_idf = tf_idf_vect.transform(preprocessed_reviews)
print("the type of count vectorizer ",type(final_tf_idf))
print("the shape of out text TFIDF vectorizer ",final_tf_idf.get_shape())
print("the number of unique words including both unigrams and bigrams ", final_tf_idf.get_shape()[1])

some sample features(unique words in the corpus) ['ability', 'able', 'able find', 'able get', 'absolute', 'absolutely', 'absolutely delicious', 'absolutely love', 'absolutely no', 'according']
=====
the type of count vectorizer <class 'scipy.sparse.csr.csr_matrix'>
the shape of out text TFIDF vectorizer (4986, 3144)
the number of unique words including both unigrams and bigrams 3144
```

[4.4] Word2Vec

```
In [28]: # Train your own Word2Vec model using your own text corpus
i=0
list_of_sentence=[]
for sentence in preprocessed_reviews:
    list_of_sentence.append(sentence.split())
```

```
In [42]: # Using Google News Word2Vectors

# in this project we are using a pretrained model by google
# its 3.3G file, once you load this into your memory
# it occupies ~9Gb, so please do this step only if you have >12G of ram
# we will provide a pickle file wich contains a dict ,
# and it contains all our courpus words as keys and model[word] as values
# To use this code-snippet, download "GoogleNews-vectors-negative300.bin"
# from https://drive.google.com/file/d/0B7XkCwpI5KDYNLNUttLSS21pQmM/edit
# it's 1.9GB in size.

# http://kavita-ganesan.com/gensim-word2vec-tutorial-starter-code/#.W17SRFA
# zZPY
# you can comment this whole cell
# or change these variable according to your need

is_your_ram_gt_16g=False
want_to_use_google_w2v = False
want_to_train_w2v = True

if want_to_train_w2v:
    # min_count = 5 considers only words that occurred atleast 5 times
    w2v_model=Word2Vec(list_of_sentence,min_count=5,size=50, workers=4)
    print(w2v_model.wv.most_similar('great'))
    print('='*50)
    print(w2v_model.wv.most_similar('worst'))

elif want_to_use_google_w2v and is_your_ram_gt_16g:
    if os.path.isfile('GoogleNews-vectors-negative300.bin'):
        w2v_model=KeyedVectors.load_word2vec_format('GoogleNews-vectors-neg
ative300.bin', binary=True)
        print(w2v_model.wv.most_similar('great'))
        print(w2v_model.wv.most_similar('worst'))
    else:
        print("you don't have gogole's word2vec file, keep want_to_train_w2
v = True, to train your own w2v ")

[('snack', 0.9951335191726685), ('calorie', 0.9946465492248535), ('wonderfu
l', 0.9946032166481018), ('excellent', 0.9944332838058472), ('especially',
0.9941144585609436), ('baked', 0.9940600395202637), ('salted', 0.9940472245
21637), ('alternative', 0.9937226176261902), ('tasty', 0.9936816692352295),
('healthy', 0.9936649799346924)]

=====
[('varieties', 0.9994194507598877), ('become', 0.9992934465408325), ('popco
rn', 0.9992750883102417), ('de', 0.9992610216140747), ('miss', 0.9992451071
739197), ('melitta', 0.999218761920929), ('choice', 0.9992102384567261),
('american', 0.9991837739944458), ('beef', 0.9991780519485474), ('finish',
0.9991567134857178)]
```

```
In [36]: w2v_words = list(w2v_model.wv.vocab)
print("number of words that occurred minimum 5 times ",len(w2v_words))
print("sample words ", w2v_words[0:50])
```

```
number of words that occurred minimum 5 times 3817
sample words ['product', 'available', 'course', 'total', 'pretty', 'stink
y', 'right', 'nearby', 'used', 'ca', 'not', 'beat', 'great', 'received', 's
hipment', 'could', 'hardly', 'wait', 'try', 'love', 'call', 'instead', 'rem
oved', 'easily', 'daughter', 'designed', 'printed', 'use', 'car', 'window
s', 'beautifully', 'shop', 'program', 'going', 'lot', 'fun', 'everywhere',
'like', 'tv', 'computer', 'really', 'good', 'idea', 'final', 'outstanding',
'window', 'everybody', 'asks', 'bought', 'made']
```

[4.4.1] Converting text into vectors using Avg W2V, TFIDF-W2V

[4.4.1.1] Avg W2v

```
In [38]: # average Word2Vec
# compute average word2vec for each review.
sent_vectors = []; # the avg-w2v for each sentence/review is stored in this
list
for sent in tqdm(list_of_sentence): # for each review/sentence
    sent_vec = np.zeros(50) # as word vectors are of zero length 50, you mi
ght need to change this to 300 if you use google's w2v
    cnt_words = 0; # num of words with a valid vector in the sentence/review
    for word in sent: # for each word in a review/sentence
        if word in w2v_words:
            vec = w2v_model.wv[word]
            sent_vec += vec
            cnt_words += 1
    if cnt_words != 0:
        sent_vec /= cnt_words
    sent_vectors.append(sent_vec)
print(len(sent_vectors))
print(len(sent_vectors[0]))
```

```
100% |████████████████████████████████████████████████████████████████████████████████|
██████████ | 4986/4986 [00:03<00:00, 1330.47it/s]
```

```
4986
50
```

[4.4.1.2] TFIDF weighted W2v

```
In [39]: # S = ["abc def pqr", "def def def abc", "pqr pqr def"]
model = TfidfVectorizer()
tf_idf_matrix = model.fit_transform(preprocessed_reviews)
# we are converting a dictionary with word as a key, and the idf as a value
dictionary = dict(zip(model.get_feature_names(), list(model.idf_)))
```


1. Apply SVM on these feature sets

- SET 1: Review text, preprocessed one converted into vectors using (BOW)
- SET 2: Review text, preprocessed one converted into vectors using (TFIDF)
- SET 3: Review text, preprocessed one converted into vectors using (AVG W2v)
- SET 4: Review text, preprocessed one converted into vectors using (TFIDF W2v)

2. Procedure

- You need to work with 2 versions of SVM
 - Linear kernel
 - RBF kernel
- When you are working with linear kernel, use 'SGDClassifier' with hinge loss because it is computationally less expensive.
- When you are working with 'SGDClassifier' with hinge loss and trying to find the AUC score, you would have to use CalibratedClassifierCV (<https://scikit-learn.org/stable/modules/generated/sklearn.calibration.CalibratedClassifierCV.html>).
- Similarly, like kdtree or knn, when you are working with RBF kernel it's better to reduce the number of dimensions. You can put `min_df = 10`, `max_features = 500` and consider a sample size of 40k points.

3. Hyper parameter tuning (find best alpha in range $[10^{-4}$ to 10^4], and the best penalty among 'l1', 'l2')

- Find the best hyper parameter which will give the maximum AUC (<https://www.appliedaicourse.com/course/applied-ai-course-online/lessons/receiver-operating-characteristic-curve-roc-curve-and-auc-1/>), value
- Find the best hyper parameter using k-fold cross validation or simple cross validation data
- Use gridsearch cv or randomsearch cv or you can also write your own for loops to do this task of hyperparameter tuning


4. Feature importance

- When you are working on the linear kernel with BOW or TFIDF please print the top 10 best features for each of the positive and negative classes.


5. Feature engineering


- To increase the performance of your model, you can also experiment with feature engineering like :
 - Taking length of reviews as another feature.
 - Considering some features from review summary as well.

6. Representation of results

- You need to plot the performance of model both on train data and cross validation data for each hyper parameter, like shown in the figure.
-  Once after you found the best hyper parameter, you need to train your model with it, and find the AUC on test data and plot the ROC curve on both train and

test.

•  Along with plotting ROC curve, you need to print the confusion matrix (<https://www.appliedaicourse.com/course/applied-ai-course-online/lessons/confusion-matrix-tpr-fpr-fnr-tnr-1/>) with predicted and original labels of test data points. Please visualize your confusion matrices using seaborn heatmaps.

 (<https://seaborn.pydata.org/generated/seaborn.heatmap.html>)
(<https://seaborn.pydata.org/generated/seaborn.heatmap.html>)
(<https://seaborn.pydata.org/generated/seaborn.heatmap.html>)

(<https://seaborn.pydata.org/generated/seaborn.heatmap.html>)

7. **Conclusion** (<https://seaborn.pydata.org/generated/seaborn.heatmap.html>)

(<https://seaborn.pydata.org/generated/seaborn.heatmap.html>)

- You need to summarize the results at the end of the notebook, summarize it in the table format. To print out a table please refer to this prettytable library. (<https://seaborn.pydata.org/generated/seaborn.heatmap.html>) link (<http://zetcode.com/python/prettytable/>).



Note: Data Leakage

1. There will be an issue of data-leakage if you vectorize the entire data and then split it into train/cv/test.
2. To avoid the issue of data-leakage, make sure to split your data first and then vectorize it.
3. While vectorizing your data, apply the method `fit_transform()` on you train data, and apply the method `transform()` on cv/test data.
4. For more details please go through this link. (<https://soundcloud.com/applied-ai-course/leakage-bow-and-tfidf>).

Applying SVM

[5.1] Linear SVM

Common code for the assignment

```

In [34]: import warnings
warnings.filterwarnings("ignore")

from sklearn.svm import SVC
from sklearn.calibration import CalibratedClassifierCV
from sklearn.model_selection import GridSearchCV
from sklearn.metrics import confusion_matrix
from sklearn import metrics
from sklearn.metrics import classification_report, accuracy_score, confusion_
matrix
from sklearn.metrics import roc_curve, auc
from sklearn.metrics import roc_auc_score

import sqlite3
import pandas as pd
import numpy as np

import string
import matplotlib.pyplot as plt
import re
from tqdm import tqdm
import os
import pickle

"""
import nltk
from sklearn.feature_extraction.text import TfidfTransformer
from sklearn.feature_extraction.text import TfidfVectorizer
from sklearn.feature_extraction.text import CountVectorizer
from nltk.corpus import stopwords
from nltk.stem.wordnet import WordNetLemmatizer
from gensim.models import Word2Vec
from gensim.models import KeyedVectors
"""

class assign7RBF:

    def __init__(self):
        self.X_train=pd.DataFrame()
        self.X_test=pd.DataFrame()
        self.xtrain=pd.DataFrame()
        self.xval=pd.DataFrame()
        self.y_train= pd.Series([])
        self.ytrain= pd.Series([])
        self.y_test= pd.Series([])
        self.yval= pd.Series([])
        self.svm_clf = None
        self.rbf_C = []
        self.yprdprobatrn = []
        self.yprdprobaval = []
        self.yprdprobatest = []

```



```
self.rocaucscoretrn = []
self.rocaucscoreval = []
self.rocaucscoretest = []
self.predicted = []
self.test_predict = []
self.accuracy_score_val = []
self.accuracy_score_test = []
self.clasify_report = []
self.confsnmtxytstpred = {}
self.roc_curve_test = {}
self.clasify_params = {}

#data for gridseatch
@property
def X_train(self):
    return self._X_train

@X_train.setter
def X_train(self,new_X_train):
    self._X_train = new_X_train

#unseen data for testing
@property
def X_test(self):
    return self._X_test

@X_test.setter
def X_test(self,new_X_test):
    self._X_test = new_X_test

#data for roc_auc_score
@property
def xtrain(self):
    return self._xtrain

@xtrain.setter
def xtrain(self,new_xtrain):
    self._xtrain = new_xtrain

@property
def xval(self):
    return self._xval

@xval.setter
def xval(self,new_xval):
    self._xval = new_xval

@property
def y_train(self):
    return self._y_train

@y_train.setter
def y_train(self,new_y_train):
    self._y_train = new_y_train

@property
```

```
def y_test(self):
    return self._y_test

@y_test.setter
def y_test(self,new_y_test):
    self._y_test = new_y_test

@property
def ytrain(self):
    return self._ytrain

@ytrain.setter
def ytrain(self,new_ytrain):
    self._ytrain = new_ytrain

@property
def yval(self):
    return self._yval

@yval.setter
def yval(self,new_yval):
    self._yval = new_yval

@property
def SVM_alpha (self):
    return self._SVM_alpha

@SVM_alpha.setter
def SVM_alpha (self,new_SVM_alpha):
    self._SVM_alpha = new_SVM_alpha

@property
def yprdprobatrn(self):
    return self._yprdprobatrn

@yprdprobatrn.setter
def yprdprobatrn(self,new_yprdprobatrn):
    self._yprdprobatrn = new_yprdprobatrn

@property
def yprdprobaval (self):
    return self._yprdprobaval

@yprdprobaval.setter
def yprdprobaval (self,new_yprdprobaval):
    self._yprdprobaval = new_yprdprobaval

@property
def yprdprobatest (self):
    return self._yprdprobatest

@yprdprobatest.setter
def yprdprobatest (self,new_yprdprobatest):
    self._yprdprobatest = new_yprdprobatest

def load_data(self,mltype):
```

```
f1name = 'E:/appliedaiacourse/assignments/dblite/svm'
if mltpe == 'BOW':
    f1name1 = f1name + '/bowvectorizer/ppvectscld_x_train'
    f1name2 = f1name + '/bowvectorizer/ppvectscld_x_test'
    f1name3 = f1name + '/bowvectorizer/ppvectscld_xtrain'
    f1name4 = f1name + '/bowvectorizer/ppvectscld_xval'
    f1name5 = f1name + '/bowvectorizer/y_train'
    f1name6 = f1name + '/bowvectorizer/y_test'
    f1name7 = f1name + '/bowvectorizer/ytrain'
    f1name8 = f1name + '/bowvectorizer/yval'
elif mltpe == 'TFIDF':
    f1name1 = f1name + '/tfidfvectorizer/ppvectscld_x_train'
    f1name2 = f1name + '/tfidfvectorizer/ppvectscld_x_test'
    f1name3 = f1name + '/tfidfvectorizer/ppvectscld_xtrain'
    f1name4 = f1name + '/tfidfvectorizer/ppvectscld_xval'
    f1name5 = f1name + '/tfidfvectorizer/y_train'
    f1name6 = f1name + '/tfidfvectorizer/y_test'
    f1name7 = f1name + '/tfidfvectorizer/ytrain'
    f1name8 = f1name + '/tfidfvectorizer/yval'
elif mltpe == 'AVGW2V':
    f1name1 = f1name + '/avgw2vectorizer/ppvectscld_x_train'
    f1name2 = f1name + '/avgw2vectorizer/ppvectscld_x_test'
    f1name3 = f1name + '/avgw2vectorizer/ppvectscld_xtrain'
    f1name4 = f1name + '/avgw2vectorizer/ppvectscld_xval'
    f1name5 = f1name + '/avgw2vectorizer/y_train'
    f1name6 = f1name + '/avgw2vectorizer/y_test'
    f1name7 = f1name + '/avgw2vectorizer/ytrain'
    f1name8 = f1name + '/avgw2vectorizer/yval'
elif mltpe == 'WTW2V':
    f1name1 = f1name + '/tfidfwtw2vectorizer/ppvectscld_x_train'
    f1name2 = f1name + '/tfidfwtw2vectorizer/ppvectscld_x_test'
    f1name3 = f1name + '/tfidfwtw2vectorizer/ppvectscld_xtrain'
    f1name4 = f1name + '/tfidfwtw2vectorizer/ppvectscld_xval'
    f1name5 = f1name + '/tfidfwtw2vectorizer/y_train'
    f1name6 = f1name + '/tfidfwtw2vectorizer/y_test'
    f1name7 = f1name + '/tfidfwtw2vectorizer/ytrain'
    f1name8 = f1name + '/tfidfwtw2vectorizer/yval'

with open (f1name1, 'rb') as fp:
    self.X_train = pickle.load(fp)

with open (f1name2, 'rb') as fp:
    self.X_test = pickle.load(fp)

with open (f1name3, 'rb') as fp:
    self.xtrain = pickle.load(fp)

with open (f1name4, 'rb') as fp:
    self.xval = pickle.load(fp)

with open (f1name5, 'rb') as fp:
    self.y_train = pickle.load(fp)

with open (f1name6, 'rb') as fp:
    self.y_test = pickle.load(fp)

with open (f1name7, 'rb') as fp:
```

```

        self.ytrain = pickle.load(fp)

    with open (fname8, 'rb') as fp:
        self.yval = pickle.load(fp)

    def SVMClasifier(self):
        self.svm_clf= SVC(kernel='rbf',class_weight={0:5.14,1:1},max_iter=1
000,\
                                tol=1e-3, verbose=100,random_state=42)
        return self.svm_clf

    def getSVMClasifier(self):
        return self.svm_clf

    @property
    def svm_clf(self):
        return self._svm_clf

    @svm_clf.setter
    def svm_clf(self,new_svm_clf):
        self._svm_clf = new_svm_clf

    #set alpha parameter for classifier
    def setCparm(self,prmval):
        params = {'C': prmval}
        (self.svm_clf).set_params(**params)
        print(self.svm_clf)
        return self.svm_clf

    def SVM_hyperparamtuning(self,measure,cvfold=5,verbose=100):

        # setting two parameter values for tuning
        param_grid = {'C':[10 ** x for x in range (-4,4)]}

        cvfold=5
        vbose=100
        #get the classifier
        grdsch_clf = self.getSVMClasifier()
        grdschcv = GridSearchCV(grdsch_clf,param_grid,scoring=measure,cv=cv
fold, verbose=vbose)

        #fit the data with the classifier
        grdschcv.fit(self.X_train,self.y_train)

        return [grdschcv.best_score_,grdschcv.best_params_,grdschcv]

    def SVM_calcrocaucscore(self,endval):

        """
        this function uses CalibratedClasifierCV for prediciting probab
ilities
        this is an imbalanced dataset hence we are using class weights
and
        sample weights in the fit process
        """

```

```

alpha_start = 0.0000001

trn_smp_wts=compute_sample_weight(class_weight={0:5.14,1:1}, y=self
.ytrain)
val_smp_wts=compute_sample_weight(class_weight={0:5.14,1:1}, y=self
.yval)

while(alpha_start <= endval):

    # set alpha param for classifier
    self.setCparm(alpha_start)

    # fit the x-train model
    (self.svm_clf).fit(self.xtrain,self.ytrain,sample_weight=trn_sm
p_wts
                        )
    my_calib = CalibratedClassifierCV((self.svm_clf),method='sigmoi
d',cv='prefit')
    my_calib.fit(self.xtrain,self.ytrain,sample_weight=trn_smp_wts)

    self.yprdprobatrn = (my_calib).predict_proba(self.xtrain)[: ,1]
    (self.rocaucscoretrn).append(roc_auc_score(self.ytrain,self.ypr
dprobatrn))
    print('Fitting probability generation and roc auc score generat
ion for training data complete...')

    #fit the validation model
    (self.svm_clf).fit(self.xval,self.yval,sample_weight=val_smp_wt
s)

    my_calib_1 = CalibratedClassifierCV((self.svm_clf),method='sigm
oid',cv='prefit')
    my_calib_1.fit(self.xval,self.yval,sample_weight=val_smp_wts)

    self.yprdprobaval = (my_calib_1).predict_proba(self.xval)[: ,1]
    (self.rocaucscoreval).append(roc_auc_score(self.yval,self.yprdpr
obaval))
    print('Fitting probability generation and roc auc score generat
ion for validation data complete...')

    #set alpha to the next value
    (self.rbf_C).append(alpha_start)
    alpha_start = alpha_start * 10

    print('Function exiting...')
def SVM_actualClasifier(self,param_alpha):

    """
    this function uses CalibratedClasifierCV for prediciting probab
ilities
    this is an imbalanced dataset hence we are using class weights
    and
    sample weights in the fit process
    """
    train_clf = self.SVMClasifier()
    test_clf = self.SVMClasifier()

```

```

params = {'C': parm_alpha}
(train_clf).set_params(**params)

#compute all the sample weights
trn_smp_wts=compute_sample_weight(class_weight={0:5.14,1:1}, y=self
.ytrain)
val_smp_wts=compute_sample_weight(class_weight={0:5.14,1:1}, y=self
.yval)
train_smp_wts=compute_sample_weight(class_weight={0:5.14,1:1}, y=self.y_train)
test_smp_wts=compute_sample_weight(class_weight={0:5.14,1:1}, y=self.y_test)

# fit train again and predict probabilities from xtrain
(train_clf).fit(self.xtrain,self.ytrain,sample_weight=trn_smp_wts)

#Calibratedcv for predicting probabilities
my_calib_1 = CalibratedClassifierCV((train_clf),method='sigmoid',cv
='prefit')

# fit train with sample weights
my_calib_1.fit(self.xtrain,self.ytrain,sample_weight=trn_smp_wts)

# predict probabilities using predict_proba from calibratedcv
self.ytrn_predprob_actclf = (my_calib_1).predict_proba(self.xtrain)
[:,1]

# compute the false-positive r, true positive rates and thresholds
fpr_trn, tpr_trn, thrshld_trn = roc_curve(self.ytrain, self.ytrn_predprob_actclf)

# calibratedCv for validation dataset
my_calib_2 = CalibratedClassifierCV((train_clf),method='sigmoid',cv
='prefit')
#fit the validation dataset with sample weights
my_calib_2.fit(self.xval,self.yval,sample_weight=val_smp_wts)

# predict the labels for validation
self.predicted = (my_calib_2).predict(self.xval)

# calculate accuracy_score for validation dataset
self.accuracy_score_val = accuracy_score(self.yval, self.predicted)

(test_clf).fit(self.X_train,self.y_train,sample_weight=train_smp_wts)

#calibratedclasifierCV using my model prefit with X_test
my_calib = CalibratedClassifierCV((test_clf),method='sigmoid',cv='prefit')

#predicting probabilities for X_test setweights test sample weights
my_calib.fit(self.X_test,self.y_test,sample_weight=test_smp_wts)

# predict xtest labels
self.test_predict = (my_calib).predict(self.X_test)

print('***X_test predict',self.test_predict)

```

```

#store the classifier parameters
self.classify_params['clfparams'] = (test_clf).get_params(deep=True)

#calculate accuracy_score for X_test
self.accuracy_score_test = accuracy_score(self.y_test, self.test_pr
edict)

# generate classification report for X_test
print(classification_report(self.y_test, self.test_predict))

# confusion matrix for ytest
tn, fp, fn, tp = confusion_matrix(self.y_test, self.test_predict ).
ravel()
self.confsnmtxystpred['tn'] = tn
self.confsnmtxystpred['fp'] = fp
self.confsnmtxystpred['fn'] = fn
self.confsnmtxystpred['tp'] = tp

# predict probabilites from xtest for roc_curve
self.ytst_predprob_actclf = (my_calib).predict_proba(self.X_test)
[:,1]

print('*** predict probabilities***',self.ytst_predprob_actclf)

fpr, tpr, thrshld_test = roc_curve(self.y_test,self.ytst_predprob_a
ctclf)

# store the above into the dictionary
self.roc_curve_test['fpr_trn'] = fpr_trn
self.roc_curve_test['tpr_trn'] = tpr_trn
self.roc_curve_test['thrshld_trn'] = thrshld_trn
self.roc_curve_test['fpr'] = fpr
self.roc_curve_test['tpr'] = tpr
self.roc_curve_test['thrshld_test'] = thrshld_test

self.sgd_clf = test_clf

def SVM_actualClasifier_0(self,parm_alpha):

    """
        this fn uses calibratedclassifierCV to predict and get the predi
cted probabilities
    """

    self.setCparm(parm_alpha)
    (self.svm_clf).fit(self.X_test,self.y_test)

    #calibratedclasifierCV using my model prefit with X_test
    my_calib = CalibratedClassifierCV((self.svm_clf),method='sigmoid',c
v='prefit')
    my_calib.fit(self.X_test,self.y_test)

    # predict xtest labels
    self.test_predict = (my_calib).predict(self.X_test)

    #store the classifier parameters

```

```

self.classify_params['clfparams'] = (self.svm_clf).get_params(deep=True)

# calculate accuracy_score
self.accuracy_score_test = accuracy_score(self.y_test, self.test_predict)

# generate classification report
#classification_report(self.ytest, self.test_predict)

# confusion matrix for ytest
tn, fp, fn, tp = confusion_matrix(self.y_test, self.test_predict ).ravel()
self.confsnmtxystpred['tn'] = tn
self.confsnmtxystpred['fp'] = fp
self.confsnmtxystpred['fn'] = fn
self.confsnmtxystpred['tp'] = tp

# predict probabilities from xtest for roc_curve
self.ytst_predprob_actclf = (my_calib).predict_proba(self.X_test)[:,1]
fpr, tpr, thrshld_test = roc_curve(self.y_test, self.ytst_predprob_actclf)

# fit train again and predict probabilities from xtrain
(self.svm_clf).fit(self.xtrain, self.ytrain)
my_calib_1 = CalibratedClassifierCV((self.svm_clf), method='sigmoid', cv='prefit')
my_calib_1.fit(self.xtrain, self.ytrain)
self.ytrn_predprob_actclf = (my_calib_1).predict_proba(self.X_train)[:,1]
fpr_trn, tpr_trn, thrshld_trn = roc_curve(self.y_train, self.ytrn_predprob_actclf)

#fit the validation model predict and generate the accuracy score
(self.svm_clf).fit(self.xval, self.yval)
my_calib_2 = CalibratedClassifierCV((self.svm_clf), method='sigmoid', cv='prefit')
my_calib_2.fit(self.xval, self.yval)
# predict the labels for validation
self.predicted = (my_calib_2).predict(self.xval)

# calculate accuracy_score
self.accuracy_score_val = accuracy_score(self.yval, self.predicted)

# store the above into the dictionary
self.roc_curve_test['fpr_trn'] = fpr_trn
self.roc_curve_test['tpr_trn'] = tpr_trn
self.roc_curve_test['thrshld_trn'] = thrshld_trn
self.roc_curve_test['fpr'] = fpr
self.roc_curve_test['tpr'] = tpr
self.roc_curve_test['thrshld_test'] = thrshld_test
"""
if __name__ == '__main__':
    lnrsvm = assign7SVM()
    lnrsvm.Load_data('BOW')
    lnrsvm.Load_data('TFIDF')

```



```
Lnrsvm.Load_data('AVGW2V')
Lnrsvm.Load_data('WTW2V')
ret_grdschcv = Lnrsvm.hyperparamtuning('roc_auc')
print(ret_grdschcv[0])
print(ret_grdschcv[1])
print(ret_grdschcv[2])
"""
```

```
import warnings warnings.filterwarnings("ignore")

from sklearn import linear_model from sklearn.calibration import CalibratedClassifierCV from
sklearn.model_selection import GridSearchCV from sklearn.metrics import confusion_matrix from sklearn import
metrics from sklearn.metrics import classification_report,accuracy_score,confusion_matrix from sklearn.metrics
import roc_curve, auc from sklearn.metrics import roc_auc_score from sklearn.feature_extraction.text import
CountVectorizer from sklearn.feature_extraction.text import TfidfTransformer from
sklearn.feature_extraction.text import TfidfVectorizer from sklearn.utils.class_weight import
compute_sample_weight

import sqlite3 import pandas as pd import numpy as np

import string import matplotlib.pyplot as plt import re from tqdm import tqdm import os import pickle

class assign7SVM:
```

```
def __init__(self):
    self.X_train=pd.DataFrame()
    self.X_test=pd.DataFrame()
    self.xtrain=pd.DataFrame()
    self.xval=pd.DataFrame()
    self.y_train= pd.Series([])
    self.ytrain= pd.Series([])
    self.y_test= pd.Series([])
    self.yval= pd.Series([])
    self.sgd_clf = None
    self.SVM_alpha = []
    self.yprdprobatrn = []
    self.yprdprobaval = []
    self.yprdprobatest = []
    self.rocaucscoretrn = []
    self.rocaucscoreval = []
    self.rocaucscoretest = []
    self.predicted = []
    self.test_predict = []
    self.accuracy_score_val = []
    self.accuracy_score_test = []
    self.clasify_report = []
    self.confsnmtxytstpred = {}
    self.roc_curve_test = {}
    self.clasify_params = {}
    self.feat_names = []
```

#data for gridseatch

@property

```
def X_train(self):
    return self._X_train
```

@X_train.setter

```
def X_train(self,new_X_train):
    self._X_train = new_X_train
```

#unseen data for testing

@property

```
def X_test(self):
    return self._X_test
```

@X_test.setter

```
def X_test(self,new_X_test):
    self._X_test = new_X_test
```

#data for roc_auc_score

@property

```
def xtrain(self):
```

```
        return self._xtrain

    @xtrain.setter
    def xtrain(self,new_xtrain):
        self._xtrain = new_xtrain

    @property
    def xval(self):
        return self._xval

    @xval.setter
    def xval(self,new_xval):
        self._xval = new_xval

    @property
    def y_train(self):
        return self._y_train

    @y_train.setter
    def y_train(self,new_y_train):
        self._y_train = new_y_train

    @property
    def y_test(self):
        return self._y_test

    @y_test.setter
    def y_test(self,new_y_test):
        self._y_test = new_y_test

    @property
    def ytrain(self):
        return self._ytrain

    @ytrain.setter
    def ytrain(self,new_ytrain):
        self._ytrain = new_ytrain

    @property
    def yval(self):
        return self._yval

    @yval.setter
    def yval(self,new_yval):
        self._yval = new_yval

    @property
    def SVM_alpha (self):
        return self._SVM_alpha
```

```
@SVM_alpha.setter
def SVM_alpha (self,new_SVM_alpha):
    self._SVM_alpha = new_SVM_alpha

@property
def yprdprobatrn(self):
    return self._yprdprobatrn

@yprdprobatrn.setter
def yprdprobatrn(self,new_yprdprobatrn):
    self._yprdprobatrn = new_yprdprobatrn

@property
def yprdprobaval (self):
    return self._yprdprobaval

@yprdprobaval.setter
def yprdprobaval (self,new_yprdprobaval):
    self._yprdprobaval = new_yprdprobaval

@property
def yprdprobatest (self):
    return self._yprdprobatest

@yprdprobatest.setter
def yprdprobatest (self,new_yprdprobatest):
    self._yprdprobatest = new_yprdprobatest

def load_data(self,mltype):
    f1name = 'E:/appliedaiacourse/assignments/dblite/svm'
    if mltype == 'BOW':
        fname1 = f1name + '/bowvectorizer/ppvectscld_x_train'
        fname2 = f1name + '/bowvectorizer/ppvectscld_x_test'
        fname3 = f1name + '/bowvectorizer/ppvectscld_xtrain'
        fname4 = f1name + '/bowvectorizer/ppvectscld_xval'
        fname5 = f1name + '/bowvectorizer/y_train'
        fname6 = f1name + '/bowvectorizer/y_test'
        fname7 = f1name + '/bowvectorizer/ytrain'
        fname8 = f1name + '/bowvectorizer/yval'
        fname9 = f1name + '/bowvectorizer/bow_feat'
    elif mltype == 'TFIDF':
        fname1 = f1name + '/tfidfvectorizer/ppvectscld_x_train'
        fname2 = f1name + '/tfidfvectorizer/ppvectscld_x_test'
        fname3 = f1name + '/tfidfvectorizer/ppvectscld_xtrain'
        fname4 = f1name + '/tfidfvectorizer/ppvectscld_xval'
        fname5 = f1name + '/tfidfvectorizer/y_train'
        fname6 = f1name + '/tfidfvectorizer/y_test'
```

```
fname7 = f1name + '/tfidfvectorizer/ytrain'
fname8 = f1name + '/tfidfvectorizer/yval'
fname9 = f1name + '/tfidfvectorizer/tfidf_feat'
elif mltype == 'AVGW2V':
    fname1 = f1name + '/avgw2vectorizer/ppvectscld_x_train'
    fname2 = f1name + '/avgw2vectorizer/ppvectscld_x_test'
    fname3 = f1name + '/avgw2vectorizer/ppvectscld_xtrain'
    fname4 = f1name + '/avgw2vectorizer/ppvectscld_xval'
    fname5 = f1name + '/avgw2vectorizer/y_train'
    fname6 = f1name + '/avgw2vectorizer/y_test'
    fname7 = f1name + '/avgw2vectorizer/ytrain'
    fname8 = f1name + '/avgw2vectorizer/yval'
elif mltype == 'WTW2V':
    fname1 = f1name + '/tfidfwtw2vectorizer/ppvectscld_x_train'
    fname2 = f1name + '/tfidfwtw2vectorizer/ppvectscld_x_test'
    fname3 = f1name + '/tfidfwtw2vectorizer/ppvectscld_xtrain'
    fname4 = f1name + '/tfidfwtw2vectorizer/ppvectscld_xval'
    fname5 = f1name + '/tfidfwtw2vectorizer/y_train'
    fname6 = f1name + '/tfidfwtw2vectorizer/y_test'
    fname7 = f1name + '/tfidfwtw2vectorizer/ytrain'
    fname8 = f1name + '/tfidfwtw2vectorizer/yval'

with open (fname1, 'rb') as fp:
    self.X_train = pickle.load(fp)

with open (fname2, 'rb') as fp:
    self.X_test = pickle.load(fp)

with open (fname3, 'rb') as fp:
    self.xtrain = pickle.load(fp)

with open (fname4, 'rb') as fp:
    self.xval = pickle.load(fp)

with open (fname5, 'rb') as fp:
    self.y_train = pickle.load(fp)

with open (fname6, 'rb') as fp:
    self.y_test = pickle.load(fp)

with open (fname7, 'rb') as fp:
    self.ytrain = pickle.load(fp)

with open (fname8, 'rb') as fp:
    self.yval = pickle.load(fp)

if (mltype == 'BOW' or mltype=='TFIDF'):
    with open (fname9, 'rb') as fp:
        self.feat_names = pickle.load(fp)
```

```
def SGDClasifier(self):
    self.sgd_clf= linear_model.SGDClassifier(loss='hinge',class_weight={0:5.14,
1:1},max_iter=1000,\
                                                    tol=1e-3,verbose=100,random_state=4
2)
    return self.sgd_clf

def getSGDClassifier(self):
    return self.sgd_clf

@property
def sgd_clf(self):
    return self._sgd_clf

@sgd_clf.setter
def sgd_clf(self,new_sgd_clf):
    self._sgd_clf = new_sgd_clf

#set alpha parameter for classifier
def setalphaparm(self,prmval):
    params = {'alpha': prmval}
    (self.sgd_clf).set_params(**params)
    print(self.sgd_clf)
    return self.sgd_clf

#set penalty parameter for classifier
def setpenaltyparm(self,prmval):
    params = {'penalty': prmval}
    (self.sgd_clf).set_params(**params)
    return self.sgd_clf

#set class_weights = blanced for classifier
def setclasswts(self,prmval):
    params = {'class_weight': prmval}  #='balanced'
    (self.sgd_clf).set_params(**params)
    return self.sgd_clf

#set n_iter parameter for classifier
def setniterparm(self,prmval):
    params = {'n_iter': prmval}
    (self.sgd_clf).set_params(**params)
    return self.sgd_clf

def svm_fitdata(self):
    (self.sgd_clf).fit(self.X_test,self.y_test)
    return self.sgd_clf
```

```

def hyperparamtuning(self,measure,cvfold=5,verbose=100):

    # setting two parameter values for tuning
    param_grid = { 'penalty':['l2','l1'],
                    'alpha':[10 ** x for x in range (-4,4)]}
    cvfold=10
    vbose=100
    #get the classifier
    grdsch_clf = self.SGDClassifier()
    grdschcv = GridSearchCV(grdsch_clf,param_grid,scoring=measure,cv=cvfold, ver
bose=vbose)

    #fit the data with the classifier
    grdschcv.fit(self.X_train,self.y_train)

    return [grdschcv.best_score_,grdschcv.best_params_,grdschcv]

def SVM_calcroaucscore(self,endval):
    alpha_start = 0.000001

    while(alpha_start <= endval):

        # set alpha param for classifier
        self.setalphaparm(alpha_start)

        # fit the x-train model
        (self.sgd_clf).fit(self.xtrain,self.ytrain)
        my_calib = CalibratedClassifierCV((self.sgd_clf),method='sigmoid',cv='pr
efit')
        my_calib.fit(self.xtrain,self.ytrain)
        self.yprdprobatrn = (my_calib).predict_proba(self.xtrain)[: ,1]
        (self.rocaucscoretrn).append(roc_auc_score(self.ytrain,self.yprdprobatr
n))

        print('Fitting probability generation and roc auc score generation for t
raining data complete...')

        #fit the validation model
        #(self.sgd_clf).fit(self.xval,self.yval)
        my_calib_1 = CalibratedClassifierCV((self.sgd_clf),method='sigmoid',cv
='prefit')
        my_calib_1.fit(self.xval,self.yval)
        self.yprdprobaval = (my_calib_1).predict_proba(self.xval)[: ,1]
        (self.rocaucscoreval).append(roc_auc_score(self.yval,self.yprdprobaval))
        print('Fitting probability generation and roc auc score generation for v
alidation data complete...')

        #set alpha to the next value

```



```

        (self.SVM_alpha).append(alpha_start)
        alpha_start = alpha_start * 10

    print('Function exiting...')

def SVM_actualClassifier(self, parm_alpha):

    """
        this fn uses calibratedclassifierCV to predict and get the predicted prob
abilities
    """
    train_clf = self.SGDClassifier()
    test_clf = self.SGDClassifier()

    params = {'alpha': parm_alpha}
    (train_clf).set_params(**params)

    params = {'penalty': 'l2'}
    (train_clf).set_params(**params)

    trn_smp_wts=compute_sample_weight(class_weight={0:5.14,1:1}, y=self.ytrain)
    val_smp_wts=compute_sample_weight(class_weight={0:5.14,1:1}, y=self.yval)

    # fit train again and predict probabilities from xtrain
    (train_clf).fit(self.xtrain,self.ytrain,sample_weight=trn_smp_wts)
    #(self.sgd_clf).fit(self.xtrain,self.ytrain)

    my_calib_1 = CalibratedClassifierCV((train_clf),method='sigmoid',cv='prefi
t')
    my_calib_1.fit(self.xtrain,self.ytrain,sample_weight=trn_smp_wts)
    self.ytrn_predprob_actclf = (my_calib_1).predict_proba(self.xtrain)[: ,1]
    fpr_trn, tpr_trn, thrshld_trn = roc_curve(self.ytrain, self.ytrn_predprob_ac
tclf)

    #fit the validation model predict and generate the accuracy score
    #self.setalphaparm(parm_alpha)
    #(self.sgd_clf).fit(self.xval,self.yval)
    my_calib_2 = CalibratedClassifierCV((train_clf),method='sigmoid',cv='prefi
t')
    my_calib_2.fit(self.xval,self.yval,sample_weight=val_smp_wts)
    # predict the labels for validation
    self.predicted = (my_calib_2).predict(self.xval)

    # calculate accuracy_score
    self.accuracy_score_val = accuracy_score(self.yval, self.predicted)

    params = {'alpha': parm_alpha}

```

```

(test_clf).set_params(**params)

params = {'penalty': 'l2'}
(test_clf).set_params(**params)

train_smp_wts=compute_sample_weight(class_weight={0:5.14,1:1}, y=self.y_train)
n)
test_smp_wts=compute_sample_weight(class_weight={0:5.14,1:1}, y=self.y_test)
#(self.sgd_clf).fit(self.X_test,self.y_test)
(test_clf).fit(self.X_train,self.y_train,sample_weight=train_smp_wts)
#calibratedclassifierCV using my model prefit with X_test
my_calib = CalibratedClassifierCV((test_clf),method='sigmoid',cv='prefit')
my_calib.fit(self.X_test,self.y_test,sample_weight=test_smp_wts)

# predict xtest labels
self.test_predict = (my_calib).predict(self.X_test)

print(self.test_predict)
#store the classifier parameters
self.classify_params['clfparams'] = (test_clf).get_params(deep=True)

# calculate accuracy_score
self.accuracy_score_test = accuracy_score(self.y_test, self.test_predict)

# generate classification report
print(classification_report(self.y_test, self.test_predict))

# confusion matrix for ytest
tn, fp, fn, tp = confusion_matrix(self.y_test, self.test_predict ).ravel()
self.confsnmtxystpred['tn'] = tn
self.confsnmtxystpred['fp'] = fp
self.confsnmtxystpred['fn'] = fn
self.confsnmtxystpred['tp'] = tp

# predict probabilites from xtest for roc_curve
self.ytst_predprob_actclf = (my_calib).predict_proba(self.X_test)[:,:1]
print(self.ytst_predprob_actclf)
fpr, tpr, thrshld_test = roc_curve(self.y_test,self.ytst_predprob_actclf)

# store the above into the dictionary
self.roc_curve_test['fpr_trn'] = fpr_trn
self.roc_curve_test['tpr_trn'] = tpr_trn
self.roc_curve_test['thrshld_trn'] = thrshld_trn
self.roc_curve_test['fpr'] = fpr
self.roc_curve_test['tpr'] = tpr
self.roc_curve_test['thrshld_test'] = thrshld_test

self.sgd_clf = test_clf

```

```

def SVM_actualClassifier_0(self,parm_alpha):

    """
        this fn uses calibratedclassifierCV to predict and get the predicted prob
abilities
    """
    train_clf = self.SGDClassifier()
    test_cls = self.SGDClassifier()

    self.setalphaparm(parm_alpha)
    # fit train again and predict probabilitites from xtrain
    (self.sgd_clf).fit(self.xtrain,self.ytrain)
    my_calib_1 = CalibratedClassifierCV((self.sgd_clf),method='sigmoid',cv='pref
it')
    my_calib_1.fit(self.xtrain,self.ytrain)
    self.ytrn_predprob_actclf = (my_calib_1).predict_proba(self.xtrain)[:,1]
    fpr_trn, tpr_trn, thrshld_trn = roc_curve(self.ytrain, self.ytrn_predprob_ac
tclf)

    #fit the validation model predict and generate the accuracy score
    #self.setalphaparm(parm_alpha)
    #(self.sgd_clf).fit(self.xval,self.yval)
    my_calib_2 = CalibratedClassifierCV((self.sgd_clf),method='sigmoid',cv='pref
it')
    my_calib_2.fit(self.xval,self.yval)
    # predict the labels for validation
    self.predicted = (my_calib_2).predict(self.xval)

    # calculate accuracy_score
    self.accuracy_score_val = accuracy_score(self.yval, self.predicted)

    self.setalphaparm(parm_alpha)
    #(self.sgd_clf).fit(self.X_test,self.y_test)
    (self.sgd_clf).fit(self.X_train,self.y_train)
    #calibratedclasifierCV using my model prefit with X_test
    my_calib = CalibratedClassifierCV((self.sgd_clf),method='sigmoid',cv='prefi
t')
    my_calib.fit(self.X_test,self.y_test)

    # predict xtest labels
    self.test_predict = (my_calib).predict(self.X_test)

    print(self.test_predict)
    #store the classifier parameters
    self.clasify_params['clfparams'] = (self.sgd_clf).get_params(deep=True)

    # calculate accuracy_score

```

```

self.accuracy_score_test = accuracy_score(self.y_test, self.test_predict)

# generate classification report
classification_report(self.y_test, self.test_predict)

# confusion matrix for ytest
tn, fp, fn, tp = confusion_matrix(self.y_test, self.test_predict ).ravel()
self.confsnmtxystpred['tn'] = tn
self.confsnmtxystpred['fp'] = fp
self.confsnmtxystpred['fn'] = fn
self.confsnmtxystpred['tp'] = tp

# predict probabilities from xtest for roc_curve
self.ytst_predprob_actclf = (my_calib).predict_proba(self.X_test)[: ,1]
print(self.ytst_predprob_actclf)
fpr, tpr, thrshld_test = roc_curve(self.y_test, self.ytst_predprob_actclf)

# store the above into the dictionary
self.roc_curve_test['fpr_trn'] = fpr_trn
self.roc_curve_test['tpr_trn'] = tpr_trn
self.roc_curve_test['thrshld_trn'] = thrshld_trn
self.roc_curve_test['fpr'] = fpr
self.roc_curve_test['tpr'] = tpr
self.roc_curve_test['thrshld_test'] = thrshld_test

def SVM_actualClassifier_old(self, parm_alpha):

    self.setalphaparm(parm_alpha)
    (self.sgd_clf).fit(self.X_test, self.y_test)

    # predict xtest labels
    self.test_predict = (self.sgd_clf).predict(self.X_test)

    #store the classifier parameters
    self.classify_params['clfparams'] = (self.sgd_clf).get_params(deep=True)

    # calculate accuracy_score
    self.accuracy_score_test = accuracy_score(self.y_test, self.test_predict)

    # generate classification report
    #classification_report(self.ytest, self.test_predict)

    # confusion matrix for ytest
    tn, fp, fn, tp = confusion_matrix(self.y_test, self.test_predict ).ravel()
    self.confsnmtxystpred['tn'] = tn
    self.confsnmtxystpred['fp'] = fp
    self.confsnmtxystpred['fn'] = fn
    self.confsnmtxystpred['tp'] = tp

```

```

# predict probabilities from xtest for roc_curve
self.ytst_predprob_actclf = (self.sgd_clf).decision_function(self.X_test)
#[:,1]
fpr, tpr, thrshld_test = roc_curve(self.y_test, self.ytst_predprob_actclf)

# fit train again and predict probabilities from xtrain
(self.sgd_clf).fit(self.xtrain, self.ytrain)
self.ytrn_predprob_actclf = (self.sgd_clf).decision_function(self.X_train)
#[:,1]
fpr_trn, tpr_trn, thrshld_trn = roc_curve(self.y_train, self.ytrn_predprob_actclf)

#fit the validation model predict and generate the accuracy score
(self.sgd_clf).fit(self.xval, self.yval)
# predict the labels for validation
self.predicted = (self.sgd_clf).predict(self.xval)

# calculate accuracy_score
self.accuracy_score_val = accuracy_score(self.yval, self.predicted)

# store the above into the dictionary
self.roc_curve_test['fpr_trn'] = fpr_trn
self.roc_curve_test['tpr_trn'] = tpr_trn
self.roc_curve_test['thrshld_trn'] = thrshld_trn
self.roc_curve_test['fpr'] = fpr
self.roc_curve_test['tpr'] = tpr
self.roc_curve_test['thrshld_test'] = thrshld_test

"""
if __name__ == '__main__':
    lnrsvm = assign7SVM()
    lnrsvm.load_data('BOW')
    lnrsvm.load_data('TFIDF')
    lnrsvm.load_data('AVGW2V')
    lnrsvm.load_data('WTW2V')

```

```
In [13]: import matplotlib.pyplot as plt
import pandas as pd
import numpy as np

class drawgraphs:
    def __init__(self):
        self.graph_parameters= {}
        self.plt = None

    #self.graph_parameters['']=
    def setdefaultparm(self):
        self.Xdata=pd.DataFrame()
        self.ydatatrn=pd.DataFrame()
        self.ydataval=pd.DataFrame()
        self.graph_parameters['figsize_x']= 16
        self.graph_parameters['figsize_y']= 16
        self.graph_parameters['show_legnd']= False
        self.graph_parameters['show_grid']= True
        self.graph_title = None
        self.legnd_1x = None
        self.legnd_2 = None
        self.label_x = None
        self.label_y = None

    @property
    def Xdata(self):
        return self._Xdata

    @Xdata.setter
    def Xdata(self,new_Xdata):
        self._Xdata = new_Xdata

    @property
    def ydatatrn(self):
        return self._ydatatrn

    @ydatatrn.setter
    def ydatatrn(self,new_ydatatrn):
        self._ydatatrn = new_ydatatrn

    @property
    def ydataval(self):
        return self._ydataval

    @ydataval.setter
    def ydataval(self,new_ydataval):
        self._ydataval = new_ydataval

    @property
    def graph_title(self):
        return self._graph_title

    @graph_title.setter
```

```

def graph_title(self,new_title):
    self._graph_title = new_title

@property
def legnd_1(self):
    return self._legnd_1

@legnd_1.setter
def legnd_1(self,new_legnd1):
    self._legnd_1 = new_legnd1

@property
def legnd_2(self):
    return self._legnd_2

@legnd_2.setter
def legnd_2(self,new_legnd2):
    self._legnd_2 = new_legnd2

@property
def label_x(self):
    return self._label_x

@label_x.setter
def label_x(self,new_lblx):
    self._label_x = new_lblx

@property
def label_y(self):
    return self._label_y

@label_y.setter
def label_y(self,new_labely):
    self._label_y = new_labely

def rocacuscograph(self):
    plt.figure(figsize=(self.graph_parameters['figsize_x'],self.graph_p
arameters['figsize_y']))
    y1=np.asarray(self.ydatatrn)
    y1 = y1.reshape(-1,1)
    y2=np.asarray(self.ydataval)
    y2 = y2.reshape(-1,1)
    x = np.log(self.Xdata)
    plt.plot(x,y1, label=self.legnd_1)
    plt.plot(x,y2, label=self.legnd_2)
    plt.xlabel(self.label_x)
    plt.ylabel(self.label_y)
    plt.title(self.graph_title)
    plt.grid(self.graph_parameters['show_grid'])

    if self.graph_parameters['show_legnd'] :
        plt.legend()
    plt.show()

```

```

def constructgraph(self, fpr_trn, tpr_trn, fpr, tpr):
    plt.figure(figsize=(self.graph_parameters['figsize_x'],self.graph_p
arameters['figsize_y']))
    plt.plot([0,1],[0,1],'k--')
    plt.plot(fpr_trn,tpr_trn, label=self.legnd_1)
    plt.plot(fpr,tpr, label=self.legnd_2)
    plt.xlabel(self.label_x)
    plt.ylabel(self.label_y)
    plt.title(self.graph_title)
    plt.grid(self.graph_parameters['show_grid'])

    if self.graph_parameters['show_legnd'] :
        plt.legend()
    plt.show()

def draw_table(self,data):
    colors = [{"#56b5fd","w"},[ "w", "#1ac3f5"]]
    table = plt.table(cellText=data,rowLabels=['Actual:\n NO','Actual:
\nYES'], collabels=['Predicted: \n NO', 'Predicted: \n YES'], loc='center',
                    cellLoc='center',cellColours=colors, colColours=[
'Red', 'Green'],rowColours=['Yellow','Green'])

    table.set_fontsize(24)
    for i in range(0,3):
        for j in range(-1,2):
            if (i==0 and j == -1):
                continue
            table.get_celld()[(i,j)].set_height(0.5)
            table.get_celld()[(i,j)].set_width(0.5)
            table.get_celld()[(i,j)].set_linewidth(4)
    plt.axis('off')
    plt.show()

def draw_accscore(self,data):
    #colors = [{"#56b5fd", "w"}]
    table = plt.table(cellText=data,collabels=['Validation','Test'], ro
wLabels=['Accuracy\nScore'], loc='center',
                    cellLoc='center', rowColours=['Green'],colColours
=["#56b5fd", "#1ac3f5"])

    table.set_fontsize(24)
    for i in range(0,2):
        for j in range(-1,2):
            if (i==0 and j == -1):
                continue
            table.get_celld()[(i,j)].set_height(0.5)
            table.get_celld()[(i,j)].set_width(0.8)
            table.get_celld()[(i,j)].set_linewidth(4)
    plt.axis('off')
    plt.show()

def draw_posnegwords(self,data):
    #colors = [{"#56b5fd", "w"}]
    table = plt.table(cellText=data,collabels=['Postive','Negative'], r
owLabels=['1','2','3','4','5','6','7','8','9','10'], loc='center',

```



```

cellLoc='center',colColours=["#56b5fd","#1ac3f5"
])

table.set_fontsize(20)
for i in range(0,11):
    for j in range(-1,2):
        if (i==0 and j == -1):
            continue
        #if (i==0 and j == 2):
        #continue
        table.get_celld()[(i,j)].set_height(0.3)
        table.get_celld()[(i,j)].set_width(0.8)
        table.get_celld()[(i,j)].set_linewidth(4)
plt.axis('off')
plt.show()

def visual_featname(self,feature_names,coef,top_coefs,num_feat):
    # create plot
    plt.figure(figsize=(21, 7))
    colors = ['red' if c < 0 else 'blue' for c in coef[top_coefs]]
    plt.bar(np.arange(2 * num_feat), coef[top_coefs], color=colors)
    feature_names = np.array(feature_names)
    plt.xticks(np.arange(0, 1 + 2 * num_feat), feature_names[top_coefs
], rotation=60, ha='right')
    plt.show()

```

[5.1.1] Applying Linear SVM on BOW, SET 1

In [3]: *# Please write all the code with proper documentation*

GridsearchCV output for BOW

```

0.8881701783659935 {'alpha': 0.001, 'penalty': 'l2'} GridSearchCV(cv=5, error_score='raise-deprecating',
estimator=SGDClassifier(alpha=0.0001, average=False, class_weight=None, early_stopping=False,
epsilon=0.1, eta0=0.0, fit_intercept=True, l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2', power_t=0.5, random_state=42, shuffle=True,
tol=0.001, validation_fraction=0.1, verbose=100, warm_start=False), fit_params=None, iid='warn',
n_jobs=None, param_grid={'penalty': ['l2', 'l1'], 'alpha': [0.0001, 0.001, 0.01, 0.1, 1, 10, 100, 1000]},
pre_dispatch='2*n_jobs', refit=True, return_train_score='warn', scoring='roc_auc', verbose=100)

```

```
In [14]: lnrsvm = assign7SVM()  
lnrsvm_sgdclf = lnrsvm.SGDClassifier()  
lnrsvm.load_data('BOW')  
lnrsvm.setpenaltyparm('l2')
```

```
Out[14]: SGDClassifier(alpha=0.0001, average=False, class_weight={0: 5.14, 1: 1},  
    early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,  
    l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,  
    n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',  
    power_t=0.5, random_state=42, shuffle=True, tol=0.001,  
    validation_fraction=0.1, verbose=100, warm_start=False)
```

In [15]: `lnrsvm.SVM_calcrocaucscore(1000000)`

```
SGDClassifier(alpha=1e-07, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 77016.59, NNZs: 500, Bias: -155.525841, T: 23945, Avg. loss: 11167.73
3835
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 73679.23, NNZs: 500, Bias: -235.740651, T: 47890, Avg. loss: 10885.01
9822
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 67094.47, NNZs: 500, Bias: -369.780546, T: 71835, Avg. loss: 9001.547
764
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 57251.70, NNZs: 500, Bias: -454.320566, T: 95780, Avg. loss: 8496.571
535
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 54039.95, NNZs: 500, Bias: -557.725253, T: 119725, Avg. loss: 7564.47
9319
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 50000.60, NNZs: 500, Bias: -622.659203, T: 143670, Avg. loss: 6960.27
7368
Total training time: 0.09 seconds.
-- Epoch 7
Norm: 51376.95, NNZs: 500, Bias: -686.685522, T: 167615, Avg. loss: 6796.27
0634
Total training time: 0.10 seconds.
-- Epoch 8
Norm: 43991.75, NNZs: 500, Bias: -757.470239, T: 191560, Avg. loss: 6384.03
6764
Total training time: 0.11 seconds.
-- Epoch 9
Norm: 39894.05, NNZs: 500, Bias: -843.591895, T: 215505, Avg. loss: 5341.07
9335
Total training time: 0.13 seconds.
-- Epoch 10
Norm: 39656.16, NNZs: 500, Bias: -869.342426, T: 239450, Avg. loss: 5373.26
9082
Total training time: 0.14 seconds.
-- Epoch 11
Norm: 37089.00, NNZs: 500, Bias: -920.555951, T: 263395, Avg. loss: 5273.36
6449
Total training time: 0.15 seconds.
-- Epoch 12
Norm: 34923.94, NNZs: 500, Bias: -965.800662, T: 287340, Avg. loss: 4870.53
2841
Total training time: 0.16 seconds.
-- Epoch 13
Norm: 31534.41, NNZs: 500, Bias: -1017.690123, T: 311285, Avg. loss: 4510.9
25122
```

Total training time: 0.18 seconds.
-- Epoch 14
Norm: 32851.25, NNZs: 500, Bias: -1045.100358, T: 335230, Avg. loss: 4262.945448
Total training time: 0.19 seconds.
-- Epoch 15
Norm: 31839.08, NNZs: 500, Bias: -1055.177054, T: 359175, Avg. loss: 4279.290353
Total training time: 0.20 seconds.
-- Epoch 16
Norm: 29538.83, NNZs: 500, Bias: -1073.056652, T: 383120, Avg. loss: 4158.688947
Total training time: 0.21 seconds.
-- Epoch 17
Norm: 29187.28, NNZs: 500, Bias: -1094.648164, T: 407065, Avg. loss: 3982.826653
Total training time: 0.23 seconds.
-- Epoch 18
Norm: 25746.68, NNZs: 500, Bias: -1107.577359, T: 431010, Avg. loss: 3636.495881
Total training time: 0.24 seconds.
-- Epoch 19
Norm: 25460.57, NNZs: 500, Bias: -1122.665184, T: 454955, Avg. loss: 3477.543154
Total training time: 0.25 seconds.
-- Epoch 20
Norm: 25055.91, NNZs: 500, Bias: -1140.848395, T: 478900, Avg. loss: 3464.135404
Total training time: 0.26 seconds.
-- Epoch 21
Norm: 23120.60, NNZs: 500, Bias: -1161.063872, T: 502845, Avg. loss: 3246.570861
Total training time: 0.27 seconds.
-- Epoch 22
Norm: 23325.82, NNZs: 500, Bias: -1171.807056, T: 526790, Avg. loss: 3173.079311
Total training time: 0.29 seconds.
-- Epoch 23
Norm: 22112.18, NNZs: 500, Bias: -1177.829772, T: 550735, Avg. loss: 3142.694514
Total training time: 0.30 seconds.
-- Epoch 24
Norm: 21482.09, NNZs: 500, Bias: -1176.509561, T: 574680, Avg. loss: 2980.373392
Total training time: 0.31 seconds.
-- Epoch 25
Norm: 20752.77, NNZs: 500, Bias: -1176.999979, T: 598625, Avg. loss: 2857.897519
Total training time: 0.32 seconds.
-- Epoch 26
Norm: 19708.24, NNZs: 500, Bias: -1171.396658, T: 622570, Avg. loss: 2872.084268
Total training time: 0.33 seconds.
-- Epoch 27
Norm: 19603.97, NNZs: 500, Bias: -1170.254450, T: 646515, Avg. loss: 2806.338069
Total training time: 0.35 seconds.

```
-- Epoch 28
Norm: 22260.52, NNZs: 500, Bias: -1161.521576, T: 670460, Avg. loss: 2687.4
92036
Total training time: 0.36 seconds.
-- Epoch 29
Norm: 19515.19, NNZs: 500, Bias: -1150.343912, T: 694405, Avg. loss: 2757.4
08456
Total training time: 0.37 seconds.
-- Epoch 30
Norm: 17209.82, NNZs: 500, Bias: -1164.847233, T: 718350, Avg. loss: 2408.7
34549
Total training time: 0.39 seconds.
-- Epoch 31
Norm: 17329.58, NNZs: 500, Bias: -1174.927270, T: 742295, Avg. loss: 2436.5
73141
Total training time: 0.40 seconds.
-- Epoch 32
Norm: 18004.06, NNZs: 500, Bias: -1154.812048, T: 766240, Avg. loss: 2395.1
43064
Total training time: 0.42 seconds.
-- Epoch 33
Norm: 17138.81, NNZs: 500, Bias: -1147.602060, T: 790185, Avg. loss: 2413.9
45650
Total training time: 0.43 seconds.
-- Epoch 34
Norm: 17269.70, NNZs: 500, Bias: -1145.365536, T: 814130, Avg. loss: 2327.8
67265
Total training time: 0.45 seconds.
-- Epoch 35
Norm: 15305.87, NNZs: 500, Bias: -1147.525422, T: 838075, Avg. loss: 2223.7
08891
Total training time: 0.46 seconds.
-- Epoch 36
Norm: 15758.61, NNZs: 500, Bias: -1138.769147, T: 862020, Avg. loss: 2170.7
08356
Total training time: 0.47 seconds.
-- Epoch 37
Norm: 15427.92, NNZs: 500, Bias: -1126.598889, T: 885965, Avg. loss: 2075.8
28570
Total training time: 0.48 seconds.
-- Epoch 38
Norm: 14448.87, NNZs: 500, Bias: -1121.299925, T: 909910, Avg. loss: 2008.7
52138
Total training time: 0.49 seconds.
-- Epoch 39
Norm: 15980.18, NNZs: 500, Bias: -1110.598503, T: 933855, Avg. loss: 2093.8
52044
Total training time: 0.50 seconds.
-- Epoch 40
Norm: 14698.82, NNZs: 500, Bias: -1104.088356, T: 957800, Avg. loss: 2008.2
13755
Total training time: 0.51 seconds.
-- Epoch 41
Norm: 14060.00, NNZs: 500, Bias: -1112.530690, T: 981745, Avg. loss: 1897.0
73705
Total training time: 0.52 seconds.
-- Epoch 42
```

Norm: 14117.43, NNZs: 500, Bias: -1099.582009, T: 1005690, Avg. loss: 1935.634731
Total training time: 0.53 seconds.
-- Epoch 43
Norm: 12903.76, NNZs: 500, Bias: -1101.582530, T: 1029635, Avg. loss: 1853.587389
Total training time: 0.54 seconds.
-- Epoch 44
Norm: 13740.03, NNZs: 500, Bias: -1090.716574, T: 1053580, Avg. loss: 1715.039971
Total training time: 0.55 seconds.
-- Epoch 45
Norm: 12457.30, NNZs: 500, Bias: -1081.754558, T: 1077525, Avg. loss: 1812.422067
Total training time: 0.56 seconds.
-- Epoch 46
Norm: 13273.43, NNZs: 500, Bias: -1075.565163, T: 1101470, Avg. loss: 1671.787398
Total training time: 0.58 seconds.
-- Epoch 47
Norm: 12537.42, NNZs: 500, Bias: -1060.776781, T: 1125415, Avg. loss: 1642.260560
Total training time: 0.59 seconds.
-- Epoch 48
Norm: 12710.06, NNZs: 500, Bias: -1050.650321, T: 1149360, Avg. loss: 1726.731087
Total training time: 0.60 seconds.
-- Epoch 49
Norm: 12010.36, NNZs: 500, Bias: -1043.595948, T: 1173305, Avg. loss: 1600.543994
Total training time: 0.61 seconds.
-- Epoch 50
Norm: 11653.51, NNZs: 500, Bias: -1035.342589, T: 1197250, Avg. loss: 1557.015315
Total training time: 0.62 seconds.
-- Epoch 51
Norm: 12388.98, NNZs: 500, Bias: -1030.158001, T: 1221195, Avg. loss: 1609.615116
Total training time: 0.64 seconds.
-- Epoch 52
Norm: 11040.95, NNZs: 500, Bias: -1021.342516, T: 1245140, Avg. loss: 1569.210816
Total training time: 0.65 seconds.
-- Epoch 53
Norm: 11340.49, NNZs: 500, Bias: -1012.324743, T: 1269085, Avg. loss: 1460.273751
Total training time: 0.66 seconds.
-- Epoch 54
Norm: 11558.30, NNZs: 500, Bias: -999.328397, T: 1293030, Avg. loss: 1566.29313
Total training time: 0.67 seconds.
-- Epoch 55
Norm: 11033.43, NNZs: 500, Bias: -980.852998, T: 1316975, Avg. loss: 1632.751533
Total training time: 0.68 seconds.
-- Epoch 56
Norm: 11147.23, NNZs: 500, Bias: -966.268355, T: 1340920, Avg. loss: 1563.0

```
09996
Total training time: 0.69 seconds.
-- Epoch 57
Norm: 10737.03, NNZs: 500, Bias: -958.795077, T: 1364865, Avg. loss: 1509.0
15215
Total training time: 0.71 seconds.
-- Epoch 58
Norm: 10848.69, NNZs: 500, Bias: -945.059147, T: 1388810, Avg. loss: 1507.8
13213
Total training time: 0.72 seconds.
Convergence after 58 epochs took 0.72 seconds
Fitting probability generation and roc auc score generation for training da
ta complete...
Fitting probability generation and roc auc score generation for validation
data complete...
SGDClassifier(alpha=1e-06, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 27965.97, NNZs: 500, Bias: -67.971289, T: 23945, Avg. loss: 4940.6823
97
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 20974.73, NNZs: 500, Bias: -97.873387, T: 47890, Avg. loss: 3452.3882
83
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 16106.45, NNZs: 500, Bias: -132.949523, T: 71835, Avg. loss: 2307.755
512
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 12761.65, NNZs: 500, Bias: -153.770516, T: 95780, Avg. loss: 2006.378
433
Total training time: 0.04 seconds.
-- Epoch 5
Norm: 10950.98, NNZs: 500, Bias: -173.493389, T: 119725, Avg. loss: 1594.01
9465
Total training time: 0.05 seconds.
-- Epoch 6
Norm: 9154.05, NNZs: 500, Bias: -188.406874, T: 143670, Avg. loss: 1321.284
651
Total training time: 0.06 seconds.
-- Epoch 7
Norm: 8048.11, NNZs: 500, Bias: -202.048590, T: 167615, Avg. loss: 1149.484
297
Total training time: 0.08 seconds.
-- Epoch 8
Norm: 7342.82, NNZs: 500, Bias: -213.566990, T: 191560, Avg. loss: 1031.265
397
Total training time: 0.09 seconds.
-- Epoch 9
Norm: 6491.89, NNZs: 500, Bias: -221.767202, T: 215505, Avg. loss: 962.2902
88
Total training time: 0.10 seconds.
```



```
-- Epoch 10
Norm: 6131.54, NNZs: 500, Bias: -223.543435, T: 239450, Avg. loss: 850.8720
14
Total training time: 0.11 seconds.
-- Epoch 11
Norm: 5658.75, NNZs: 500, Bias: -231.081621, T: 263395, Avg. loss: 764.7829
37
Total training time: 0.12 seconds.
-- Epoch 12
Norm: 5113.20, NNZs: 500, Bias: -233.849810, T: 287340, Avg. loss: 719.4365
90
Total training time: 0.14 seconds.
-- Epoch 13
Norm: 4585.04, NNZs: 500, Bias: -235.324185, T: 311285, Avg. loss: 673.3151
78
Total training time: 0.15 seconds.
-- Epoch 14
Norm: 4745.41, NNZs: 500, Bias: -232.127356, T: 335230, Avg. loss: 641.4371
35
Total training time: 0.17 seconds.
-- Epoch 15
Norm: 4160.04, NNZs: 500, Bias: -233.444066, T: 359175, Avg. loss: 579.9119
49
Total training time: 0.18 seconds.
-- Epoch 16
Norm: 4057.10, NNZs: 500, Bias: -234.054107, T: 383120, Avg. loss: 571.3702
22
Total training time: 0.19 seconds.
-- Epoch 17
Norm: 3913.72, NNZs: 500, Bias: -234.879824, T: 407065, Avg. loss: 514.9335
38
Total training time: 0.20 seconds.
-- Epoch 18
Norm: 3368.96, NNZs: 500, Bias: -233.069754, T: 431010, Avg. loss: 495.8487
04
Total training time: 0.21 seconds.
-- Epoch 19
Norm: 3319.59, NNZs: 500, Bias: -235.350731, T: 454955, Avg. loss: 433.5527
89
Total training time: 0.22 seconds.
-- Epoch 20
Norm: 3234.04, NNZs: 500, Bias: -233.275883, T: 478900, Avg. loss: 464.2513
05
Total training time: 0.23 seconds.
-- Epoch 21
Norm: 2928.70, NNZs: 500, Bias: -231.534281, T: 502845, Avg. loss: 400.8330
63
Total training time: 0.24 seconds.
-- Epoch 22
Norm: 2936.66, NNZs: 500, Bias: -231.563444, T: 526790, Avg. loss: 405.4051
43
Total training time: 0.25 seconds.
-- Epoch 23
Norm: 2806.49, NNZs: 500, Bias: -230.634441, T: 550735, Avg. loss: 397.7959
22
Total training time: 0.26 seconds.
-- Epoch 24
```

Norm: 2678.84, NNZs: 500, Bias: -231.018045, T: 574680, Avg. loss: 362.0401
27
Total training time: 0.27 seconds.
-- Epoch 25
Norm: 2702.33, NNZs: 500, Bias: -227.299344, T: 598625, Avg. loss: 368.1920
96
Total training time: 0.28 seconds.
-- Epoch 26
Norm: 2446.73, NNZs: 500, Bias: -223.912421, T: 622570, Avg. loss: 349.1559
55
Total training time: 0.29 seconds.
-- Epoch 27
Norm: 2432.86, NNZs: 500, Bias: -224.157922, T: 646515, Avg. loss: 315.9127
32
Total training time: 0.30 seconds.
-- Epoch 28
Norm: 2554.58, NNZs: 500, Bias: -221.250642, T: 670460, Avg. loss: 319.0319
52
Total training time: 0.31 seconds.
-- Epoch 29
Norm: 2325.01, NNZs: 500, Bias: -218.692853, T: 694405, Avg. loss: 336.9245
16
Total training time: 0.32 seconds.
-- Epoch 30
Norm: 2113.31, NNZs: 500, Bias: -217.454650, T: 718350, Avg. loss: 300.9181
18
Total training time: 0.33 seconds.
-- Epoch 31
Norm: 2201.29, NNZs: 500, Bias: -214.977469, T: 742295, Avg. loss: 303.3412
21
Total training time: 0.34 seconds.
-- Epoch 32
Norm: 2117.92, NNZs: 500, Bias: -213.402130, T: 766240, Avg. loss: 278.4002
85
Total training time: 0.35 seconds.
-- Epoch 33
Norm: 1987.09, NNZs: 500, Bias: -209.932391, T: 790185, Avg. loss: 276.7175
55
Total training time: 0.36 seconds.
-- Epoch 34
Norm: 2002.43, NNZs: 500, Bias: -207.558894, T: 814130, Avg. loss: 276.1475
38
Total training time: 0.37 seconds.
-- Epoch 35
Norm: 1847.71, NNZs: 500, Bias: -205.408936, T: 838075, Avg. loss: 274.8581
25
Total training time: 0.38 seconds.
-- Epoch 36
Norm: 1746.12, NNZs: 500, Bias: -202.525668, T: 862020, Avg. loss: 253.1300
59
Total training time: 0.39 seconds.
-- Epoch 37
Norm: 1774.85, NNZs: 500, Bias: -199.044600, T: 885965, Avg. loss: 243.3012
80
Total training time: 0.40 seconds.
-- Epoch 38
Norm: 1623.28, NNZs: 500, Bias: -196.987504, T: 909910, Avg. loss: 238.1568

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78
Total training time: 0.41 seconds.
-- Epoch 39
Norm: 1772.54, NNZs: 500, Bias: -193.773912, T: 933855, Avg. loss: 232.5067
47
Total training time: 0.42 seconds.
-- Epoch 40
Norm: 1628.88, NNZs: 500, Bias: -191.198972, T: 957800, Avg. loss: 234.2304
36
Total training time: 0.43 seconds.
-- Epoch 41
Norm: 1603.14, NNZs: 500, Bias: -189.354709, T: 981745, Avg. loss: 226.9785
99
Total training time: 0.44 seconds.
-- Epoch 42
Norm: 1593.74, NNZs: 500, Bias: -186.678012, T: 1005690, Avg. loss: 214.727
108
Total training time: 0.45 seconds.
-- Epoch 43
Norm: 1439.88, NNZs: 500, Bias: -183.600101, T: 1029635, Avg. loss: 196.903
280
Total training time: 0.46 seconds.
-- Epoch 44
Norm: 1604.21, NNZs: 500, Bias: -181.419924, T: 1053580, Avg. loss: 206.511
120
Total training time: 0.47 seconds.
-- Epoch 45
Norm: 1428.06, NNZs: 500, Bias: -178.448380, T: 1077525, Avg. loss: 208.604
453
Total training time: 0.48 seconds.
-- Epoch 46
Norm: 1475.50, NNZs: 500, Bias: -176.592745, T: 1101470, Avg. loss: 192.664
004
Total training time: 0.49 seconds.
-- Epoch 47
Norm: 1408.80, NNZs: 500, Bias: -173.272165, T: 1125415, Avg. loss: 195.581
501
Total training time: 0.50 seconds.
-- Epoch 48
Norm: 1409.52, NNZs: 500, Bias: -170.588069, T: 1149360, Avg. loss: 188.043
678
Total training time: 0.51 seconds.
-- Epoch 49
Norm: 1428.42, NNZs: 500, Bias: -168.104068, T: 1173305, Avg. loss: 189.486
045
Total training time: 0.52 seconds.
-- Epoch 50
Norm: 1330.01, NNZs: 500, Bias: -166.381344, T: 1197250, Avg. loss: 183.575
155
Total training time: 0.53 seconds.
-- Epoch 51
Norm: 1447.46, NNZs: 500, Bias: -163.331277, T: 1221195, Avg. loss: 181.112
242
Total training time: 0.54 seconds.
-- Epoch 52
Norm: 1281.74, NNZs: 500, Bias: -160.870563, T: 1245140, Avg. loss: 180.087
794
```

Total training time: 0.55 seconds.
-- Epoch 53
Norm: 1262.01, NNZs: 500, Bias: -158.248018, T: 1269085, Avg. loss: 175.643797
Total training time: 0.56 seconds.
-- Epoch 54
Norm: 1266.43, NNZs: 500, Bias: -155.307033, T: 1293030, Avg. loss: 175.803914
Total training time: 0.57 seconds.
-- Epoch 55
Norm: 1264.79, NNZs: 500, Bias: -151.900211, T: 1316975, Avg. loss: 183.976843
Total training time: 0.58 seconds.
-- Epoch 56
Norm: 1204.22, NNZs: 500, Bias: -149.680306, T: 1340920, Avg. loss: 166.773009
Total training time: 0.59 seconds.
-- Epoch 57
Norm: 1189.09, NNZs: 500, Bias: -147.966830, T: 1364865, Avg. loss: 161.786872
Total training time: 0.60 seconds.
-- Epoch 58
Norm: 1169.39, NNZs: 500, Bias: -145.338498, T: 1388810, Avg. loss: 167.868705
Total training time: 0.61 seconds.
-- Epoch 59
Norm: 1128.87, NNZs: 500, Bias: -142.836097, T: 1412755, Avg. loss: 159.026946
Total training time: 0.62 seconds.
-- Epoch 60
Norm: 1169.03, NNZs: 500, Bias: -140.526764, T: 1436700, Avg. loss: 162.209929
Total training time: 0.63 seconds.
-- Epoch 61
Norm: 1166.57, NNZs: 500, Bias: -138.459124, T: 1460645, Avg. loss: 154.816188
Total training time: 0.64 seconds.
-- Epoch 62
Norm: 1162.73, NNZs: 500, Bias: -136.023861, T: 1484590, Avg. loss: 156.741363
Total training time: 0.65 seconds.
-- Epoch 63
Norm: 1055.28, NNZs: 500, Bias: -133.753113, T: 1508535, Avg. loss: 141.738161
Total training time: 0.66 seconds.
-- Epoch 64
Norm: 1034.18, NNZs: 500, Bias: -131.501238, T: 1532480, Avg. loss: 149.692721
Total training time: 0.67 seconds.
-- Epoch 65
Norm: 1083.73, NNZs: 500, Bias: -129.091047, T: 1556425, Avg. loss: 147.751438
Total training time: 0.68 seconds.
-- Epoch 66
Norm: 1000.29, NNZs: 500, Bias: -128.351576, T: 1580370, Avg. loss: 136.839846
Total training time: 0.69 seconds.

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-- Epoch 67
Norm: 1027.55, NNZs: 500, Bias: -126.181087, T: 1604315, Avg. loss: 141.705
470
Total training time: 0.70 seconds.
-- Epoch 68
Norm: 984.74, NNZs: 500, Bias: -124.438142, T: 1628260, Avg. loss: 141.5987
44
Total training time: 0.71 seconds.
-- Epoch 69
Norm: 964.67, NNZs: 500, Bias: -122.059998, T: 1652205, Avg. loss: 128.3903
38
Total training time: 0.72 seconds.
-- Epoch 70
Norm: 954.08, NNZs: 500, Bias: -120.285546, T: 1676150, Avg. loss: 128.9529
86
Total training time: 0.73 seconds.
-- Epoch 71
Norm: 974.90, NNZs: 500, Bias: -118.363337, T: 1700095, Avg. loss: 138.1640
85
Total training time: 0.73 seconds.
-- Epoch 72
Norm: 999.30, NNZs: 500, Bias: -116.610264, T: 1724040, Avg. loss: 132.3375
21
Total training time: 0.74 seconds.
-- Epoch 73
Norm: 912.06, NNZs: 500, Bias: -114.811747, T: 1747985, Avg. loss: 131.9567
59
Total training time: 0.75 seconds.
-- Epoch 74
Norm: 920.26, NNZs: 500, Bias: -113.140336, T: 1771930, Avg. loss: 127.9029
67
Total training time: 0.76 seconds.
-- Epoch 75
Norm: 925.28, NNZs: 500, Bias: -111.476043, T: 1795875, Avg. loss: 128.8828
07
Total training time: 0.77 seconds.
-- Epoch 76
Norm: 861.86, NNZs: 500, Bias: -109.928728, T: 1819820, Avg. loss: 120.6257
93
Total training time: 0.78 seconds.
-- Epoch 77
Norm: 845.00, NNZs: 500, Bias: -108.408338, T: 1843765, Avg. loss: 119.6731
97
Total training time: 0.79 seconds.
-- Epoch 78
Norm: 839.08, NNZs: 500, Bias: -107.481341, T: 1867710, Avg. loss: 121.8882
40
Total training time: 0.80 seconds.
-- Epoch 79
Norm: 840.59, NNZs: 500, Bias: -105.624772, T: 1891655, Avg. loss: 116.1039
35
Total training time: 0.81 seconds.
-- Epoch 80
Norm: 866.75, NNZs: 500, Bias: -104.241115, T: 1915600, Avg. loss: 117.4307
57
Total training time: 0.82 seconds.
-- Epoch 81
```

Norm: 854.29, NNZs: 500, Bias: -102.746985, T: 1939545, Avg. loss: 119.164198
Total training time: 0.83 seconds.
-- Epoch 82
Norm: 807.25, NNZs: 500, Bias: -101.224148, T: 1963490, Avg. loss: 117.169166
Total training time: 0.84 seconds.
-- Epoch 83
Norm: 807.13, NNZs: 500, Bias: -99.953524, T: 1987435, Avg. loss: 105.729869
Total training time: 0.85 seconds.
-- Epoch 84
Norm: 783.25, NNZs: 500, Bias: -98.914750, T: 2011380, Avg. loss: 113.596980
Total training time: 0.86 seconds.
-- Epoch 85
Norm: 814.06, NNZs: 500, Bias: -97.115054, T: 2035325, Avg. loss: 114.081851
Total training time: 0.87 seconds.
-- Epoch 86
Norm: 760.26, NNZs: 500, Bias: -95.475572, T: 2059270, Avg. loss: 105.705354
Total training time: 0.88 seconds.
-- Epoch 87
Norm: 803.58, NNZs: 500, Bias: -93.880036, T: 2083215, Avg. loss: 107.188496
Total training time: 0.89 seconds.
-- Epoch 88
Norm: 826.76, NNZs: 500, Bias: -93.091521, T: 2107160, Avg. loss: 109.308134
Total training time: 0.90 seconds.
-- Epoch 89
Norm: 757.96, NNZs: 500, Bias: -91.953538, T: 2131105, Avg. loss: 106.236175
Total training time: 0.91 seconds.
-- Epoch 90
Norm: 766.26, NNZs: 500, Bias: -90.635671, T: 2155050, Avg. loss: 104.981534
Total training time: 0.92 seconds.
-- Epoch 91
Norm: 754.08, NNZs: 500, Bias: -88.628639, T: 2178995, Avg. loss: 102.512760
Total training time: 0.93 seconds.
-- Epoch 92
Norm: 729.04, NNZs: 500, Bias: -87.463947, T: 2202940, Avg. loss: 104.990044
Total training time: 0.94 seconds.
-- Epoch 93
Norm: 711.83, NNZs: 500, Bias: -86.594171, T: 2226885, Avg. loss: 93.405652
Total training time: 0.94 seconds.
-- Epoch 94
Norm: 744.05, NNZs: 500, Bias: -85.202018, T: 2250830, Avg. loss: 98.986501
Total training time: 0.95 seconds.
-- Epoch 95
Norm: 704.89, NNZs: 500, Bias: -84.085373, T: 2274775, Avg. loss: 101.141846
Total training time: 0.96 seconds.

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-- Epoch 96
Norm: 703.43, NNZs: 500, Bias: -83.022310, T: 2298720, Avg. loss: 102.30279
9
Total training time: 0.97 seconds.
-- Epoch 97
Norm: 712.90, NNZs: 500, Bias: -82.091985, T: 2322665, Avg. loss: 99.582458
Total training time: 0.98 seconds.
-- Epoch 98
Norm: 717.38, NNZs: 500, Bias: -80.602916, T: 2346610, Avg. loss: 95.823163
Total training time: 1.00 seconds.
Convergence after 98 epochs took 1.00 seconds
Fitting probability generation and roc auc score generation for training da
ta complete...
Fitting probability generation and roc auc score generation for validation
data complete...
SGDClassifier(alpha=9.999999999999999e-06, average=False,
               class_weight={0: 5.14, 1: 1}, early_stopping=False, epsilon=0.1,
               eta0=0.0, fit_intercept=True, l1_ratio=0.15,
               learning_rate='optimal', loss='hinge', max_iter=1000, n_iter=None,
               n_iter_no_change=5, n_jobs=None, penalty='l2', power_t=0.5,
               random_state=42, shuffle=True, tol=0.001, validation_fraction=0.1,
               verbose=100, warm_start=False)
-- Epoch 1
Norm: 5214.08, NNZs: 500, Bias: -12.930161, T: 23945, Avg. loss: 1425.28770
5
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 3049.84, NNZs: 500, Bias: -16.856967, T: 47890, Avg. loss: 553.551129
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 2078.45, NNZs: 500, Bias: -23.080709, T: 71835, Avg. loss: 332.711458
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 1544.98, NNZs: 500, Bias: -25.584561, T: 95780, Avg. loss: 251.128073
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 1283.42, NNZs: 500, Bias: -27.546098, T: 119725, Avg. loss: 191.21852
9
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 1090.70, NNZs: 500, Bias: -28.351452, T: 143670, Avg. loss: 158.53598
9
Total training time: 0.07 seconds.
-- Epoch 7
Norm: 940.44, NNZs: 500, Bias: -29.283069, T: 167615, Avg. loss: 133.400708
Total training time: 0.08 seconds.
-- Epoch 8
Norm: 786.62, NNZs: 500, Bias: -30.563821, T: 191560, Avg. loss: 115.812670
Total training time: 0.09 seconds.
-- Epoch 9
Norm: 735.19, NNZs: 500, Bias: -31.480448, T: 215505, Avg. loss: 102.525144
Total training time: 0.10 seconds.
-- Epoch 10
Norm: 663.86, NNZs: 500, Bias: -32.037082, T: 239450, Avg. loss: 91.095598
Total training time: 0.11 seconds.
-- Epoch 11
Norm: 594.42, NNZs: 500, Bias: -32.711462, T: 263395, Avg. loss: 82.956353
```

Total training time: 0.13 seconds.
-- Epoch 12
Norm: 547.28, NNZs: 500, Bias: -33.047983, T: 287340, Avg. loss: 77.375003
Total training time: 0.15 seconds.
-- Epoch 13
Norm: 486.28, NNZs: 500, Bias: -33.209595, T: 311285, Avg. loss: 71.717664
Total training time: 0.16 seconds.
-- Epoch 14
Norm: 474.29, NNZs: 500, Bias: -32.911113, T: 335230, Avg. loss: 65.426002
Total training time: 0.17 seconds.
-- Epoch 15
Norm: 473.90, NNZs: 500, Bias: -32.675155, T: 359175, Avg. loss: 61.809693
Total training time: 0.19 seconds.
-- Epoch 16
Norm: 419.01, NNZs: 500, Bias: -32.391778, T: 383120, Avg. loss: 59.388574
Total training time: 0.20 seconds.
-- Epoch 17
Norm: 412.77, NNZs: 500, Bias: -32.248846, T: 407065, Avg. loss: 56.169238
Total training time: 0.21 seconds.
-- Epoch 18
Norm: 375.52, NNZs: 500, Bias: -31.937992, T: 431010, Avg. loss: 53.673777
Total training time: 0.22 seconds.
-- Epoch 19
Norm: 355.70, NNZs: 500, Bias: -31.808938, T: 454955, Avg. loss: 48.557558
Total training time: 0.23 seconds.
-- Epoch 20
Norm: 331.15, NNZs: 500, Bias: -31.482941, T: 478900, Avg. loss: 49.729720
Total training time: 0.24 seconds.
-- Epoch 21
Norm: 312.07, NNZs: 500, Bias: -31.349620, T: 502845, Avg. loss: 43.926523
Total training time: 0.25 seconds.
-- Epoch 22
Norm: 310.44, NNZs: 500, Bias: -31.095789, T: 526790, Avg. loss: 43.795206
Total training time: 0.26 seconds.
-- Epoch 23
Norm: 291.82, NNZs: 500, Bias: -30.734627, T: 550735, Avg. loss: 41.597678
Total training time: 0.27 seconds.
-- Epoch 24
Norm: 280.75, NNZs: 500, Bias: -30.502205, T: 574680, Avg. loss: 39.356229
Total training time: 0.28 seconds.
-- Epoch 25
Norm: 268.32, NNZs: 500, Bias: -29.914129, T: 598625, Avg. loss: 37.827283
Total training time: 0.29 seconds.
-- Epoch 26
Norm: 263.54, NNZs: 500, Bias: -29.344058, T: 622570, Avg. loss: 37.315294
Total training time: 0.30 seconds.
-- Epoch 27
Norm: 250.00, NNZs: 500, Bias: -29.089724, T: 646515, Avg. loss: 34.874613
Total training time: 0.31 seconds.
-- Epoch 28
Norm: 238.32, NNZs: 500, Bias: -28.809819, T: 670460, Avg. loss: 32.264720
Total training time: 0.32 seconds.
-- Epoch 29
Norm: 234.48, NNZs: 500, Bias: -28.426442, T: 694405, Avg. loss: 32.881314
Total training time: 0.33 seconds.
-- Epoch 30
Norm: 227.57, NNZs: 500, Bias: -28.047543, T: 718350, Avg. loss: 31.454581

Total training time: 0.34 seconds.
-- Epoch 31
Norm: 230.27, NNZs: 500, Bias: -27.685264, T: 742295, Avg. loss: 31.905664
Total training time: 0.35 seconds.
-- Epoch 32
Norm: 216.79, NNZs: 500, Bias: -27.252772, T: 766240, Avg. loss: 30.085558
Total training time: 0.36 seconds.
-- Epoch 33
Norm: 210.28, NNZs: 500, Bias: -26.874859, T: 790185, Avg. loss: 28.759092
Total training time: 0.37 seconds.
-- Epoch 34
Norm: 209.74, NNZs: 500, Bias: -26.525674, T: 814130, Avg. loss: 29.174523
Total training time: 0.38 seconds.
-- Epoch 35
Norm: 182.97, NNZs: 500, Bias: -26.359097, T: 838075, Avg. loss: 26.106669
Total training time: 0.39 seconds.
-- Epoch 36
Norm: 176.95, NNZs: 500, Bias: -25.958335, T: 862020, Avg. loss: 25.747274
Total training time: 0.40 seconds.
-- Epoch 37
Norm: 185.45, NNZs: 500, Bias: -25.404885, T: 885965, Avg. loss: 25.239323
Total training time: 0.41 seconds.
-- Epoch 38
Norm: 173.05, NNZs: 500, Bias: -24.968644, T: 909910, Avg. loss: 25.193573
Total training time: 0.42 seconds.
-- Epoch 39
Norm: 191.94, NNZs: 500, Bias: -24.420831, T: 933855, Avg. loss: 26.450528
Total training time: 0.43 seconds.
-- Epoch 40
Norm: 180.83, NNZs: 500, Bias: -24.063049, T: 957800, Avg. loss: 24.804085
Total training time: 0.44 seconds.
-- Epoch 41
Norm: 175.05, NNZs: 500, Bias: -23.688881, T: 981745, Avg. loss: 23.366198
Total training time: 0.45 seconds.
-- Epoch 42
Norm: 176.68, NNZs: 500, Bias: -23.240304, T: 1005690, Avg. loss: 24.141360
Total training time: 0.46 seconds.
-- Epoch 43
Norm: 153.79, NNZs: 500, Bias: -22.982221, T: 1029635, Avg. loss: 21.912832
Total training time: 0.47 seconds.
-- Epoch 44
Norm: 165.41, NNZs: 500, Bias: -22.579949, T: 1053580, Avg. loss: 21.987276
Total training time: 0.48 seconds.
-- Epoch 45
Norm: 144.90, NNZs: 500, Bias: -22.271403, T: 1077525, Avg. loss: 21.164946
Total training time: 0.49 seconds.
-- Epoch 46
Norm: 156.41, NNZs: 500, Bias: -21.866092, T: 1101470, Avg. loss: 20.554848
Total training time: 0.50 seconds.
-- Epoch 47
Norm: 145.66, NNZs: 500, Bias: -21.512365, T: 1125415, Avg. loss: 19.615448
Total training time: 0.51 seconds.
-- Epoch 48
Norm: 150.98, NNZs: 500, Bias: -21.107830, T: 1149360, Avg. loss: 19.764159
Total training time: 0.52 seconds.
-- Epoch 49
Norm: 143.59, NNZs: 500, Bias: -20.721753, T: 1173305, Avg. loss: 18.999129

Total training time: 0.53 seconds.
-- Epoch 50
Norm: 136.53, NNZs: 500, Bias: -20.390790, T: 1197250, Avg. loss: 19.105054
Total training time: 0.54 seconds.
-- Epoch 51
Norm: 140.83, NNZs: 500, Bias: -20.033787, T: 1221195, Avg. loss: 18.658763
Total training time: 0.54 seconds.
-- Epoch 52
Norm: 129.81, NNZs: 500, Bias: -19.656488, T: 1245140, Avg. loss: 18.917534
Total training time: 0.56 seconds.
-- Epoch 53
Norm: 132.15, NNZs: 500, Bias: -19.428863, T: 1269085, Avg. loss: 17.372554
Total training time: 0.56 seconds.
-- Epoch 54
Norm: 126.70, NNZs: 500, Bias: -19.064157, T: 1293030, Avg. loss: 17.870085
Total training time: 0.57 seconds.
-- Epoch 55
Norm: 129.11, NNZs: 500, Bias: -18.663399, T: 1316975, Avg. loss: 18.568920
Total training time: 0.58 seconds.
-- Epoch 56
Norm: 124.11, NNZs: 500, Bias: -18.293236, T: 1340920, Avg. loss: 17.550413
Total training time: 0.59 seconds.
-- Epoch 57
Norm: 118.54, NNZs: 500, Bias: -18.040657, T: 1364865, Avg. loss: 17.126963
Total training time: 0.60 seconds.
-- Epoch 58
Norm: 121.55, NNZs: 500, Bias: -17.662067, T: 1388810, Avg. loss: 17.760085
Total training time: 0.61 seconds.
-- Epoch 59
Norm: 117.43, NNZs: 500, Bias: -17.427736, T: 1412755, Avg. loss: 16.633990
Total training time: 0.62 seconds.
-- Epoch 60
Norm: 119.22, NNZs: 500, Bias: -17.104417, T: 1436700, Avg. loss: 16.045778
Total training time: 0.63 seconds.
-- Epoch 61
Norm: 113.70, NNZs: 500, Bias: -16.794157, T: 1460645, Avg. loss: 15.930580
Total training time: 0.64 seconds.
-- Epoch 62
Norm: 120.72, NNZs: 500, Bias: -16.480375, T: 1484590, Avg. loss: 16.285488
Total training time: 0.65 seconds.
-- Epoch 63
Norm: 113.55, NNZs: 500, Bias: -16.212228, T: 1508535, Avg. loss: 15.346712
Total training time: 0.66 seconds.
-- Epoch 64
Norm: 108.59, NNZs: 500, Bias: -15.889392, T: 1532480, Avg. loss: 15.709597
Total training time: 0.67 seconds.
-- Epoch 65
Norm: 113.29, NNZs: 500, Bias: -15.604256, T: 1556425, Avg. loss: 15.327087
Total training time: 0.68 seconds.
-- Epoch 66
Norm: 105.36, NNZs: 500, Bias: -15.332218, T: 1580370, Avg. loss: 14.505592
Total training time: 0.69 seconds.
-- Epoch 67
Norm: 106.23, NNZs: 500, Bias: -15.071327, T: 1604315, Avg. loss: 14.976058
Total training time: 0.70 seconds.
-- Epoch 68
Norm: 100.42, NNZs: 500, Bias: -14.842139, T: 1628260, Avg. loss: 14.710897

Total training time: 0.71 seconds.
-- Epoch 69
Norm: 98.57, NNZs: 500, Bias: -14.549751, T: 1652205, Avg. loss: 13.935352
Total training time: 0.72 seconds.
-- Epoch 70
Norm: 103.22, NNZs: 500, Bias: -14.276893, T: 1676150, Avg. loss: 13.832447
Total training time: 0.73 seconds.
-- Epoch 71
Norm: 98.39, NNZs: 500, Bias: -14.040737, T: 1700095, Avg. loss: 13.818227
Total training time: 0.74 seconds.
-- Epoch 72
Norm: 100.70, NNZs: 500, Bias: -13.831062, T: 1724040, Avg. loss: 13.373392
Total training time: 0.75 seconds.
-- Epoch 73
Norm: 94.52, NNZs: 500, Bias: -13.594330, T: 1747985, Avg. loss: 13.583326
Total training time: 0.76 seconds.
-- Epoch 74
Norm: 94.64, NNZs: 500, Bias: -13.383583, T: 1771930, Avg. loss: 13.414002
Total training time: 0.77 seconds.
-- Epoch 75
Norm: 88.96, NNZs: 500, Bias: -13.166113, T: 1795875, Avg. loss: 12.711821
Total training time: 0.78 seconds.
-- Epoch 76
Norm: 90.22, NNZs: 500, Bias: -12.947002, T: 1819820, Avg. loss: 13.010917
Total training time: 0.79 seconds.
-- Epoch 77
Norm: 88.39, NNZs: 500, Bias: -12.749996, T: 1843765, Avg. loss: 12.643041
Total training time: 0.80 seconds.
-- Epoch 78
Norm: 84.63, NNZs: 500, Bias: -12.615097, T: 1867710, Avg. loss: 12.153928
Total training time: 0.81 seconds.
-- Epoch 79
Norm: 92.27, NNZs: 500, Bias: -12.422211, T: 1891655, Avg. loss: 12.489995
Total training time: 0.82 seconds.
-- Epoch 80
Norm: 88.94, NNZs: 500, Bias: -12.195084, T: 1915600, Avg. loss: 12.684462
Total training time: 0.82 seconds.
-- Epoch 81
Norm: 89.56, NNZs: 500, Bias: -11.982612, T: 1939545, Avg. loss: 12.220237
Total training time: 0.83 seconds.
-- Epoch 82
Norm: 83.74, NNZs: 500, Bias: -11.740890, T: 1963490, Avg. loss: 12.419934
Total training time: 0.84 seconds.
-- Epoch 83
Norm: 85.09, NNZs: 500, Bias: -11.565803, T: 1987435, Avg. loss: 11.376964
Total training time: 0.85 seconds.
-- Epoch 84
Norm: 82.71, NNZs: 500, Bias: -11.378778, T: 2011380, Avg. loss: 11.865860
Total training time: 0.86 seconds.
-- Epoch 85
Norm: 83.94, NNZs: 500, Bias: -11.186085, T: 2035325, Avg. loss: 11.439066
Total training time: 0.87 seconds.
-- Epoch 86
Norm: 79.81, NNZs: 500, Bias: -11.007568, T: 2059270, Avg. loss: 11.138387
Total training time: 0.88 seconds.
-- Epoch 87
Norm: 82.90, NNZs: 500, Bias: -10.840833, T: 2083215, Avg. loss: 11.185631

Total training time: 0.89 seconds.
-- Epoch 88
Norm: 80.82, NNZs: 500, Bias: -10.714105, T: 2107160, Avg. loss: 10.916088
Total training time: 0.90 seconds.
-- Epoch 89
Norm: 79.54, NNZs: 500, Bias: -10.544020, T: 2131105, Avg. loss: 11.578711
Total training time: 0.91 seconds.
-- Epoch 90
Norm: 77.40, NNZs: 500, Bias: -10.408880, T: 2155050, Avg. loss: 10.783226
Total training time: 0.92 seconds.
-- Epoch 91
Norm: 78.04, NNZs: 500, Bias: -10.214731, T: 2178995, Avg. loss: 10.752486
Total training time: 0.93 seconds.
-- Epoch 92
Norm: 77.51, NNZs: 500, Bias: -10.036290, T: 2202940, Avg. loss: 10.912330
Total training time: 0.94 seconds.
-- Epoch 93
Norm: 79.61, NNZs: 500, Bias: -9.837791, T: 2226885, Avg. loss: 10.262774
Total training time: 0.95 seconds.
-- Epoch 94
Norm: 75.08, NNZs: 500, Bias: -9.680350, T: 2250830, Avg. loss: 10.404423
Total training time: 0.96 seconds.
-- Epoch 95
Norm: 72.64, NNZs: 500, Bias: -9.511466, T: 2274775, Avg. loss: 10.635707
Total training time: 0.97 seconds.
-- Epoch 96
Norm: 72.69, NNZs: 500, Bias: -9.442401, T: 2298720, Avg. loss: 10.499614
Total training time: 0.97 seconds.
-- Epoch 97
Norm: 72.55, NNZs: 500, Bias: -9.291190, T: 2322665, Avg. loss: 10.303124
Total training time: 0.98 seconds.
-- Epoch 98
Norm: 75.44, NNZs: 500, Bias: -9.119202, T: 2346610, Avg. loss: 9.959609
Total training time: 0.99 seconds.
-- Epoch 99
Norm: 72.91, NNZs: 500, Bias: -8.988671, T: 2370555, Avg. loss: 10.032966
Total training time: 1.00 seconds.
-- Epoch 100
Norm: 69.95, NNZs: 500, Bias: -8.882289, T: 2394500, Avg. loss: 9.434322
Total training time: 1.01 seconds.
-- Epoch 101
Norm: 66.12, NNZs: 500, Bias: -8.737017, T: 2418445, Avg. loss: 9.720544
Total training time: 1.02 seconds.
-- Epoch 102
Norm: 68.03, NNZs: 500, Bias: -8.631379, T: 2442390, Avg. loss: 9.512140
Total training time: 1.03 seconds.
-- Epoch 103
Norm: 67.90, NNZs: 500, Bias: -8.489760, T: 2466335, Avg. loss: 9.521016
Total training time: 1.04 seconds.
-- Epoch 104
Norm: 68.03, NNZs: 500, Bias: -8.417331, T: 2490280, Avg. loss: 9.271390
Total training time: 1.05 seconds.
-- Epoch 105
Norm: 65.82, NNZs: 500, Bias: -8.239043, T: 2514225, Avg. loss: 9.606674
Total training time: 1.06 seconds.
-- Epoch 106
Norm: 66.39, NNZs: 500, Bias: -8.085801, T: 2538170, Avg. loss: 9.071991

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Total training time: 1.07 seconds.
-- Epoch 107
Norm: 69.37, NNZs: 500, Bias: -7.953890, T: 2562115, Avg. loss: 9.703663
Total training time: 1.08 seconds.
-- Epoch 108
Norm: 63.00, NNZs: 500, Bias: -7.833076, T: 2586060, Avg. loss: 8.803131
Total training time: 1.09 seconds.
-- Epoch 109
Norm: 62.10, NNZs: 500, Bias: -7.736604, T: 2610005, Avg. loss: 8.503390
Total training time: 1.10 seconds.
-- Epoch 110
Norm: 59.85, NNZs: 500, Bias: -7.631664, T: 2633950, Avg. loss: 8.927179
Total training time: 1.11 seconds.
-- Epoch 111
Norm: 67.52, NNZs: 500, Bias: -7.495921, T: 2657895, Avg. loss: 8.999954
Total training time: 1.12 seconds.
-- Epoch 112
Norm: 66.71, NNZs: 500, Bias: -7.429494, T: 2681840, Avg. loss: 8.777155
Total training time: 1.13 seconds.
-- Epoch 113
Norm: 62.61, NNZs: 500, Bias: -7.373388, T: 2705785, Avg. loss: 8.720766
Total training time: 1.14 seconds.
-- Epoch 114
Norm: 59.33, NNZs: 500, Bias: -7.288740, T: 2729730, Avg. loss: 8.802430
Total training time: 1.15 seconds.
Convergence after 114 epochs took 1.15 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=9.999999999999999e-05, average=False,
               class_weight={0: 5.14, 1: 1}, early_stopping=False, epsilon=0.1,
               eta0=0.0, fit_intercept=True, l1_ratio=0.15,
               learning_rate='optimal', loss='hinge', max_iter=1000, n_iter=None,
               n_iter_no_change=5, n_jobs=None, penalty='l2', power_t=0.5,
               random_state=42, shuffle=True, tol=0.001, validation_fraction=0.1,
               verbose=100, warm_start=False)
-- Epoch 1
Norm: 623.11, NNZs: 500, Bias: -4.120910, T: 23945, Avg. loss: 244.012020
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 329.56, NNZs: 500, Bias: -4.910849, T: 47890, Avg. loss: 61.463562
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 221.89, NNZs: 500, Bias: -5.326570, T: 71835, Avg. loss: 35.972892
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 166.87, NNZs: 500, Bias: -5.397901, T: 95780, Avg. loss: 27.946197
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 144.14, NNZs: 500, Bias: -5.541486, T: 119725, Avg. loss: 20.478011
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 112.18, NNZs: 500, Bias: -5.592295, T: 143670, Avg. loss: 17.276387
Total training time: 0.07 seconds.
-- Epoch 7
Norm: 101.74, NNZs: 500, Bias: -5.642952, T: 167615, Avg. loss: 14.353650
```

Total training time: 0.08 seconds.
-- Epoch 8
Norm: 86.40, NNZs: 500, Bias: -5.644044, T: 191560, Avg. loss: 13.260193
Total training time: 0.09 seconds.
-- Epoch 9
Norm: 76.05, NNZs: 500, Bias: -5.616647, T: 215505, Avg. loss: 11.349240
Total training time: 0.10 seconds.
-- Epoch 10
Norm: 68.81, NNZs: 500, Bias: -5.531954, T: 239450, Avg. loss: 9.855189
Total training time: 0.11 seconds.
-- Epoch 11
Norm: 63.05, NNZs: 500, Bias: -5.528916, T: 263395, Avg. loss: 9.198126
Total training time: 0.12 seconds.
-- Epoch 12
Norm: 62.68, NNZs: 500, Bias: -5.463392, T: 287340, Avg. loss: 8.279019
Total training time: 0.13 seconds.
-- Epoch 13
Norm: 50.87, NNZs: 500, Bias: -5.437457, T: 311285, Avg. loss: 7.865610
Total training time: 0.15 seconds.
-- Epoch 14
Norm: 52.40, NNZs: 500, Bias: -5.348562, T: 335230, Avg. loss: 7.273184
Total training time: 0.16 seconds.
-- Epoch 15
Norm: 46.35, NNZs: 500, Bias: -5.269963, T: 359175, Avg. loss: 6.687286
Total training time: 0.17 seconds.
-- Epoch 16
Norm: 44.60, NNZs: 500, Bias: -5.190003, T: 383120, Avg. loss: 6.517096
Total training time: 0.18 seconds.
-- Epoch 17
Norm: 43.32, NNZs: 500, Bias: -5.134630, T: 407065, Avg. loss: 6.122279
Total training time: 0.19 seconds.
-- Epoch 18
Norm: 39.32, NNZs: 500, Bias: -5.062395, T: 431010, Avg. loss: 5.729803
Total training time: 0.20 seconds.
-- Epoch 19
Norm: 37.64, NNZs: 500, Bias: -4.989678, T: 454955, Avg. loss: 5.294220
Total training time: 0.21 seconds.
-- Epoch 20
Norm: 34.67, NNZs: 500, Bias: -4.914349, T: 478900, Avg. loss: 5.337411
Total training time: 0.22 seconds.
-- Epoch 21
Norm: 33.11, NNZs: 500, Bias: -4.867867, T: 502845, Avg. loss: 4.729585
Total training time: 0.23 seconds.
-- Epoch 22
Norm: 32.66, NNZs: 500, Bias: -4.810778, T: 526790, Avg. loss: 4.679035
Total training time: 0.24 seconds.
-- Epoch 23
Norm: 33.55, NNZs: 500, Bias: -4.711280, T: 550735, Avg. loss: 4.765720
Total training time: 0.25 seconds.
-- Epoch 24
Norm: 29.73, NNZs: 500, Bias: -4.656685, T: 574680, Avg. loss: 4.201053
Total training time: 0.26 seconds.
-- Epoch 25
Norm: 29.01, NNZs: 500, Bias: -4.575788, T: 598625, Avg. loss: 4.296323
Total training time: 0.27 seconds.
-- Epoch 26
Norm: 27.95, NNZs: 500, Bias: -4.478574, T: 622570, Avg. loss: 4.134259

Total training time: 0.28 seconds.
-- Epoch 27
Norm: 27.06, NNZs: 500, Bias: -4.404896, T: 646515, Avg. loss: 3.895634
Total training time: 0.29 seconds.
-- Epoch 28
Norm: 27.12, NNZs: 500, Bias: -4.331742, T: 670460, Avg. loss: 3.723183
Total training time: 0.30 seconds.
-- Epoch 29
Norm: 25.09, NNZs: 500, Bias: -4.255073, T: 694405, Avg. loss: 3.765371
Total training time: 0.31 seconds.
-- Epoch 30
Norm: 25.22, NNZs: 500, Bias: -4.180082, T: 718350, Avg. loss: 3.535418
Total training time: 0.32 seconds.
-- Epoch 31
Norm: 23.18, NNZs: 500, Bias: -4.112946, T: 742295, Avg. loss: 3.576320
Total training time: 0.33 seconds.
-- Epoch 32
Norm: 23.55, NNZs: 500, Bias: -4.038646, T: 766240, Avg. loss: 3.348061
Total training time: 0.34 seconds.
-- Epoch 33
Norm: 22.50, NNZs: 500, Bias: -3.959648, T: 790185, Avg. loss: 3.334846
Total training time: 0.35 seconds.
-- Epoch 34
Norm: 22.85, NNZs: 500, Bias: -3.896029, T: 814130, Avg. loss: 3.335281
Total training time: 0.36 seconds.
-- Epoch 35
Norm: 20.52, NNZs: 500, Bias: -3.842478, T: 838075, Avg. loss: 3.116563
Total training time: 0.37 seconds.
-- Epoch 36
Norm: 20.31, NNZs: 500, Bias: -3.764705, T: 862020, Avg. loss: 3.014517
Total training time: 0.38 seconds.
-- Epoch 37
Norm: 20.92, NNZs: 500, Bias: -3.693334, T: 885965, Avg. loss: 2.891708
Total training time: 0.39 seconds.
-- Epoch 38
Norm: 18.64, NNZs: 500, Bias: -3.625154, T: 909910, Avg. loss: 2.904732
Total training time: 0.40 seconds.
-- Epoch 39
Norm: 20.25, NNZs: 500, Bias: -3.557693, T: 933855, Avg. loss: 2.960381
Total training time: 0.40 seconds.
-- Epoch 40
Norm: 18.99, NNZs: 500, Bias: -3.495965, T: 957800, Avg. loss: 2.809571
Total training time: 0.41 seconds.
-- Epoch 41
Norm: 19.10, NNZs: 500, Bias: -3.431656, T: 981745, Avg. loss: 2.792958
Total training time: 0.42 seconds.
-- Epoch 42
Norm: 18.11, NNZs: 500, Bias: -3.364015, T: 1005690, Avg. loss: 2.701958
Total training time: 0.43 seconds.
-- Epoch 43
Norm: 17.29, NNZs: 500, Bias: -3.308748, T: 1029635, Avg. loss: 2.610122
Total training time: 0.44 seconds.
-- Epoch 44
Norm: 18.37, NNZs: 500, Bias: -3.260519, T: 1053580, Avg. loss: 2.542862
Total training time: 0.45 seconds.
-- Epoch 45
Norm: 16.27, NNZs: 500, Bias: -3.206466, T: 1077525, Avg. loss: 2.579027

Total training time: 0.46 seconds.
-- Epoch 46
Norm: 17.22, NNZs: 500, Bias: -3.148216, T: 1101470, Avg. loss: 2.439050
Total training time: 0.47 seconds.
-- Epoch 47
Norm: 16.39, NNZs: 500, Bias: -3.089014, T: 1125415, Avg. loss: 2.385149
Total training time: 0.48 seconds.
-- Epoch 48
Norm: 16.44, NNZs: 500, Bias: -3.036824, T: 1149360, Avg. loss: 2.378949
Total training time: 0.49 seconds.
-- Epoch 49
Norm: 14.59, NNZs: 500, Bias: -2.979091, T: 1173305, Avg. loss: 2.243031
Total training time: 0.50 seconds.
-- Epoch 50
Norm: 15.09, NNZs: 500, Bias: -2.929542, T: 1197250, Avg. loss: 2.244942
Total training time: 0.51 seconds.
-- Epoch 51
Norm: 16.19, NNZs: 500, Bias: -2.885598, T: 1221195, Avg. loss: 2.267194
Total training time: 0.52 seconds.
-- Epoch 52
Norm: 14.82, NNZs: 500, Bias: -2.838606, T: 1245140, Avg. loss: 2.267651
Total training time: 0.53 seconds.
-- Epoch 53
Norm: 14.10, NNZs: 500, Bias: -2.790524, T: 1269085, Avg. loss: 2.164642
Total training time: 0.54 seconds.
-- Epoch 54
Norm: 14.08, NNZs: 500, Bias: -2.737120, T: 1293030, Avg. loss: 2.129000
Total training time: 0.55 seconds.
-- Epoch 55
Norm: 14.68, NNZs: 500, Bias: -2.680009, T: 1316975, Avg. loss: 2.248891
Total training time: 0.55 seconds.
-- Epoch 56
Norm: 14.06, NNZs: 500, Bias: -2.628019, T: 1340920, Avg. loss: 2.122057
Total training time: 0.56 seconds.
-- Epoch 57
Norm: 13.97, NNZs: 500, Bias: -2.581074, T: 1364865, Avg. loss: 2.098214
Total training time: 0.57 seconds.
-- Epoch 58
Norm: 13.37, NNZs: 500, Bias: -2.529664, T: 1388810, Avg. loss: 2.102639
Total training time: 0.58 seconds.
-- Epoch 59
Norm: 13.25, NNZs: 500, Bias: -2.488403, T: 1412755, Avg. loss: 1.974342
Total training time: 0.59 seconds.
-- Epoch 60
Norm: 13.00, NNZs: 500, Bias: -2.445449, T: 1436700, Avg. loss: 1.909564
Total training time: 0.60 seconds.
-- Epoch 61
Norm: 12.62, NNZs: 500, Bias: -2.404392, T: 1460645, Avg. loss: 1.931857
Total training time: 0.61 seconds.
-- Epoch 62
Norm: 12.90, NNZs: 500, Bias: -2.356067, T: 1484590, Avg. loss: 1.940495
Total training time: 0.62 seconds.
-- Epoch 63
Norm: 12.46, NNZs: 500, Bias: -2.313884, T: 1508535, Avg. loss: 1.950419
Total training time: 0.63 seconds.
-- Epoch 64
Norm: 12.47, NNZs: 500, Bias: -2.270255, T: 1532480, Avg. loss: 1.944642

Total training time: 0.64 seconds.
-- Epoch 65
Norm: 12.70, NNZs: 500, Bias: -2.223157, T: 1556425, Avg. loss: 1.885906
Total training time: 0.65 seconds.
-- Epoch 66
Norm: 12.04, NNZs: 500, Bias: -2.191987, T: 1580370, Avg. loss: 1.781281
Total training time: 0.66 seconds.
-- Epoch 67
Norm: 12.39, NNZs: 500, Bias: -2.147954, T: 1604315, Avg. loss: 1.838100
Total training time: 0.67 seconds.
-- Epoch 68
Norm: 11.51, NNZs: 500, Bias: -2.113574, T: 1628260, Avg. loss: 1.799012
Total training time: 0.68 seconds.
-- Epoch 69
Norm: 12.18, NNZs: 500, Bias: -2.070711, T: 1652205, Avg. loss: 1.747020
Total training time: 0.69 seconds.
-- Epoch 70
Norm: 11.62, NNZs: 500, Bias: -2.039348, T: 1676150, Avg. loss: 1.674570
Total training time: 0.70 seconds.
-- Epoch 71
Norm: 10.95, NNZs: 500, Bias: -2.009803, T: 1700095, Avg. loss: 1.706772
Total training time: 0.71 seconds.
-- Epoch 72
Norm: 10.92, NNZs: 500, Bias: -1.969618, T: 1724040, Avg. loss: 1.666788
Total training time: 0.72 seconds.
-- Epoch 73
Norm: 11.02, NNZs: 500, Bias: -1.931184, T: 1747985, Avg. loss: 1.690999
Total training time: 0.73 seconds.
-- Epoch 74
Norm: 10.81, NNZs: 500, Bias: -1.896192, T: 1771930, Avg. loss: 1.722633
Total training time: 0.73 seconds.
-- Epoch 75
Norm: 10.62, NNZs: 500, Bias: -1.869879, T: 1795875, Avg. loss: 1.655192
Total training time: 0.74 seconds.
-- Epoch 76
Norm: 10.30, NNZs: 500, Bias: -1.840655, T: 1819820, Avg. loss: 1.633496
Total training time: 0.75 seconds.
-- Epoch 77
Norm: 9.88, NNZs: 500, Bias: -1.811788, T: 1843765, Avg. loss: 1.560990
Total training time: 0.76 seconds.
-- Epoch 78
Norm: 9.74, NNZs: 500, Bias: -1.791438, T: 1867710, Avg. loss: 1.547502
Total training time: 0.77 seconds.
-- Epoch 79
Norm: 10.24, NNZs: 500, Bias: -1.761704, T: 1891655, Avg. loss: 1.560352
Total training time: 0.78 seconds.
-- Epoch 80
Norm: 10.03, NNZs: 500, Bias: -1.736203, T: 1915600, Avg. loss: 1.571559
Total training time: 0.79 seconds.
-- Epoch 81
Norm: 9.88, NNZs: 500, Bias: -1.701247, T: 1939545, Avg. loss: 1.583304
Total training time: 0.80 seconds.
-- Epoch 82
Norm: 9.59, NNZs: 500, Bias: -1.670089, T: 1963490, Avg. loss: 1.529644
Total training time: 0.81 seconds.
-- Epoch 83
Norm: 9.84, NNZs: 500, Bias: -1.642784, T: 1987435, Avg. loss: 1.508314

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Total training time: 0.82 seconds.
-- Epoch 84
Norm: 9.39, NNZs: 500, Bias: -1.615293, T: 2011380, Avg. loss: 1.538362
Total training time: 0.83 seconds.
-- Epoch 85
Norm: 9.56, NNZs: 500, Bias: -1.585462, T: 2035325, Avg. loss: 1.465847
Total training time: 0.84 seconds.
-- Epoch 86
Norm: 9.43, NNZs: 500, Bias: -1.557619, T: 2059270, Avg. loss: 1.457562
Total training time: 0.85 seconds.
-- Epoch 87
Norm: 9.38, NNZs: 500, Bias: -1.533431, T: 2083215, Avg. loss: 1.461417
Total training time: 0.86 seconds.
-- Epoch 88
Norm: 9.20, NNZs: 500, Bias: -1.508347, T: 2107160, Avg. loss: 1.394101
Total training time: 0.86 seconds.
-- Epoch 89
Norm: 9.29, NNZs: 500, Bias: -1.488568, T: 2131105, Avg. loss: 1.456171
Total training time: 0.87 seconds.
-- Epoch 90
Norm: 9.27, NNZs: 500, Bias: -1.463682, T: 2155050, Avg. loss: 1.440604
Total training time: 0.88 seconds.
-- Epoch 91
Norm: 8.85, NNZs: 500, Bias: -1.439271, T: 2178995, Avg. loss: 1.401403
Total training time: 0.89 seconds.
-- Epoch 92
Norm: 9.12, NNZs: 500, Bias: -1.412963, T: 2202940, Avg. loss: 1.431908
Total training time: 0.90 seconds.
-- Epoch 93
Norm: 8.72, NNZs: 500, Bias: -1.392735, T: 2226885, Avg. loss: 1.315625
Total training time: 0.91 seconds.
-- Epoch 94
Norm: 8.83, NNZs: 500, Bias: -1.373966, T: 2250830, Avg. loss: 1.380209
Total training time: 0.92 seconds.
-- Epoch 95
Norm: 8.38, NNZs: 500, Bias: -1.351610, T: 2274775, Avg. loss: 1.394524
Total training time: 0.93 seconds.
-- Epoch 96
Norm: 8.26, NNZs: 500, Bias: -1.331281, T: 2298720, Avg. loss: 1.369739
Total training time: 0.94 seconds.
-- Epoch 97
Norm: 8.64, NNZs: 500, Bias: -1.312991, T: 2322665, Avg. loss: 1.371746
Total training time: 0.95 seconds.
-- Epoch 98
Norm: 8.70, NNZs: 500, Bias: -1.289567, T: 2346610, Avg. loss: 1.324717
Total training time: 0.96 seconds.
Convergence after 98 epochs took 0.96 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=0.001, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
```

```
-- Epoch 1
Norm: 67.27, NNZs: 500, Bias: -1.078383, T: 23945, Avg. loss: 32.438426
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 34.18, NNZs: 500, Bias: -1.121421, T: 47890, Avg. loss: 6.683271
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 23.96, NNZs: 500, Bias: -1.152306, T: 71835, Avg. loss: 3.885850
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 17.51, NNZs: 500, Bias: -1.152982, T: 95780, Avg. loss: 3.035712
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 15.12, NNZs: 500, Bias: -1.153513, T: 119725, Avg. loss: 2.382666
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 12.55, NNZs: 500, Bias: -1.142799, T: 143670, Avg. loss: 2.103682
Total training time: 0.07 seconds.
-- Epoch 7
Norm: 11.24, NNZs: 500, Bias: -1.137576, T: 167615, Avg. loss: 1.719279
Total training time: 0.08 seconds.
-- Epoch 8
Norm: 9.29, NNZs: 500, Bias: -1.127275, T: 191560, Avg. loss: 1.612659
Total training time: 0.09 seconds.
-- Epoch 9
Norm: 9.04, NNZs: 500, Bias: -1.115135, T: 215505, Avg. loss: 1.456715
Total training time: 0.10 seconds.
-- Epoch 10
Norm: 8.43, NNZs: 500, Bias: -1.099123, T: 239450, Avg. loss: 1.338025
Total training time: 0.11 seconds.
-- Epoch 11
Norm: 7.52, NNZs: 500, Bias: -1.087160, T: 263395, Avg. loss: 1.207716
Total training time: 0.12 seconds.
-- Epoch 12
Norm: 7.07, NNZs: 500, Bias: -1.075480, T: 287340, Avg. loss: 1.152040
Total training time: 0.13 seconds.
-- Epoch 13
Norm: 6.69, NNZs: 500, Bias: -1.061563, T: 311285, Avg. loss: 1.138680
Total training time: 0.14 seconds.
-- Epoch 14
Norm: 6.30, NNZs: 500, Bias: -1.044267, T: 335230, Avg. loss: 1.079162
Total training time: 0.15 seconds.
-- Epoch 15
Norm: 6.12, NNZs: 500, Bias: -1.027679, T: 359175, Avg. loss: 1.022645
Total training time: 0.16 seconds.
-- Epoch 16
Norm: 5.70, NNZs: 500, Bias: -1.013594, T: 383120, Avg. loss: 1.008342
Total training time: 0.18 seconds.
-- Epoch 17
Norm: 5.76, NNZs: 500, Bias: -0.998998, T: 407065, Avg. loss: 0.971131
Total training time: 0.19 seconds.
-- Epoch 18
Norm: 5.15, NNZs: 500, Bias: -0.988074, T: 431010, Avg. loss: 0.900360
Total training time: 0.20 seconds.
-- Epoch 19
Norm: 5.05, NNZs: 500, Bias: -0.977472, T: 454955, Avg. loss: 0.861591
Total training time: 0.21 seconds.
```

```
-- Epoch 20
Norm: 4.74, NNZs: 500, Bias: -0.966054, T: 478900, Avg. loss: 0.845480
Total training time: 0.22 seconds.
-- Epoch 21
Norm: 4.61, NNZs: 500, Bias: -0.956015, T: 502845, Avg. loss: 0.816155
Total training time: 0.23 seconds.
-- Epoch 22
Norm: 4.64, NNZs: 500, Bias: -0.943707, T: 526790, Avg. loss: 0.837272
Total training time: 0.25 seconds.
-- Epoch 23
Norm: 4.47, NNZs: 500, Bias: -0.933935, T: 550735, Avg. loss: 0.803791
Total training time: 0.26 seconds.
-- Epoch 24
Norm: 4.34, NNZs: 500, Bias: -0.920442, T: 574680, Avg. loss: 0.781453
Total training time: 0.26 seconds.
-- Epoch 25
Norm: 4.25, NNZs: 500, Bias: -0.907878, T: 598625, Avg. loss: 0.783117
Total training time: 0.27 seconds.
-- Epoch 26
Norm: 4.15, NNZs: 500, Bias: -0.896177, T: 622570, Avg. loss: 0.771554
Total training time: 0.28 seconds.
-- Epoch 27
Norm: 4.08, NNZs: 500, Bias: -0.884119, T: 646515, Avg. loss: 0.743683
Total training time: 0.29 seconds.
-- Epoch 28
Norm: 3.90, NNZs: 500, Bias: -0.875076, T: 670460, Avg. loss: 0.729891
Total training time: 0.30 seconds.
-- Epoch 29
Norm: 3.96, NNZs: 500, Bias: -0.863713, T: 694405, Avg. loss: 0.737583
Total training time: 0.31 seconds.
-- Epoch 30
Norm: 3.79, NNZs: 500, Bias: -0.854456, T: 718350, Avg. loss: 0.718711
Total training time: 0.32 seconds.
-- Epoch 31
Norm: 3.76, NNZs: 500, Bias: -0.846275, T: 742295, Avg. loss: 0.702204
Total training time: 0.33 seconds.
-- Epoch 32
Norm: 3.72, NNZs: 500, Bias: -0.837603, T: 766240, Avg. loss: 0.696057
Total training time: 0.34 seconds.
-- Epoch 33
Norm: 3.66, NNZs: 500, Bias: -0.827774, T: 790185, Avg. loss: 0.701432
Total training time: 0.35 seconds.
-- Epoch 34
Norm: 3.59, NNZs: 500, Bias: -0.819841, T: 814130, Avg. loss: 0.676422
Total training time: 0.36 seconds.
-- Epoch 35
Norm: 3.42, NNZs: 500, Bias: -0.812850, T: 838075, Avg. loss: 0.673313
Total training time: 0.37 seconds.
-- Epoch 36
Norm: 3.41, NNZs: 500, Bias: -0.803966, T: 862020, Avg. loss: 0.660828
Total training time: 0.38 seconds.
-- Epoch 37
Norm: 3.39, NNZs: 500, Bias: -0.796041, T: 885965, Avg. loss: 0.633968
Total training time: 0.39 seconds.
-- Epoch 38
Norm: 3.36, NNZs: 500, Bias: -0.787353, T: 909910, Avg. loss: 0.644572
Total training time: 0.40 seconds.
```

```
-- Epoch 39
Norm: 3.42, NNZs: 500, Bias: -0.778016, T: 933855, Avg. loss: 0.660816
Total training time: 0.41 seconds.
-- Epoch 40
Norm: 3.30, NNZs: 500, Bias: -0.769752, T: 957800, Avg. loss: 0.640507
Total training time: 0.42 seconds.
-- Epoch 41
Norm: 3.25, NNZs: 500, Bias: -0.762394, T: 981745, Avg. loss: 0.634792
Total training time: 0.43 seconds.
-- Epoch 42
Norm: 3.26, NNZs: 500, Bias: -0.753509, T: 1005690, Avg. loss: 0.637322
Total training time: 0.44 seconds.
Convergence after 42 epochs took 0.44 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=0.01, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 7.10, NNZs: 500, Bias: -0.291143, T: 23945, Avg. loss: 4.089180
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 4.35, NNZs: 500, Bias: -0.295456, T: 47890, Avg. loss: 0.961958
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 3.41, NNZs: 500, Bias: -0.297739, T: 71835, Avg. loss: 0.710240
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 2.91, NNZs: 500, Bias: -0.295705, T: 95780, Avg. loss: 0.651609
Total training time: 0.04 seconds.
-- Epoch 5
Norm: 2.72, NNZs: 500, Bias: -0.295750, T: 119725, Avg. loss: 0.580891
Total training time: 0.05 seconds.
-- Epoch 6
Norm: 2.50, NNZs: 500, Bias: -0.295386, T: 143670, Avg. loss: 0.552507
Total training time: 0.06 seconds.
-- Epoch 7
Norm: 2.39, NNZs: 500, Bias: -0.295867, T: 167615, Avg. loss: 0.522935
Total training time: 0.07 seconds.
-- Epoch 8
Norm: 2.25, NNZs: 500, Bias: -0.295572, T: 191560, Avg. loss: 0.512532
Total training time: 0.09 seconds.
-- Epoch 9
Norm: 2.21, NNZs: 500, Bias: -0.294690, T: 215505, Avg. loss: 0.510143
Total training time: 0.10 seconds.
-- Epoch 10
Norm: 2.18, NNZs: 500, Bias: -0.293896, T: 239450, Avg. loss: 0.502221
Total training time: 0.11 seconds.
-- Epoch 11
Norm: 2.10, NNZs: 500, Bias: -0.293819, T: 263395, Avg. loss: 0.483904
Total training time: 0.12 seconds.
-- Epoch 12
```

```
Norm: 2.07, NNZs: 500, Bias: -0.293355, T: 287340, Avg. loss: 0.482933
Total training time: 0.13 seconds.
-- Epoch 13
Norm: 2.04, NNZs: 500, Bias: -0.293051, T: 311285, Avg. loss: 0.477344
Total training time: 0.14 seconds.
-- Epoch 14
Norm: 2.01, NNZs: 500, Bias: -0.292500, T: 335230, Avg. loss: 0.479093
Total training time: 0.15 seconds.
-- Epoch 15
Norm: 2.00, NNZs: 500, Bias: -0.291802, T: 359175, Avg. loss: 0.473363
Total training time: 0.16 seconds.
-- Epoch 16
Norm: 1.97, NNZs: 500, Bias: -0.291352, T: 383120, Avg. loss: 0.467276
Total training time: 0.17 seconds.
-- Epoch 17
Norm: 1.97, NNZs: 500, Bias: -0.290995, T: 407065, Avg. loss: 0.466061
Total training time: 0.19 seconds.
-- Epoch 18
Norm: 1.94, NNZs: 500, Bias: -0.290602, T: 431010, Avg. loss: 0.463670
Total training time: 0.19 seconds.
-- Epoch 19
Norm: 1.92, NNZs: 500, Bias: -0.290210, T: 454955, Avg. loss: 0.455566
Total training time: 0.20 seconds.
-- Epoch 20
Norm: 1.89, NNZs: 500, Bias: -0.290075, T: 478900, Avg. loss: 0.450296
Total training time: 0.21 seconds.
-- Epoch 21
Norm: 1.89, NNZs: 500, Bias: -0.289786, T: 502845, Avg. loss: 0.456824
Total training time: 0.22 seconds.
-- Epoch 22
Norm: 1.89, NNZs: 500, Bias: -0.289504, T: 526790, Avg. loss: 0.453408
Total training time: 0.23 seconds.
-- Epoch 23
Norm: 1.89, NNZs: 500, Bias: -0.289193, T: 550735, Avg. loss: 0.452061
Total training time: 0.24 seconds.
-- Epoch 24
Norm: 1.89, NNZs: 500, Bias: -0.288785, T: 574680, Avg. loss: 0.451542
Total training time: 0.25 seconds.
-- Epoch 25
Norm: 1.88, NNZs: 500, Bias: -0.288409, T: 598625, Avg. loss: 0.450292
Total training time: 0.26 seconds.
Convergence after 25 epochs took 0.26 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=0.1, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 1.55, NNZs: 500, Bias: -0.088944, T: 23945, Avg. loss: 0.785442
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 1.37, NNZs: 500, Bias: -0.089354, T: 47890, Avg. loss: 0.474398
```

Total training time: 0.02 seconds.
-- Epoch 3
Norm: 1.32, NNZs: 500, Bias: -0.089854, T: 71835, Avg. loss: 0.457713
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 1.31, NNZs: 500, Bias: -0.090124, T: 95780, Avg. loss: 0.449006
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 1.30, NNZs: 500, Bias: -0.090413, T: 119725, Avg. loss: 0.439631
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 1.29, NNZs: 500, Bias: -0.090567, T: 143670, Avg. loss: 0.438930
Total training time: 0.07 seconds.
-- Epoch 7
Norm: 1.29, NNZs: 500, Bias: -0.090727, T: 167615, Avg. loss: 0.436770
Total training time: 0.08 seconds.
-- Epoch 8
Norm: 1.28, NNZs: 500, Bias: -0.090888, T: 191560, Avg. loss: 0.433001
Total training time: 0.09 seconds.
-- Epoch 9
Norm: 1.27, NNZs: 500, Bias: -0.090988, T: 215505, Avg. loss: 0.434508
Total training time: 0.10 seconds.
-- Epoch 10
Norm: 1.27, NNZs: 500, Bias: -0.091111, T: 239450, Avg. loss: 0.432678
Total training time: 0.12 seconds.
-- Epoch 11
Norm: 1.27, NNZs: 500, Bias: -0.091220, T: 263395, Avg. loss: 0.431150
Total training time: 0.13 seconds.
-- Epoch 12
Norm: 1.27, NNZs: 500, Bias: -0.091282, T: 287340, Avg. loss: 0.431230
Total training time: 0.14 seconds.
-- Epoch 13
Norm: 1.27, NNZs: 500, Bias: -0.091386, T: 311285, Avg. loss: 0.429002
Total training time: 0.15 seconds.
-- Epoch 14
Norm: 1.27, NNZs: 500, Bias: -0.091425, T: 335230, Avg. loss: 0.430919
Total training time: 0.16 seconds.
-- Epoch 15
Norm: 1.27, NNZs: 500, Bias: -0.091515, T: 359175, Avg. loss: 0.427148
Total training time: 0.18 seconds.
-- Epoch 16
Norm: 1.27, NNZs: 500, Bias: -0.091575, T: 383120, Avg. loss: 0.429678
Total training time: 0.19 seconds.
-- Epoch 17
Norm: 1.26, NNZs: 500, Bias: -0.091640, T: 407065, Avg. loss: 0.428496
Total training time: 0.20 seconds.
-- Epoch 18
Norm: 1.26, NNZs: 500, Bias: -0.091693, T: 431010, Avg. loss: 0.427402
Total training time: 0.21 seconds.
-- Epoch 19
Norm: 1.26, NNZs: 500, Bias: -0.091772, T: 454955, Avg. loss: 0.426721
Total training time: 0.22 seconds.
-- Epoch 20
Norm: 1.26, NNZs: 500, Bias: -0.091816, T: 478900, Avg. loss: 0.426641
Total training time: 0.23 seconds.
Convergence after 20 epochs took 0.23 seconds
Fitting probability generation and roc auc score generation for training da

ta complete...

Fitting probability generation and roc auc score generation for validation data complete...

```
SGDClassifier(alpha=1.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
```

-- Epoch 1

Norm: 0.63, NNZs: 500, Bias: -0.012899, T: 23945, Avg. loss: 0.586408

Total training time: 0.01 seconds.

-- Epoch 2

Norm: 0.63, NNZs: 500, Bias: -0.012690, T: 47890, Avg. loss: 0.540903

Total training time: 0.02 seconds.

-- Epoch 3

Norm: 0.63, NNZs: 500, Bias: -0.012566, T: 71835, Avg. loss: 0.540069

Total training time: 0.03 seconds.

-- Epoch 4

Norm: 0.63, NNZs: 500, Bias: -0.012488, T: 95780, Avg. loss: 0.536846

Total training time: 0.04 seconds.

-- Epoch 5

Norm: 0.63, NNZs: 500, Bias: -0.012437, T: 119725, Avg. loss: 0.533636

Total training time: 0.06 seconds.

-- Epoch 6

Norm: 0.63, NNZs: 500, Bias: -0.012386, T: 143670, Avg. loss: 0.534446

Total training time: 0.07 seconds.

-- Epoch 7

Norm: 0.63, NNZs: 500, Bias: -0.012341, T: 167615, Avg. loss: 0.535420

Total training time: 0.08 seconds.

-- Epoch 8

Norm: 0.63, NNZs: 500, Bias: -0.012308, T: 191560, Avg. loss: 0.532603

Total training time: 0.09 seconds.

-- Epoch 9

Norm: 0.63, NNZs: 500, Bias: -0.012270, T: 215505, Avg. loss: 0.535410

Total training time: 0.10 seconds.

-- Epoch 10

Norm: 0.63, NNZs: 500, Bias: -0.012238, T: 239450, Avg. loss: 0.535712

Total training time: 0.12 seconds.

-- Epoch 11

Norm: 0.63, NNZs: 500, Bias: -0.012215, T: 263395, Avg. loss: 0.532355

Total training time: 0.13 seconds.

-- Epoch 12

Norm: 0.63, NNZs: 500, Bias: -0.012191, T: 287340, Avg. loss: 0.534304

Total training time: 0.14 seconds.

-- Epoch 13

Norm: 0.63, NNZs: 500, Bias: -0.012170, T: 311285, Avg. loss: 0.532475

Total training time: 0.15 seconds.

Convergence after 13 epochs took 0.16 seconds

Fitting probability generation and roc auc score generation for training data complete...

Fitting probability generation and roc auc score generation for validation data complete...

```
SGDClassifier(alpha=10.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
```



```

        power_t=0.5, random_state=42, shuffle=True, tol=0.001,
        validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.16, NNZs: 500, Bias: 0.002226, T: 23945, Avg. loss: 0.917667
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.16, NNZs: 500, Bias: 0.002239, T: 47890, Avg. loss: 0.911455
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 0.16, NNZs: 500, Bias: 0.002246, T: 71835, Avg. loss: 0.912396
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 0.16, NNZs: 500, Bias: 0.002250, T: 95780, Avg. loss: 0.911661
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 0.16, NNZs: 500, Bias: 0.002254, T: 119725, Avg. loss: 0.910045
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 0.16, NNZs: 500, Bias: 0.002258, T: 143670, Avg. loss: 0.908464
Total training time: 0.07 seconds.
-- Epoch 7
Norm: 0.16, NNZs: 500, Bias: 0.002260, T: 167615, Avg. loss: 0.909408
Total training time: 0.08 seconds.
-- Epoch 8
Norm: 0.16, NNZs: 500, Bias: 0.002263, T: 191560, Avg. loss: 0.909523
Total training time: 0.09 seconds.
-- Epoch 9
Norm: 0.16, NNZs: 500, Bias: 0.002265, T: 215505, Avg. loss: 0.909200
Total training time: 0.10 seconds.
-- Epoch 10
Norm: 0.16, NNZs: 500, Bias: 0.002267, T: 239450, Avg. loss: 0.910076
Total training time: 0.11 seconds.
-- Epoch 11
Norm: 0.16, NNZs: 500, Bias: 0.002269, T: 263395, Avg. loss: 0.908998
Total training time: 0.12 seconds.
Convergence after 11 epochs took 0.13 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=100.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.02, NNZs: 500, Bias: 0.002694, T: 23945, Avg. loss: 0.999284
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.02, NNZs: 500, Bias: 0.002694, T: 47890, Avg. loss: 0.996320
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 0.02, NNZs: 500, Bias: 0.002694, T: 71835, Avg. loss: 0.996694
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 0.02, NNZs: 500, Bias: 0.002694, T: 95780, Avg. loss: 0.996525

```

```
Total training time: 0.04 seconds.
-- Epoch 5
Norm: 0.02, NNZs: 500, Bias: 0.002694, T: 119725, Avg. loss: 0.996482
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 0.02, NNZs: 500, Bias: 0.002694, T: 143670, Avg. loss: 0.996268
Total training time: 0.07 seconds.
-- Epoch 7
Norm: 0.02, NNZs: 500, Bias: 0.002694, T: 167615, Avg. loss: 0.996320
Total training time: 0.08 seconds.
Convergence after 7 epochs took 0.08 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=1000.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 500, Bias: 0.001741, T: 23945, Avg. loss: 0.998897
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 500, Bias: 0.001741, T: 47890, Avg. loss: 0.998640
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 500, Bias: 0.001741, T: 71835, Avg. loss: 0.998677
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 500, Bias: 0.001741, T: 95780, Avg. loss: 0.998660
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 500, Bias: 0.001741, T: 119725, Avg. loss: 0.998656
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 500, Bias: 0.001741, T: 143670, Avg. loss: 0.998635
Total training time: 0.07 seconds.
Convergence after 6 epochs took 0.07 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=10000.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 500, Bias: 0.000996, T: 23945, Avg. loss: 0.999317
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 500, Bias: 0.000996, T: 47890, Avg. loss: 0.999310
Total training time: 0.02 seconds.
-- Epoch 3
```

```

Norm: 0.00, NNZs: 500, Bias: 0.000996, T: 71835, Avg. loss: 0.999314
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 500, Bias: 0.000996, T: 95780, Avg. loss: 0.999312
Total training time: 0.04 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 500, Bias: 0.000996, T: 119725, Avg. loss: 0.999311
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 500, Bias: 0.000996, T: 143670, Avg. loss: 0.999309
Total training time: 0.07 seconds.
Convergence after 6 epochs took 0.07 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=100000.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 500, Bias: 0.000562, T: 23945, Avg. loss: 0.999610
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 500, Bias: 0.000562, T: 47890, Avg. loss: 0.999619
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 500, Bias: 0.000562, T: 71835, Avg. loss: 0.999620
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 500, Bias: 0.000562, T: 95780, Avg. loss: 0.999620
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 500, Bias: 0.000562, T: 119725, Avg. loss: 0.999619
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 500, Bias: 0.000562, T: 143670, Avg. loss: 0.999619
Total training time: 0.07 seconds.
Convergence after 6 epochs took 0.07 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=1000000.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 500, Bias: 0.000316, T: 23945, Avg. loss: 0.999780
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 500, Bias: 0.000316, T: 47890, Avg. loss: 0.999787
Total training time: 0.02 seconds.

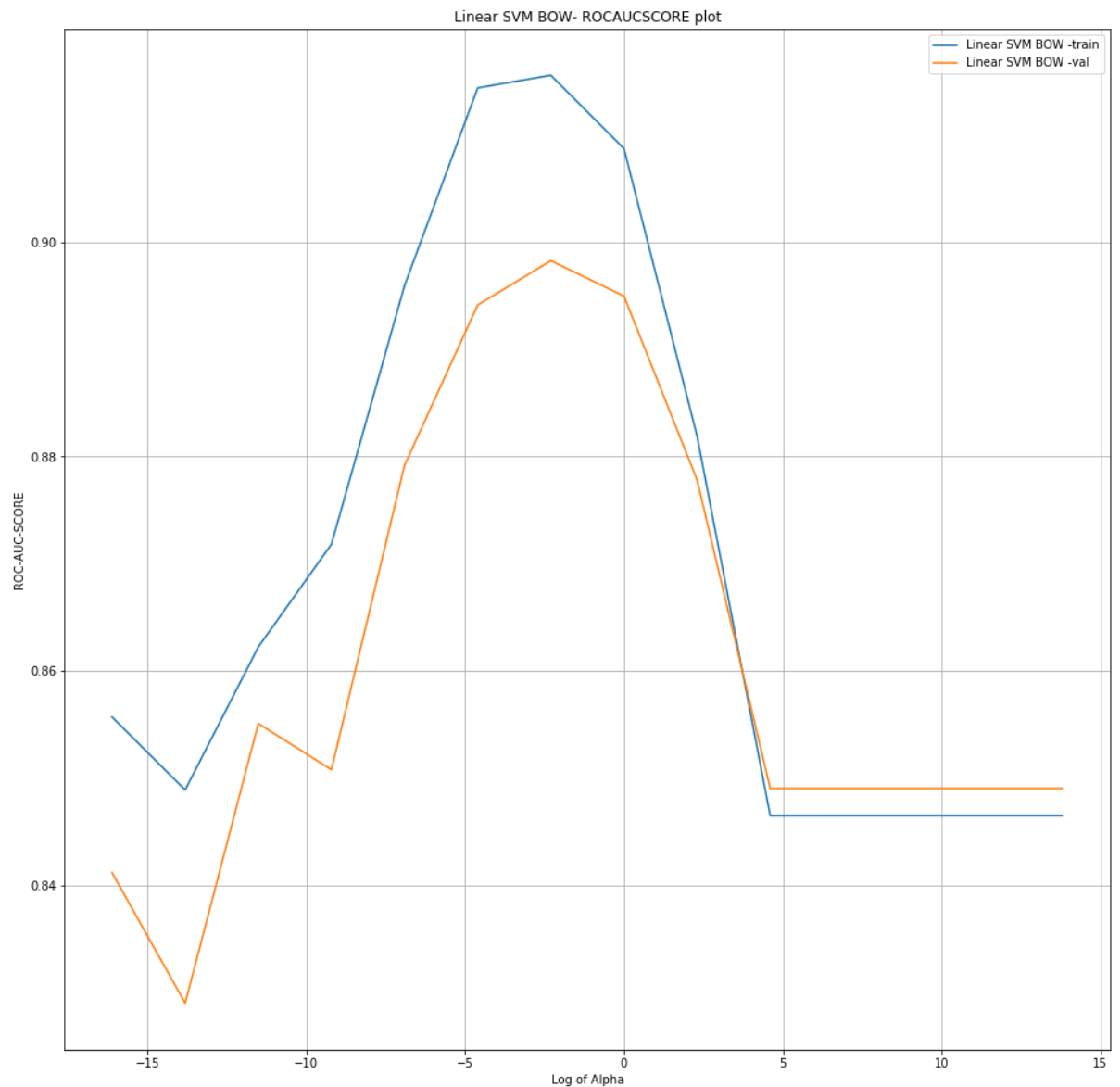
```

```
-- Epoch 3
Norm: 0.00, NNZs: 500, Bias: 0.000316, T: 71835, Avg. loss: 0.999787
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 500, Bias: 0.000316, T: 95780, Avg. loss: 0.999787
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 500, Bias: 0.000316, T: 119725, Avg. loss: 0.999787
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 500, Bias: 0.000316, T: 143670, Avg. loss: 0.999787
Total training time: 0.07 seconds.
Convergence after 6 epochs took 0.07 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
Function exiting...
```

```
In [16]: print(lnrsvm.rocaucscoretrn)
print(lnrsvm.rocaucscoreval)
print(lnrsvm.SVM_alpha)

[0.85570636790562, 0.8489012909788802, 0.8622381472351104, 0.8718174108649489, 0.8959506602066449, 0.914383543602679, 0.9155644490434751, 0.9087272909119305, 0.8819028900779777, 0.8464963258261781, 0.8464993690014444, 0.846493690014444, 0.8464993690014444, 0.8464993690014444]
[0.84118421463264, 0.8290108111304382, 0.8550958251822798, 0.8507923973870637, 0.8791896826139874, 0.8941373187673799, 0.898268691577272, 0.8949663856298362, 0.8778079045098938, 0.8490445404776805, 0.8490484414857009, 0.8490484414857009, 0.8490484414857009, 0.8490484414857009]
[1e-07, 1e-06, 9.999999999999999e-06, 9.999999999999999e-05, 0.001, 0.01, 0.1, 1.0, 10.0, 100.0, 1000.0, 10000.0, 100000.0, 1000000.0]
```

```
In [19]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='Linear SVM BOW- ROCAUCSCORE plot'
displaygraph.legnd_1 = 'Linear SVM BOW -train'
displaygraph.legnd_2 = 'Linear SVM BOW -val'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='Log of Alpha'
displaygraph.label_y='ROC-AUC-SCORE'
displaygraph.Xdata = lnrsvm.SVM_alpha
displaygraph.ydatatrn = lnrsvm.rocaucscoretrn
displaygraph.ydataval = lnrsvm.rocaucscoreval
displaygraph.rocacscoregraph()
```



```
In [92]: # using alpha value returned by gridearchcv  
lnrsvm.SVM_actualClasifier(0.001)
```

```
-- Epoch 1
Norm: 250.34, NNZs: 500, Bias: -11.768142, T: 23945, Avg. loss: 272.252519
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 137.61, NNZs: 500, Bias: -12.401852, T: 47890, Avg. loss: 55.731028
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 94.24, NNZs: 500, Bias: -12.686839, T: 71835, Avg. loss: 31.892876
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 68.60, NNZs: 500, Bias: -12.881386, T: 95780, Avg. loss: 21.766602
Total training time: 0.04 seconds.
-- Epoch 5
Norm: 58.00, NNZs: 500, Bias: -12.949407, T: 119725, Avg. loss: 18.929339
Total training time: 0.05 seconds.
-- Epoch 6
Norm: 48.04, NNZs: 500, Bias: -12.992264, T: 143670, Avg. loss: 14.598738
Total training time: 0.06 seconds.
-- Epoch 7
Norm: 44.69, NNZs: 500, Bias: -12.983052, T: 167615, Avg. loss: 13.211349
Total training time: 0.07 seconds.
-- Epoch 8
Norm: 37.70, NNZs: 500, Bias: -12.971638, T: 191560, Avg. loss: 11.751479
Total training time: 0.08 seconds.
-- Epoch 9
Norm: 33.86, NNZs: 500, Bias: -12.953464, T: 215505, Avg. loss: 10.600028
Total training time: 0.09 seconds.
-- Epoch 10
Norm: 33.28, NNZs: 500, Bias: -12.900959, T: 239450, Avg. loss: 9.915077
Total training time: 0.10 seconds.
-- Epoch 11
Norm: 29.38, NNZs: 500, Bias: -12.869042, T: 263395, Avg. loss: 9.129493
Total training time: 0.11 seconds.
-- Epoch 12
Norm: 28.49, NNZs: 500, Bias: -12.816414, T: 287340, Avg. loss: 8.481103
Total training time: 0.12 seconds.
-- Epoch 13
Norm: 25.87, NNZs: 500, Bias: -12.756708, T: 311285, Avg. loss: 8.136776
Total training time: 0.14 seconds.
-- Epoch 14
Norm: 25.64, NNZs: 500, Bias: -12.697781, T: 335230, Avg. loss: 7.550774
Total training time: 0.15 seconds.
-- Epoch 15
Norm: 25.15, NNZs: 500, Bias: -12.638617, T: 359175, Avg. loss: 7.791640
Total training time: 0.16 seconds.
-- Epoch 16
Norm: 22.06, NNZs: 500, Bias: -12.585921, T: 383120, Avg. loss: 6.920864
Total training time: 0.17 seconds.
-- Epoch 17
Norm: 21.63, NNZs: 500, Bias: -12.533591, T: 407065, Avg. loss: 6.306566
Total training time: 0.18 seconds.
-- Epoch 18
Norm: 20.77, NNZs: 500, Bias: -12.473769, T: 431010, Avg. loss: 6.653586
Total training time: 0.20 seconds.
-- Epoch 19
Norm: 21.65, NNZs: 500, Bias: -12.410682, T: 454955, Avg. loss: 6.637197
Total training time: 0.21 seconds.
```

```
-- Epoch 20
Norm: 20.03, NNZs: 500, Bias: -12.362152, T: 478900, Avg. loss: 6.045140
Total training time: 0.23 seconds.
-- Epoch 21
Norm: 19.06, NNZs: 500, Bias: -12.309428, T: 502845, Avg. loss: 5.815589
Total training time: 0.24 seconds.
-- Epoch 22
Norm: 18.07, NNZs: 500, Bias: -12.260808, T: 526790, Avg. loss: 5.456134
Total training time: 0.25 seconds.
-- Epoch 23
Norm: 17.88, NNZs: 500, Bias: -12.208187, T: 550735, Avg. loss: 5.584912
Total training time: 0.27 seconds.
-- Epoch 24
Norm: 17.54, NNZs: 500, Bias: -12.150944, T: 574680, Avg. loss: 5.437114
Total training time: 0.28 seconds.
-- Epoch 25
Norm: 17.11, NNZs: 500, Bias: -12.098345, T: 598625, Avg. loss: 5.365212
Total training time: 0.29 seconds.
-- Epoch 26
Norm: 16.51, NNZs: 500, Bias: -12.048840, T: 622570, Avg. loss: 5.134812
Total training time: 0.31 seconds.
-- Epoch 27
Norm: 16.26, NNZs: 500, Bias: -11.998873, T: 646515, Avg. loss: 4.944349
Total training time: 0.32 seconds.
-- Epoch 28
Norm: 16.01, NNZs: 500, Bias: -11.953806, T: 670460, Avg. loss: 4.986948
Total training time: 0.34 seconds.
-- Epoch 29
Norm: 15.42, NNZs: 500, Bias: -11.900521, T: 694405, Avg. loss: 5.070306
Total training time: 0.35 seconds.
-- Epoch 30
Norm: 14.98, NNZs: 500, Bias: -11.857696, T: 718350, Avg. loss: 4.558657
Total training time: 0.36 seconds.
-- Epoch 31
Norm: 15.23, NNZs: 500, Bias: -11.806011, T: 742295, Avg. loss: 4.896439
Total training time: 0.38 seconds.
-- Epoch 32
Norm: 15.27, NNZs: 500, Bias: -11.760640, T: 766240, Avg. loss: 4.601130
Total training time: 0.39 seconds.
-- Epoch 33
Norm: 15.02, NNZs: 500, Bias: -11.713913, T: 790185, Avg. loss: 4.798848
Total training time: 0.40 seconds.
-- Epoch 34
Norm: 14.72, NNZs: 500, Bias: -11.669525, T: 814130, Avg. loss: 4.427955
Total training time: 0.41 seconds.
-- Epoch 35
Norm: 14.38, NNZs: 500, Bias: -11.624499, T: 838075, Avg. loss: 4.559223
Total training time: 0.42 seconds.
-- Epoch 36
Norm: 14.60, NNZs: 500, Bias: -11.577496, T: 862020, Avg. loss: 4.446435
Total training time: 0.43 seconds.
-- Epoch 37
Norm: 14.59, NNZs: 500, Bias: -11.533820, T: 885965, Avg. loss: 4.305055
Total training time: 0.45 seconds.
-- Epoch 38
Norm: 13.74, NNZs: 500, Bias: -11.492339, T: 909910, Avg. loss: 4.444232
Total training time: 0.46 seconds.
```



```
-- Epoch 39
Norm: 13.95, NNZs: 500, Bias: -11.449289, T: 933855, Avg. loss: 4.245563
Total training time: 0.47 seconds.
-- Epoch 40
Norm: 13.44, NNZs: 500, Bias: -11.407532, T: 957800, Avg. loss: 4.184831
Total training time: 0.48 seconds.
-- Epoch 41
Norm: 13.49, NNZs: 500, Bias: -11.366805, T: 981745, Avg. loss: 4.295872
Total training time: 0.49 seconds.
-- Epoch 42
Norm: 13.18, NNZs: 500, Bias: -11.325845, T: 1005690, Avg. loss: 4.066543
Total training time: 0.50 seconds.
-- Epoch 43
Norm: 12.63, NNZs: 500, Bias: -11.289896, T: 1029635, Avg. loss: 3.770744
Total training time: 0.51 seconds.
-- Epoch 44
Norm: 13.37, NNZs: 500, Bias: -11.245676, T: 1053580, Avg. loss: 4.137903
Total training time: 0.52 seconds.
-- Epoch 45
Norm: 12.70, NNZs: 500, Bias: -11.210914, T: 1077525, Avg. loss: 3.932792
Total training time: 0.53 seconds.
-- Epoch 46
Norm: 12.77, NNZs: 500, Bias: -11.172564, T: 1101470, Avg. loss: 3.960247
Total training time: 0.55 seconds.
-- Epoch 47
Norm: 12.49, NNZs: 500, Bias: -11.136055, T: 1125415, Avg. loss: 3.832489
Total training time: 0.55 seconds.
-- Epoch 48
Norm: 12.73, NNZs: 500, Bias: -11.099347, T: 1149360, Avg. loss: 3.872291
Total training time: 0.57 seconds.
Convergence after 48 epochs took 0.57 seconds
-- Epoch 1
Norm: 233.14, NNZs: 500, Bias: -5.537685, T: 29932, Avg. loss: 258.955341
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 110.08, NNZs: 500, Bias: -6.239294, T: 59864, Avg. loss: 46.101950
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 74.69, NNZs: 500, Bias: -6.600302, T: 89796, Avg. loss: 24.962498
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 54.37, NNZs: 500, Bias: -6.819302, T: 119728, Avg. loss: 18.624928
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 45.12, NNZs: 500, Bias: -6.982472, T: 149660, Avg. loss: 14.133381
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 40.13, NNZs: 500, Bias: -7.084261, T: 179592, Avg. loss: 12.567952
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 32.89, NNZs: 500, Bias: -7.157591, T: 209524, Avg. loss: 10.765790
Total training time: 0.09 seconds.
-- Epoch 8
Norm: 29.81, NNZs: 500, Bias: -7.198246, T: 239456, Avg. loss: 8.966874
Total training time: 0.10 seconds.
-- Epoch 9
Norm: 26.39, NNZs: 500, Bias: -7.197672, T: 269388, Avg. loss: 8.523777
```

Total training time: 0.11 seconds.
-- Epoch 10
Norm: 24.75, NNZs: 500, Bias: -7.199858, T: 299320, Avg. loss: 7.261168
Total training time: 0.13 seconds.
-- Epoch 11
Norm: 21.60, NNZs: 500, Bias: -7.189673, T: 329252, Avg. loss: 7.738803
Total training time: 0.14 seconds.
-- Epoch 12
Norm: 20.40, NNZs: 500, Bias: -7.193493, T: 359184, Avg. loss: 6.190915
Total training time: 0.16 seconds.
-- Epoch 13
Norm: 20.35, NNZs: 500, Bias: -7.173209, T: 389116, Avg. loss: 6.061125
Total training time: 0.17 seconds.
-- Epoch 14
Norm: 17.43, NNZs: 500, Bias: -7.164411, T: 419048, Avg. loss: 5.400330
Total training time: 0.18 seconds.
-- Epoch 15
Norm: 17.91, NNZs: 500, Bias: -7.140511, T: 448980, Avg. loss: 5.498656
Total training time: 0.19 seconds.
-- Epoch 16
Norm: 16.80, NNZs: 500, Bias: -7.116443, T: 478912, Avg. loss: 5.300845
Total training time: 0.20 seconds.
-- Epoch 17
Norm: 15.83, NNZs: 500, Bias: -7.085645, T: 508844, Avg. loss: 5.056112
Total training time: 0.22 seconds.
-- Epoch 18
Norm: 14.91, NNZs: 500, Bias: -7.052390, T: 538776, Avg. loss: 5.036580
Total training time: 0.23 seconds.
-- Epoch 19
Norm: 14.50, NNZs: 500, Bias: -7.017176, T: 568708, Avg. loss: 4.919960
Total training time: 0.24 seconds.
-- Epoch 20
Norm: 14.71, NNZs: 500, Bias: -6.979653, T: 598640, Avg. loss: 4.702038
Total training time: 0.26 seconds.
-- Epoch 21
Norm: 13.30, NNZs: 500, Bias: -6.950121, T: 628572, Avg. loss: 4.364825
Total training time: 0.27 seconds.
-- Epoch 22
Norm: 13.70, NNZs: 500, Bias: -6.909194, T: 658504, Avg. loss: 4.286194
Total training time: 0.29 seconds.
-- Epoch 23
Norm: 12.29, NNZs: 500, Bias: -6.875059, T: 688436, Avg. loss: 4.213553
Total training time: 0.30 seconds.
-- Epoch 24
Norm: 12.46, NNZs: 500, Bias: -6.831896, T: 718368, Avg. loss: 3.988537
Total training time: 0.31 seconds.
-- Epoch 25
Norm: 11.97, NNZs: 500, Bias: -6.798963, T: 748300, Avg. loss: 3.681194
Total training time: 0.33 seconds.
-- Epoch 26
Norm: 11.57, NNZs: 500, Bias: -6.761326, T: 778232, Avg. loss: 3.813943
Total training time: 0.34 seconds.
-- Epoch 27
Norm: 11.31, NNZs: 500, Bias: -6.728680, T: 808164, Avg. loss: 3.595003
Total training time: 0.35 seconds.
-- Epoch 28
Norm: 11.15, NNZs: 500, Bias: -6.688287, T: 838096, Avg. loss: 3.727049

Total training time: 0.37 seconds.
-- Epoch 29
Norm: 10.87, NNZs: 500, Bias: -6.651954, T: 868028, Avg. loss: 3.553805
Total training time: 0.38 seconds.
-- Epoch 30
Norm: 10.81, NNZs: 500, Bias: -6.614570, T: 897960, Avg. loss: 3.392181
Total training time: 0.39 seconds.
-- Epoch 31
Norm: 10.34, NNZs: 500, Bias: -6.581097, T: 927892, Avg. loss: 3.558138
Total training time: 0.41 seconds.
-- Epoch 32
Norm: 10.20, NNZs: 500, Bias: -6.544485, T: 957824, Avg. loss: 3.376312
Total training time: 0.42 seconds.
-- Epoch 33
Norm: 9.96, NNZs: 500, Bias: -6.511364, T: 987756, Avg. loss: 3.258476
Total training time: 0.44 seconds.
-- Epoch 34
Norm: 10.68, NNZs: 500, Bias: -6.474683, T: 1017688, Avg. loss: 3.333641
Total training time: 0.45 seconds.
-- Epoch 35
Norm: 9.74, NNZs: 500, Bias: -6.443264, T: 1047620, Avg. loss: 3.218372
Total training time: 0.46 seconds.
-- Epoch 36
Norm: 10.02, NNZs: 500, Bias: -6.410205, T: 1077552, Avg. loss: 3.166843
Total training time: 0.47 seconds.
-- Epoch 37
Norm: 9.49, NNZs: 500, Bias: -6.376178, T: 1107484, Avg. loss: 3.214619
Total training time: 0.48 seconds.
-- Epoch 38
Norm: 9.54, NNZs: 500, Bias: -6.342240, T: 1137416, Avg. loss: 3.090609
Total training time: 0.49 seconds.
-- Epoch 39
Norm: 9.39, NNZs: 500, Bias: -6.308890, T: 1167348, Avg. loss: 3.093825
Total training time: 0.50 seconds.
-- Epoch 40
Norm: 9.46, NNZs: 500, Bias: -6.274018, T: 1197280, Avg. loss: 3.129921
Total training time: 0.51 seconds.
-- Epoch 41
Norm: 8.88, NNZs: 500, Bias: -6.244888, T: 1227212, Avg. loss: 2.879328
Total training time: 0.53 seconds.
-- Epoch 42
Norm: 8.57, NNZs: 500, Bias: -6.213124, T: 1257144, Avg. loss: 2.931260
Total training time: 0.54 seconds.
-- Epoch 43
Norm: 8.91, NNZs: 500, Bias: -6.177100, T: 1287076, Avg. loss: 3.037753
Total training time: 0.55 seconds.
-- Epoch 44
Norm: 8.99, NNZs: 500, Bias: -6.147258, T: 1317008, Avg. loss: 2.980674
Total training time: 0.56 seconds.
-- Epoch 45
Norm: 8.42, NNZs: 500, Bias: -6.118998, T: 1346940, Avg. loss: 2.830734
Total training time: 0.58 seconds.
-- Epoch 46
Norm: 8.61, NNZs: 500, Bias: -6.087044, T: 1376872, Avg. loss: 2.832967
Total training time: 0.59 seconds.
-- Epoch 47
Norm: 8.24, NNZs: 500, Bias: -6.059032, T: 1406804, Avg. loss: 2.822642

Total training time: 0.60 seconds.
-- Epoch 48
Norm: 8.26, NNZs: 500, Bias: -6.029202, T: 1436736, Avg. loss: 2.755207
Total training time: 0.61 seconds.
-- Epoch 49
Norm: 8.12, NNZs: 500, Bias: -6.000071, T: 1466668, Avg. loss: 2.735526
Total training time: 0.63 seconds.
-- Epoch 50
Norm: 7.94, NNZs: 500, Bias: -5.969876, T: 1496600, Avg. loss: 2.709345
Total training time: 0.64 seconds.
-- Epoch 51
Norm: 7.81, NNZs: 500, Bias: -5.943656, T: 1526532, Avg. loss: 2.580712
Total training time: 0.65 seconds.
-- Epoch 52
Norm: 7.93, NNZs: 500, Bias: -5.914516, T: 1556464, Avg. loss: 2.590782
Total training time: 0.66 seconds.
-- Epoch 53
Norm: 8.02, NNZs: 500, Bias: -5.884523, T: 1586396, Avg. loss: 2.667816
Total training time: 0.67 seconds.
-- Epoch 54
Norm: 7.69, NNZs: 500, Bias: -5.859815, T: 1616328, Avg. loss: 2.569343
Total training time: 0.69 seconds.
-- Epoch 55
Norm: 7.52, NNZs: 500, Bias: -5.833670, T: 1646260, Avg. loss: 2.527222
Total training time: 0.70 seconds.
-- Epoch 56
Norm: 7.63, NNZs: 500, Bias: -5.806973, T: 1676192, Avg. loss: 2.611354
Total training time: 0.71 seconds.
-- Epoch 57
Norm: 7.49, NNZs: 500, Bias: -5.779701, T: 1706124, Avg. loss: 2.535987
Total training time: 0.73 seconds.
-- Epoch 58
Norm: 7.39, NNZs: 500, Bias: -5.753995, T: 1736056, Avg. loss: 2.534637
Total training time: 0.74 seconds.
-- Epoch 59
Norm: 7.47, NNZs: 500, Bias: -5.728377, T: 1765988, Avg. loss: 2.482053
Total training time: 0.75 seconds.
-- Epoch 60
Norm: 7.27, NNZs: 500, Bias: -5.702046, T: 1795920, Avg. loss: 2.505690
Total training time: 0.76 seconds.
-- Epoch 61
Norm: 7.10, NNZs: 500, Bias: -5.677255, T: 1825852, Avg. loss: 2.455875
Total training time: 0.77 seconds.
-- Epoch 62
Norm: 7.11, NNZs: 500, Bias: -5.653628, T: 1855784, Avg. loss: 2.406903
Total training time: 0.78 seconds.
-- Epoch 63
Norm: 6.95, NNZs: 500, Bias: -5.627590, T: 1885716, Avg. loss: 2.450183
Total training time: 0.79 seconds.
-- Epoch 64
Norm: 6.97, NNZs: 500, Bias: -5.602921, T: 1915648, Avg. loss: 2.421043
Total training time: 0.81 seconds.
-- Epoch 65
Norm: 6.80, NNZs: 500, Bias: -5.580311, T: 1945580, Avg. loss: 2.329142
Total training time: 0.82 seconds.
-- Epoch 66
Norm: 6.78, NNZs: 500, Bias: -5.556487, T: 1975512, Avg. loss: 2.347170

```
Total training time: 0.83 seconds.
-- Epoch 67
Norm: 7.05, NNZs: 500, Bias: -5.531511, T: 2005444, Avg. loss: 2.413770
Total training time: 0.84 seconds.
-- Epoch 68
Norm: 6.90, NNZs: 500, Bias: -5.508784, T: 2035376, Avg. loss: 2.352232
Total training time: 0.85 seconds.
-- Epoch 69
Norm: 6.71, NNZs: 500, Bias: -5.486413, T: 2065308, Avg. loss: 2.301788
Total training time: 0.86 seconds.
-- Epoch 70
Norm: 6.73, NNZs: 500, Bias: -5.462796, T: 2095240, Avg. loss: 2.387216
Total training time: 0.88 seconds.
-- Epoch 71
Norm: 6.96, NNZs: 500, Bias: -5.439889, T: 2125172, Avg. loss: 2.354239
Total training time: 0.89 seconds.
-- Epoch 72
Norm: 6.59, NNZs: 500, Bias: -5.419486, T: 2155104, Avg. loss: 2.286669
Total training time: 0.90 seconds.
-- Epoch 73
Norm: 6.51, NNZs: 500, Bias: -5.398006, T: 2185036, Avg. loss: 2.284076
Total training time: 0.91 seconds.
-- Epoch 74
Norm: 6.56, NNZs: 500, Bias: -5.375776, T: 2214968, Avg. loss: 2.262481
Total training time: 0.93 seconds.
-- Epoch 75
Norm: 6.39, NNZs: 500, Bias: -5.353880, T: 2244900, Avg. loss: 2.265030
Total training time: 0.94 seconds.
-- Epoch 76
Norm: 6.39, NNZs: 500, Bias: -5.331397, T: 2274832, Avg. loss: 2.226388
Total training time: 0.95 seconds.
-- Epoch 77
Norm: 6.52, NNZs: 500, Bias: -5.309300, T: 2304764, Avg. loss: 2.230400
Total training time: 0.96 seconds.
-- Epoch 78
Norm: 6.44, NNZs: 500, Bias: -5.288492, T: 2334696, Avg. loss: 2.251700
Total training time: 0.97 seconds.
-- Epoch 79
Norm: 6.33, NNZs: 500, Bias: -5.269303, T: 2364628, Avg. loss: 2.126244
Total training time: 0.98 seconds.
-- Epoch 80
Norm: 6.10, NNZs: 500, Bias: -5.249640, T: 2394560, Avg. loss: 2.159301
Total training time: 1.00 seconds.
-- Epoch 81
Norm: 6.27, NNZs: 500, Bias: -5.227528, T: 2424492, Avg. loss: 2.214235
Total training time: 1.01 seconds.
-- Epoch 82
Norm: 6.15, NNZs: 500, Bias: -5.207768, T: 2454424, Avg. loss: 2.152736
Total training time: 1.02 seconds.
-- Epoch 83
Norm: 6.04, NNZs: 500, Bias: -5.187675, T: 2484356, Avg. loss: 2.149793
Total training time: 1.03 seconds.
-- Epoch 84
Norm: 6.22, NNZs: 500, Bias: -5.166658, T: 2514288, Avg. loss: 2.183010
Total training time: 1.04 seconds.
Convergence after 84 epochs took 1.05 seconds
[1 1 0 ... 1 0 1]
```

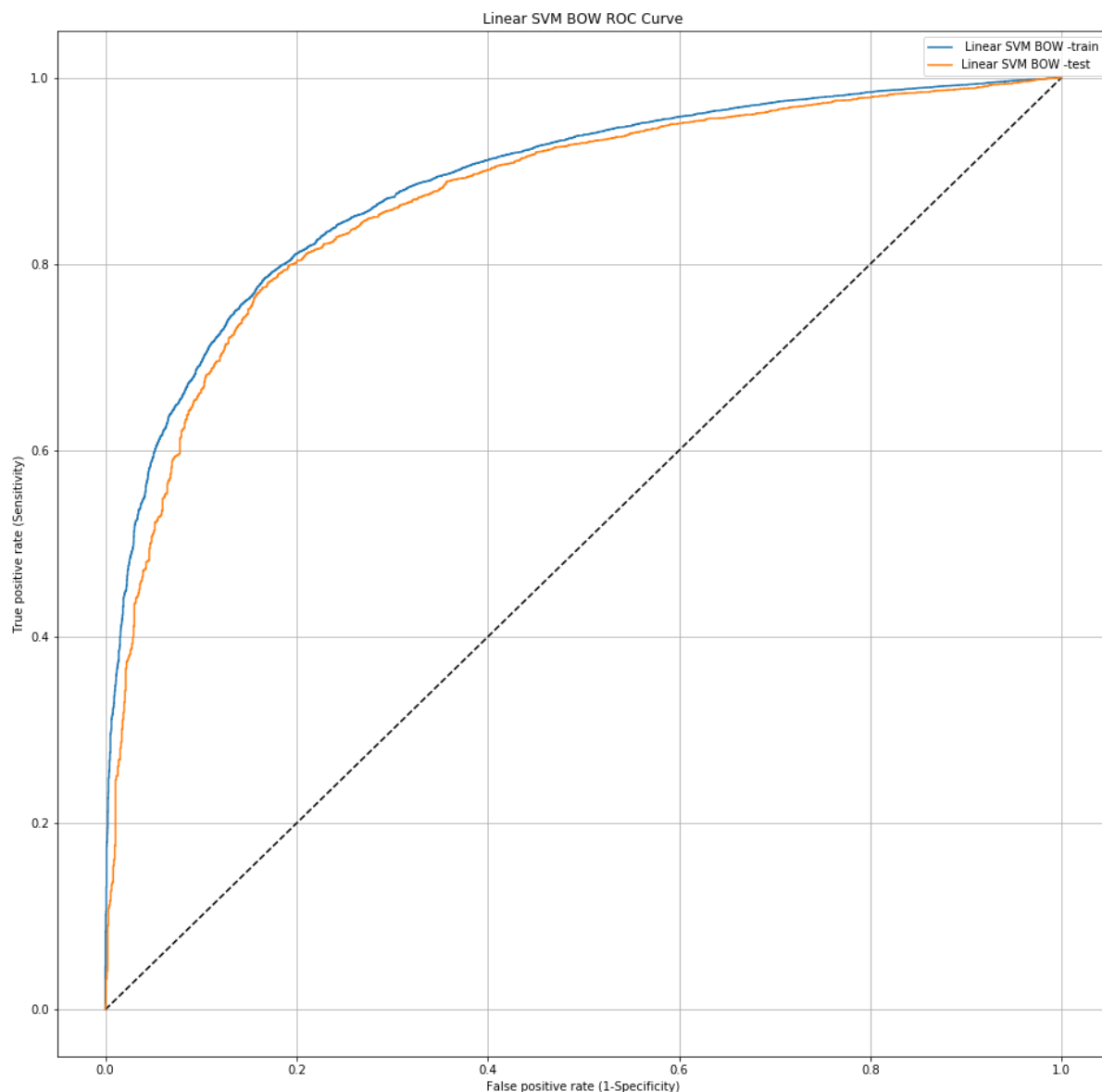
	precision	recall	f1-score	support
0	0.44	0.81	0.57	1218
1	0.96	0.80	0.87	6265
micro avg	0.80	0.80	0.80	7483
macro avg	0.70	0.80	0.72	7483
weighted avg	0.87	0.80	0.82	7483

[0.73191203 0.64077974 0.34666032 ... 0.90037521 0.28419452 0.78621771]

```

In [56]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='Linear SVM BOW ROC Curve'
displaygraph.legnd_1 = ' Linear SVM BOW -train'
displaygraph.legnd_2 = 'Linear SVM BOW -test'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='False positive rate (1-Specificity)'
displaygraph.label_y='True positive rate (Sensitivity)'
displaygraph.constructgraph(lnrsvm.roc_curve_test['fpr_trn'],lnrsvm.roc_curve_test['tpr_trn'],\
                             lnrsvm.roc_curve_test['fpr'],lnrsvm.roc_curve_test['tpr'])

```



```
In [85]: data = [[lnrsvm.confsnmtxytstpred['tn'] ,lnrsvm.confsnmtxytstpred['fn']], [1  
lnrsvm.confsnmtxytstpred['fp'],lnrsvm.confsnmtxytstpred['tp']]]  
displaygraph.draw_table(data)  
data1= [[lnrsvm.accuracy_score_val,lnrsvm.accuracy_score_test]]  
#data1=[[0,1]]  
displaygraph.draw_accscore(data1)
```

	Predicted: NO	Predicted: YES
Actual: NO	984	1268
Actual: YES	234	4997

	Validation	Test
Accuracy Score	0.7890429263404042	0.7992783642923961


```
In [93]: lnrsm_sgdc1f = lnrsvm.getSGDClassifier()
feature_names = lnrsvm.feats_names
top10_negve = sorted(zip(lnrsm_sgdc1f.coef_[0], feature_names))[-10:]
top10_posve = sorted(zip(lnrsm_sgdc1f.coef_[0], feature_names))[0:10]
feat_pos=[]
feat_neg=[]
features=[]
for coef,feat in (top10_negve):
    feat_pos.append(feat)

for cef,feat in (top10_posve):
    feat_neg.append(feat)

i=0
while i< int(len(feat_pos)):
    feat_item=[]
    feat_item.append(feat_pos[i])
    feat_item.append(feat_neg[i])
    features.append(feat_item)
    i +=1

displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.draw_posnegwords(features)
```

	Postive	Negative
1	yummy	not
2	nice	etc
3	add	different
4	loves	bags
5	per	awesome
6	going	hot
7	definitely	toy
8	love	product
9	believe	available
10	got	money

```
In [89]: import tabulate
res_tab = [['Label', 'Precision', 'Recall', 'f-1 Score'],
           [0, 0.44, 0.81, 0.57],
           [1, 0.96, 0.80, 0.87]]
print(tabulate.tabulate(res_tab, tablefmt='fancy_grid'))
```

Label	Precision	Recall	f-1 Score
0	0.44	0.81	0.57
1	0.96	0.8	0.87

```
In [86]: #using alpha value not returned by gridsearchCV  
lnrsvm.SVM_actualClassifier(0.1)
```

```
-- Epoch 1
Norm: 3.18, NNZs: 500, Bias: -0.660020, T: 23945, Avg. loss: 4.008275
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 2.17, NNZs: 500, Bias: -0.668609, T: 47890, Avg. loss: 1.352076
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 1.79, NNZs: 500, Bias: -0.673412, T: 71835, Avg. loss: 1.103648
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 1.64, NNZs: 500, Bias: -0.676958, T: 95780, Avg. loss: 1.022349
Total training time: 0.04 seconds.
-- Epoch 5
Norm: 1.57, NNZs: 500, Bias: -0.680199, T: 119725, Avg. loss: 1.005098
Total training time: 0.05 seconds.
-- Epoch 6
Norm: 1.52, NNZs: 500, Bias: -0.682808, T: 143670, Avg. loss: 0.993412
Total training time: 0.06 seconds.
-- Epoch 7
Norm: 1.49, NNZs: 500, Bias: -0.684829, T: 167615, Avg. loss: 0.972058
Total training time: 0.07 seconds.
-- Epoch 8
Norm: 1.46, NNZs: 500, Bias: -0.686606, T: 191560, Avg. loss: 0.968923
Total training time: 0.08 seconds.
-- Epoch 9
Norm: 1.42, NNZs: 500, Bias: -0.688432, T: 215505, Avg. loss: 0.945938
Total training time: 0.09 seconds.
-- Epoch 10
Norm: 1.41, NNZs: 500, Bias: -0.689773, T: 239450, Avg. loss: 0.938804
Total training time: 0.10 seconds.
-- Epoch 11
Norm: 1.39, NNZs: 500, Bias: -0.691257, T: 263395, Avg. loss: 0.931438
Total training time: 0.11 seconds.
-- Epoch 12
Norm: 1.38, NNZs: 500, Bias: -0.692557, T: 287340, Avg. loss: 0.932827
Total training time: 0.13 seconds.
-- Epoch 13
Norm: 1.37, NNZs: 500, Bias: -0.693654, T: 311285, Avg. loss: 0.931374
Total training time: 0.14 seconds.
-- Epoch 14
Norm: 1.37, NNZs: 500, Bias: -0.694624, T: 335230, Avg. loss: 0.925826
Total training time: 0.15 seconds.
-- Epoch 15
Norm: 1.36, NNZs: 500, Bias: -0.695736, T: 359175, Avg. loss: 0.911434
Total training time: 0.16 seconds.
-- Epoch 16
Norm: 1.35, NNZs: 500, Bias: -0.696703, T: 383120, Avg. loss: 0.914765
Total training time: 0.17 seconds.
-- Epoch 17
Norm: 1.35, NNZs: 500, Bias: -0.697536, T: 407065, Avg. loss: 0.913384
Total training time: 0.19 seconds.
-- Epoch 18
Norm: 1.34, NNZs: 500, Bias: -0.698281, T: 431010, Avg. loss: 0.916508
Total training time: 0.20 seconds.
-- Epoch 19
Norm: 1.34, NNZs: 500, Bias: -0.699185, T: 454955, Avg. loss: 0.907718
Total training time: 0.21 seconds.
```

```
-- Epoch 20
Norm: 1.34, NNZs: 500, Bias: -0.699891, T: 478900, Avg. loss: 0.914983
Total training time: 0.23 seconds.
-- Epoch 21
Norm: 1.33, NNZs: 500, Bias: -0.700657, T: 502845, Avg. loss: 0.903426
Total training time: 0.24 seconds.
-- Epoch 22
Norm: 1.33, NNZs: 500, Bias: -0.701289, T: 526790, Avg. loss: 0.916945
Total training time: 0.25 seconds.
-- Epoch 23
Norm: 1.33, NNZs: 500, Bias: -0.701931, T: 550735, Avg. loss: 0.911682
Total training time: 0.27 seconds.
-- Epoch 24
Norm: 1.33, NNZs: 500, Bias: -0.702575, T: 574680, Avg. loss: 0.904490
Total training time: 0.28 seconds.
-- Epoch 25
Norm: 1.32, NNZs: 500, Bias: -0.703087, T: 598625, Avg. loss: 0.912315
Total training time: 0.29 seconds.
-- Epoch 26
Norm: 1.32, NNZs: 500, Bias: -0.703666, T: 622570, Avg. loss: 0.904520
Total training time: 0.31 seconds.
Convergence after 26 epochs took 0.31 seconds
-- Epoch 1
Norm: 2.73, NNZs: 500, Bias: -0.848509, T: 29932, Avg. loss: 4.103597
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 1.95, NNZs: 500, Bias: -0.852999, T: 59864, Avg. loss: 1.261481
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 1.69, NNZs: 500, Bias: -0.855889, T: 89796, Avg. loss: 1.101700
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 1.55, NNZs: 500, Bias: -0.857201, T: 119728, Avg. loss: 1.062904
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 1.49, NNZs: 500, Bias: -0.858798, T: 149660, Avg. loss: 1.014077
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 1.44, NNZs: 500, Bias: -0.859780, T: 179592, Avg. loss: 0.995152
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 1.40, NNZs: 500, Bias: -0.860739, T: 209524, Avg. loss: 0.973226
Total training time: 0.10 seconds.
-- Epoch 8
Norm: 1.38, NNZs: 500, Bias: -0.861592, T: 239456, Avg. loss: 0.979434
Total training time: 0.11 seconds.
-- Epoch 9
Norm: 1.35, NNZs: 500, Bias: -0.862243, T: 269388, Avg. loss: 0.970104
Total training time: 0.13 seconds.
-- Epoch 10
Norm: 1.34, NNZs: 500, Bias: -0.862984, T: 299320, Avg. loss: 0.961461
Total training time: 0.14 seconds.
-- Epoch 11
Norm: 1.32, NNZs: 500, Bias: -0.863671, T: 329252, Avg. loss: 0.953864
Total training time: 0.15 seconds.
-- Epoch 12
Norm: 1.32, NNZs: 500, Bias: -0.864045, T: 359184, Avg. loss: 0.959935
```

```

Total training time: 0.17 seconds.
-- Epoch 13
Norm: 1.31, NNZs: 500, Bias: -0.864604, T: 389116, Avg. loss: 0.941542
Total training time: 0.18 seconds.
-- Epoch 14
Norm: 1.30, NNZs: 500, Bias: -0.865059, T: 419048, Avg. loss: 0.945499
Total training time: 0.19 seconds.
-- Epoch 15
Norm: 1.30, NNZs: 500, Bias: -0.865423, T: 448980, Avg. loss: 0.954138
Total training time: 0.21 seconds.
-- Epoch 16
Norm: 1.29, NNZs: 500, Bias: -0.865790, T: 478912, Avg. loss: 0.949210
Total training time: 0.22 seconds.
-- Epoch 17
Norm: 1.29, NNZs: 500, Bias: -0.866113, T: 508844, Avg. loss: 0.946656
Total training time: 0.23 seconds.
-- Epoch 18
Norm: 1.29, NNZs: 500, Bias: -0.866505, T: 538776, Avg. loss: 0.945483
Total training time: 0.25 seconds.
Convergence after 18 epochs took 0.25 seconds
[1 1 1 ... 1 0 0]
      precision    recall  f1-score   support

     0       0.47      0.81      0.60      1218
     1       0.96      0.82      0.88      6265

   micro avg       0.82      0.82      0.82      7483
   macro avg       0.71      0.82      0.74      7483
weighted avg       0.88      0.82      0.84      7483

[0.832064  0.6435246  0.54698489 ... 0.96688205 0.49093831 0.33639735]

```

```

In [87]: data = [[lnrsvm.confsvmtytstpred['tn'],lnrsvm.confsvmtytstpred['fn']],
                 [lnrsvm.confsvmtytstpred['fp'],lnrsvm.confsvmtytstpred['tp']]]
displaygraph.draw_table(data)

```

	Predicted: NO	Predicted: YES
Actual: NO	991	1115
Actual: YES	227	5150

```
In [88]: data1= [[lnrsvm.accuracy_score_val,lnrsvm.accuracy_score_test]]
#data1=[[0,1]]
displaygraph.draw_accscore(data1)
```

	Validation	Test
Accuracy Score	0.8184399532320027	0.8206601630362155

Precision, Recall and f-1 Score

```
In [3]: import tabulate
res_tab = [['Label', 'Precision', 'Recall', 'f-1 Score'],
           [0,0.47,0.81,0.60],
           [1,0.96,0.82,0.88]]
print(tabulate.tabulate(res_tab, tablefmt='fancy_grid'))
```

Label	Precision	Recall	f-1 Score
0	0.47	0.81	0.6
1	0.96	0.82	0.88

Feature Importance for Linear SVM


```
In [90]: lnrsm_sgdc1f = lnrsvm.getSGDClassifier()
feature_names = lnrsvm.feats_names
top10_negve = sorted(zip(lnrsm_sgdc1f.coef_[0], feature_names))[-10:]
top10_posve = sorted(zip(lnrsm_sgdc1f.coef_[0], feature_names))[0:10]
feat_pos=[]
feat_neg=[]
features=[]
for coef,feat in (top10_negve):
    feat_pos.append(feat)

for cef,feat in (top10_posve):
    feat_neg.append(feat)

i=0
while i< int(len(feat_pos)):
    feat_item=[]
    feat_item.append(feat_pos[i])
    feat_item.append(feat_neg[i])
    features.append(feat_item)
    i +=1

displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.draw_posnegwords(features)
```

	Postive	Negative
1	fat	not
2	help	hot
3	wonderful	different
4	going	product
5	loves	money
6	definitely	awesome
7	per	available
8	believe	problems
9	love	thought
10	got	rather

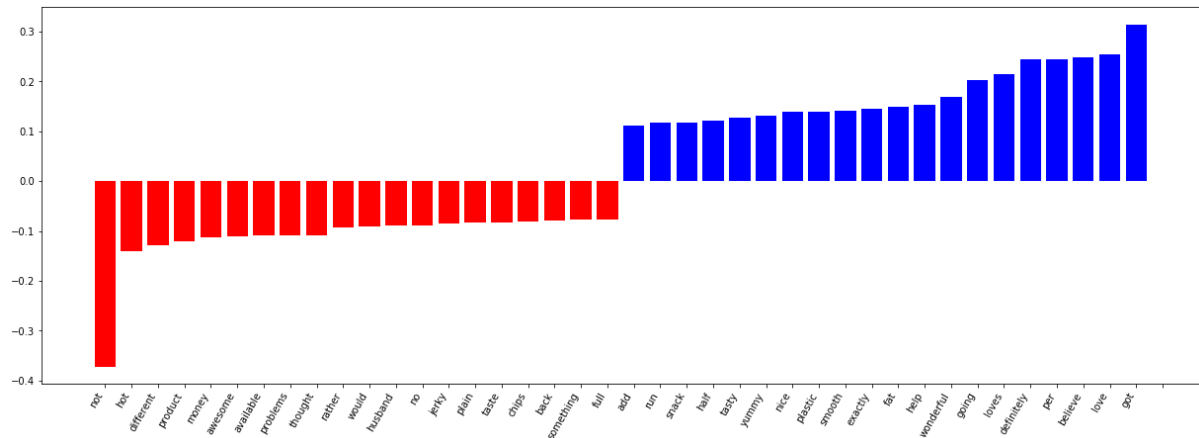
Features a visual treat

```
In [91]: no_feat = 20
coef = lnrm_sgdclf.coef_.ravel()

top_posve_coef = np.argsort(coef)[-no_feat:]
top_negve_coef = np.argsort(coef)[:no_feat]

top_coefs = np.hstack([top_negve_coef, top_posve_coef])
feature_names = lnrmsvm.feats_names

displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.visual_featname(feature_names,coef,top_coefs,no_feat)
```



[5.1.2] Applying Linear SVM on TFIDF, SET 2

```
In [3]: # Please write all the code with proper documentation
```

GridsearchCV output for TFIDF

```
0.9013660913329639 {'alpha': 0.01, 'penalty': 'l2'} GridSearchCV(cv=10, error_score='raise-deprecating',
estimator=SGDClassifier(alpha=0.0001, average=False, class_weight=None, early_stopping=False,
epsilon=0.1, eta0=0.0, fit_intercept=True, l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2', power_t=0.5, random_state=42, shuffle=True,
tol=0.001, validation_fraction=0.1, verbose=100, warm_start=False), fit_params=None, iid='warn',
n_jobs=None, param_grid={'penalty': ['l2', 'l1'], 'alpha': [0.0001, 0.001, 0.01, 0.1, 1, 10, 100, 1000]},
pre_dispatch='2*n_jobs', refit=True, return_train_score='warn', scoring='roc_auc', verbose=100)
```

```
In [20]: lnrsvm_tidf = assign7SVM()
lnrsvm_tidfclf = lnrsvm_tidf.SGDClassifier()
lnrsvm_tidf.load_data('TFIDF')
lnrsvm_tidf.setpenaltyparm('l2')

Out[20]: SGDClassifier(alpha=0.0001, average=False, class_weight={0: 5.14, 1: 1},
    early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
    l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
    n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
    power_t=0.5, random_state=42, shuffle=True, tol=0.001,
    validation_fraction=0.1, verbose=100, warm_start=False)
```

```
In [21]: lnrsvm_tidf.SVM_calcrocaucscore(1000000)
```

```
SGDClassifier(alpha=1e-07, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 67908.01, NNZs: 500, Bias: -6686.158584, T: 23945, Avg. loss: 10003.8
93301
Total training time: 0.03 seconds.
-- Epoch 2
Norm: 62887.96, NNZs: 500, Bias: -9233.542391, T: 47890, Avg. loss: 9053.15
6150
Total training time: 0.06 seconds.
-- Epoch 3
Norm: 57489.95, NNZs: 500, Bias: -12854.771624, T: 71835, Avg. loss: 8222.6
40881
Total training time: 0.09 seconds.
-- Epoch 4
Norm: 51869.59, NNZs: 500, Bias: -11411.463884, T: 95780, Avg. loss: 7583.1
45196
Total training time: 0.12 seconds.
-- Epoch 5
Norm: 49075.13, NNZs: 500, Bias: -11334.090497, T: 119725, Avg. loss: 6666.
573310
Total training time: 0.15 seconds.
-- Epoch 6
Norm: 46518.41, NNZs: 500, Bias: -11430.688321, T: 143670, Avg. loss: 6337.
414165
Total training time: 0.18 seconds.
-- Epoch 7
Norm: 41498.10, NNZs: 500, Bias: -10424.410308, T: 167615, Avg. loss: 6028.
674821
Total training time: 0.21 seconds.
-- Epoch 8
Norm: 38220.09, NNZs: 500, Bias: -10710.996511, T: 191560, Avg. loss: 5513.
046442
Total training time: 0.24 seconds.
-- Epoch 9
Norm: 36740.29, NNZs: 500, Bias: -10160.319449, T: 215505, Avg. loss: 5006.
163199
Total training time: 0.27 seconds.
-- Epoch 10
Norm: 34335.81, NNZs: 500, Bias: -9461.962759, T: 239450, Avg. loss: 4796.6
27795
Total training time: 0.30 seconds.
-- Epoch 11
Norm: 32310.33, NNZs: 500, Bias: -8226.995597, T: 263395, Avg. loss: 4615.5
59972
Total training time: 0.33 seconds.
-- Epoch 12
Norm: 31511.13, NNZs: 500, Bias: -7125.584944, T: 287340, Avg. loss: 4197.7
82627
Total training time: 0.36 seconds.
-- Epoch 13
Norm: 28697.91, NNZs: 500, Bias: -6815.073207, T: 311285, Avg. loss: 4003.7
12668
```

Total training time: 0.39 seconds.
-- Epoch 14
Norm: 28248.90, NNZs: 500, Bias: -6728.357469, T: 335230, Avg. loss: 3867.348603
Total training time: 0.42 seconds.
-- Epoch 15
Norm: 28081.94, NNZs: 500, Bias: -6420.906444, T: 359175, Avg. loss: 3724.861147
Total training time: 0.45 seconds.
-- Epoch 16
Norm: 25952.75, NNZs: 500, Bias: -6054.859412, T: 383120, Avg. loss: 3550.538255
Total training time: 0.48 seconds.
-- Epoch 17
Norm: 25581.03, NNZs: 500, Bias: -5893.759915, T: 407065, Avg. loss: 3477.943810
Total training time: 0.51 seconds.
-- Epoch 18
Norm: 23880.63, NNZs: 500, Bias: -6053.528461, T: 431010, Avg. loss: 3220.169001
Total training time: 0.54 seconds.
-- Epoch 19
Norm: 22247.11, NNZs: 500, Bias: -5431.349142, T: 454955, Avg. loss: 3099.358394
Total training time: 0.57 seconds.
-- Epoch 20
Norm: 21366.21, NNZs: 500, Bias: -5665.625913, T: 478900, Avg. loss: 2989.202565
Total training time: 0.60 seconds.
-- Epoch 21
Norm: 21059.77, NNZs: 500, Bias: -5333.753776, T: 502845, Avg. loss: 2864.492460
Total training time: 0.63 seconds.
-- Epoch 22
Norm: 21026.58, NNZs: 500, Bias: -5437.005326, T: 526790, Avg. loss: 2828.397979
Total training time: 0.66 seconds.
-- Epoch 23
Norm: 19446.84, NNZs: 500, Bias: -5012.768628, T: 550735, Avg. loss: 2724.780420
Total training time: 0.70 seconds.
-- Epoch 24
Norm: 18727.04, NNZs: 500, Bias: -4246.983326, T: 574680, Avg. loss: 2596.576292
Total training time: 0.73 seconds.
-- Epoch 25
Norm: 18607.23, NNZs: 500, Bias: -4109.385784, T: 598625, Avg. loss: 2530.507181
Total training time: 0.76 seconds.
-- Epoch 26
Norm: 17888.90, NNZs: 500, Bias: -4160.615381, T: 622570, Avg. loss: 2481.772880
Total training time: 0.79 seconds.
-- Epoch 27
Norm: 17560.19, NNZs: 500, Bias: -4323.731910, T: 646515, Avg. loss: 2431.601392
Total training time: 0.82 seconds.

```
-- Epoch 28
Norm: 16645.97, NNZs: 500, Bias: -3950.375342, T: 670460, Avg. loss: 2290.8
50404
Total training time: 0.85 seconds.
-- Epoch 29
Norm: 16294.47, NNZs: 500, Bias: -3938.002157, T: 694405, Avg. loss: 2256.9
66499
Total training time: 0.89 seconds.
-- Epoch 30
Norm: 16401.61, NNZs: 500, Bias: -4067.833031, T: 718350, Avg. loss: 2233.1
69211
Total training time: 0.92 seconds.
-- Epoch 31
Norm: 15309.02, NNZs: 500, Bias: -3785.390620, T: 742295, Avg. loss: 2099.5
79121
Total training time: 0.95 seconds.
-- Epoch 32
Norm: 15001.27, NNZs: 500, Bias: -3646.705560, T: 766240, Avg. loss: 2047.2
10884
Total training time: 0.98 seconds.
-- Epoch 33
Norm: 14535.76, NNZs: 500, Bias: -3702.376282, T: 790185, Avg. loss: 2063.3
14261
Total training time: 1.00 seconds.
-- Epoch 34
Norm: 14092.37, NNZs: 500, Bias: -3609.268540, T: 814130, Avg. loss: 1960.9
79762
Total training time: 1.03 seconds.
-- Epoch 35
Norm: 14144.79, NNZs: 500, Bias: -3621.082990, T: 838075, Avg. loss: 1947.5
93424
Total training time: 1.06 seconds.
-- Epoch 36
Norm: 13790.16, NNZs: 500, Bias: -3428.512470, T: 862020, Avg. loss: 1901.1
88692
Total training time: 1.09 seconds.
-- Epoch 37
Norm: 13973.63, NNZs: 500, Bias: -3009.816494, T: 885965, Avg. loss: 1867.2
40213
Total training time: 1.12 seconds.
-- Epoch 38
Norm: 13031.98, NNZs: 500, Bias: -3447.407433, T: 909910, Avg. loss: 1834.1
26872
Total training time: 1.15 seconds.
-- Epoch 39
Norm: 12515.00, NNZs: 500, Bias: -3337.471344, T: 933855, Avg. loss: 1800.8
64158
Total training time: 1.18 seconds.
-- Epoch 40
Norm: 12821.01, NNZs: 500, Bias: -3125.558025, T: 957800, Avg. loss: 1761.9
46288
Total training time: 1.21 seconds.
-- Epoch 41
Norm: 12348.33, NNZs: 500, Bias: -3285.804988, T: 981745, Avg. loss: 1710.8
63670
Total training time: 1.23 seconds.
-- Epoch 42
```


Norm: 12211.21, NNZs: 500, Bias: -2862.286032, T: 1005690, Avg. loss: 1674.744363
Total training time: 1.26 seconds.
-- Epoch 43
Norm: 11640.09, NNZs: 500, Bias: -2754.694607, T: 1029635, Avg. loss: 1602.805447
Total training time: 1.29 seconds.
-- Epoch 44
Norm: 11581.23, NNZs: 500, Bias: -2759.500768, T: 1053580, Avg. loss: 1557.920826
Total training time: 1.32 seconds.
-- Epoch 45
Norm: 11228.21, NNZs: 500, Bias: -2624.702646, T: 1077525, Avg. loss: 1580.647940
Total training time: 1.34 seconds.
-- Epoch 46
Norm: 11182.71, NNZs: 500, Bias: -2643.234228, T: 1101470, Avg. loss: 1495.962611
Total training time: 1.37 seconds.
-- Epoch 47
Norm: 10856.26, NNZs: 500, Bias: -2351.737538, T: 1125415, Avg. loss: 1516.688407
Total training time: 1.40 seconds.
-- Epoch 48
Norm: 10681.01, NNZs: 500, Bias: -2368.903672, T: 1149360, Avg. loss: 1438.181387
Total training time: 1.43 seconds.
-- Epoch 49
Norm: 10920.13, NNZs: 500, Bias: -2473.587641, T: 1173305, Avg. loss: 1463.513019
Total training time: 1.46 seconds.
-- Epoch 50
Norm: 10306.42, NNZs: 500, Bias: -2545.313341, T: 1197250, Avg. loss: 1430.768953
Total training time: 1.49 seconds.
-- Epoch 51
Norm: 10364.21, NNZs: 500, Bias: -2454.870749, T: 1221195, Avg. loss: 1425.183627
Total training time: 1.51 seconds.
-- Epoch 52
Norm: 10094.13, NNZs: 500, Bias: -2225.073445, T: 1245140, Avg. loss: 1349.356130
Total training time: 1.54 seconds.
-- Epoch 53
Norm: 10101.48, NNZs: 500, Bias: -2620.888190, T: 1269085, Avg. loss: 1344.178457
Total training time: 1.57 seconds.
-- Epoch 54
Norm: 9620.65, NNZs: 500, Bias: -2286.275817, T: 1293030, Avg. loss: 1322.533333
Total training time: 1.60 seconds.
-- Epoch 55
Norm: 9387.45, NNZs: 500, Bias: -1957.671307, T: 1316975, Avg. loss: 1332.990243
Total training time: 1.63 seconds.
-- Epoch 56
Norm: 9528.44, NNZs: 500, Bias: -2036.199463, T: 1340920, Avg. loss: 1293.6

```
01745
Total training time: 1.66 seconds.
-- Epoch 57
Norm: 9384.60, NNZs: 500, Bias: -2269.724951, T: 1364865, Avg. loss: 1287.0
31013
Total training time: 1.69 seconds.
-- Epoch 58
Norm: 8978.30, NNZs: 500, Bias: -2191.045697, T: 1388810, Avg. loss: 1283.7
76235
Total training time: 1.71 seconds.
-- Epoch 59
Norm: 9175.35, NNZs: 500, Bias: -2084.247941, T: 1412755, Avg. loss: 1217.4
36237
Total training time: 1.74 seconds.
-- Epoch 60
Norm: 8994.33, NNZs: 500, Bias: -1896.345968, T: 1436700, Avg. loss: 1227.0
38010
Total training time: 1.77 seconds.
-- Epoch 61
Norm: 9009.01, NNZs: 500, Bias: -1942.095587, T: 1460645, Avg. loss: 1183.1
83839
Total training time: 1.80 seconds.
-- Epoch 62
Norm: 8711.67, NNZs: 500, Bias: -2160.867120, T: 1484590, Avg. loss: 1178.4
29053
Total training time: 1.83 seconds.
-- Epoch 63
Norm: 8654.54, NNZs: 500, Bias: -2007.672682, T: 1508535, Avg. loss: 1177.8
54205
Total training time: 1.86 seconds.
-- Epoch 64
Norm: 8455.92, NNZs: 500, Bias: -1949.576481, T: 1532480, Avg. loss: 1166.5
62236
Total training time: 1.89 seconds.
-- Epoch 65
Norm: 8326.13, NNZs: 500, Bias: -1767.234627, T: 1556425, Avg. loss: 1138.8
99735
Total training time: 1.92 seconds.
-- Epoch 66
Norm: 8095.40, NNZs: 500, Bias: -1820.831867, T: 1580370, Avg. loss: 1106.3
37398
Total training time: 1.94 seconds.
-- Epoch 67
Norm: 8317.48, NNZs: 500, Bias: -1856.696083, T: 1604315, Avg. loss: 1092.7
43128
Total training time: 1.97 seconds.
-- Epoch 68
Norm: 7951.16, NNZs: 500, Bias: -1664.823504, T: 1628260, Avg. loss: 1094.5
74260
Total training time: 2.00 seconds.
-- Epoch 69
Norm: 7747.62, NNZs: 500, Bias: -1400.353242, T: 1652205, Avg. loss: 1055.2
18472
Total training time: 2.03 seconds.
-- Epoch 70
Norm: 7892.38, NNZs: 500, Bias: -1616.185591, T: 1676150, Avg. loss: 1029.6
92811
```

Total training time: 2.06 seconds.
-- Epoch 71
Norm: 7566.08, NNZs: 500, Bias: -1721.023647, T: 1700095, Avg. loss: 1058.5
53722
Total training time: 2.08 seconds.
-- Epoch 72
Norm: 7653.64, NNZs: 500, Bias: -1671.190489, T: 1724040, Avg. loss: 1022.7
68956
Total training time: 2.11 seconds.
-- Epoch 73
Norm: 7489.14, NNZs: 500, Bias: -1667.543525, T: 1747985, Avg. loss: 1025.5
95697
Total training time: 2.14 seconds.
-- Epoch 74
Norm: 7317.81, NNZs: 500, Bias: -1467.490564, T: 1771930, Avg. loss: 1015.2
44949
Total training time: 2.17 seconds.
-- Epoch 75
Norm: 7309.49, NNZs: 500, Bias: -1463.453776, T: 1795875, Avg. loss: 980.49
7727
Total training time: 2.20 seconds.
-- Epoch 76
Norm: 7242.11, NNZs: 500, Bias: -1693.094408, T: 1819820, Avg. loss: 1001.2
56717
Total training time: 2.22 seconds.
-- Epoch 77
Norm: 6938.76, NNZs: 500, Bias: -1707.155985, T: 1843765, Avg. loss: 978.73
8958
Total training time: 2.25 seconds.
-- Epoch 78
Norm: 6780.66, NNZs: 500, Bias: -1535.737358, T: 1867710, Avg. loss: 940.21
8808
Total training time: 2.28 seconds.
-- Epoch 79
Norm: 6780.33, NNZs: 500, Bias: -1592.841015, T: 1891655, Avg. loss: 963.06
1696
Total training time: 2.31 seconds.
-- Epoch 80
Norm: 7209.30, NNZs: 500, Bias: -1479.676866, T: 1915600, Avg. loss: 948.05
3652
Total training time: 2.34 seconds.
-- Epoch 81
Norm: 6838.47, NNZs: 500, Bias: -1615.632231, T: 1939545, Avg. loss: 934.09
8984
Total training time: 2.36 seconds.
-- Epoch 82
Norm: 6772.85, NNZs: 500, Bias: -1386.604722, T: 1963490, Avg. loss: 917.05
1454
Total training time: 2.39 seconds.
-- Epoch 83
Norm: 6537.35, NNZs: 500, Bias: -1387.801408, T: 1987435, Avg. loss: 885.01
1082
Total training time: 2.42 seconds.
-- Epoch 84
Norm: 6439.33, NNZs: 500, Bias: -1441.080522, T: 2011380, Avg. loss: 892.36
5124
Total training time: 2.45 seconds.

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-- Epoch 85
Norm: 6502.52, NNZs: 500, Bias: -1470.154297, T: 2035325, Avg. loss: 878.89
9910
Total training time: 2.48 seconds.
-- Epoch 86
Norm: 6323.13, NNZs: 500, Bias: -1146.315976, T: 2059270, Avg. loss: 858.03
2085
Total training time: 2.51 seconds.
-- Epoch 87
Norm: 6450.14, NNZs: 500, Bias: -1294.993517, T: 2083215, Avg. loss: 867.40
8354
Total training time: 2.53 seconds.
-- Epoch 88
Norm: 6441.66, NNZs: 500, Bias: -1467.905678, T: 2107160, Avg. loss: 851.91
4108
Total training time: 2.56 seconds.
-- Epoch 89
Norm: 6249.14, NNZs: 500, Bias: -1542.615453, T: 2131105, Avg. loss: 862.39
0240
Total training time: 2.59 seconds.
-- Epoch 90
Norm: 6000.38, NNZs: 500, Bias: -1408.976758, T: 2155050, Avg. loss: 832.19
8072
Total training time: 2.62 seconds.
-- Epoch 91
Norm: 6074.33, NNZs: 500, Bias: -1441.855469, T: 2178995, Avg. loss: 835.07
3486
Total training time: 2.65 seconds.
-- Epoch 92
Norm: 6184.25, NNZs: 500, Bias: -1180.046514, T: 2202940, Avg. loss: 832.47
9562
Total training time: 2.67 seconds.
-- Epoch 93
Norm: 5824.99, NNZs: 500, Bias: -1410.848828, T: 2226885, Avg. loss: 822.96
2415
Total training time: 2.70 seconds.
-- Epoch 94
Norm: 5844.27, NNZs: 500, Bias: -1395.885113, T: 2250830, Avg. loss: 792.49
9635
Total training time: 2.73 seconds.
-- Epoch 95
Norm: 5913.64, NNZs: 500, Bias: -1290.773961, T: 2274775, Avg. loss: 802.97
9617
Total training time: 2.76 seconds.
-- Epoch 96
Norm: 5759.71, NNZs: 500, Bias: -1449.576069, T: 2298720, Avg. loss: 803.04
8163
Total training time: 2.79 seconds.
-- Epoch 97
Norm: 5750.96, NNZs: 500, Bias: -1365.996617, T: 2322665, Avg. loss: 773.06
9230
Total training time: 2.81 seconds.
-- Epoch 98
Norm: 5590.74, NNZs: 500, Bias: -1171.910040, T: 2346610, Avg. loss: 752.93
6161
Total training time: 2.84 seconds.
-- Epoch 99
```

Norm: 5781.89, NNZs: 500, Bias: -1264.618672, T: 2370555, Avg. loss: 769.03
8594
Total training time: 2.87 seconds.
-- Epoch 100
Norm: 5677.43, NNZs: 500, Bias: -1275.121009, T: 2394500, Avg. loss: 755.77
7298
Total training time: 2.90 seconds.
-- Epoch 101
Norm: 5233.97, NNZs: 500, Bias: -1309.489540, T: 2418445, Avg. loss: 745.80
5485
Total training time: 2.92 seconds.
-- Epoch 102
Norm: 5294.84, NNZs: 500, Bias: -1225.646246, T: 2442390, Avg. loss: 746.65
3933
Total training time: 2.95 seconds.
-- Epoch 103
Norm: 5561.32, NNZs: 500, Bias: -1302.466599, T: 2466335, Avg. loss: 729.75
6722
Total training time: 2.98 seconds.
-- Epoch 104
Norm: 5336.81, NNZs: 500, Bias: -1441.616701, T: 2490280, Avg. loss: 741.55
3575
Total training time: 3.01 seconds.
-- Epoch 105
Norm: 5407.03, NNZs: 500, Bias: -1248.967984, T: 2514225, Avg. loss: 735.71
5017
Total training time: 3.04 seconds.
-- Epoch 106
Norm: 5283.28, NNZs: 500, Bias: -1241.944393, T: 2538170, Avg. loss: 742.38
3105
Total training time: 3.06 seconds.
-- Epoch 107
Norm: 5191.31, NNZs: 500, Bias: -1136.145644, T: 2562115, Avg. loss: 718.57
9715
Total training time: 3.09 seconds.
-- Epoch 108
Norm: 5314.50, NNZs: 500, Bias: -1123.892348, T: 2586060, Avg. loss: 695.78
5879
Total training time: 3.12 seconds.
-- Epoch 109
Norm: 5090.68, NNZs: 500, Bias: -1063.982789, T: 2610005, Avg. loss: 717.41
2079
Total training time: 3.15 seconds.
-- Epoch 110
Norm: 5017.16, NNZs: 500, Bias: -988.155204, T: 2633950, Avg. loss: 712.978
315
Total training time: 3.18 seconds.
-- Epoch 111
Norm: 5056.11, NNZs: 500, Bias: -1175.289377, T: 2657895, Avg. loss: 691.82
7304
Total training time: 3.20 seconds.
-- Epoch 112
Norm: 5037.32, NNZs: 500, Bias: -1184.038211, T: 2681840, Avg. loss: 681.36
8917
Total training time: 3.23 seconds.
-- Epoch 113
Norm: 5046.93, NNZs: 500, Bias: -1106.614184, T: 2705785, Avg. loss: 674.27

7051
Total training time: 3.26 seconds.
-- Epoch 114
Norm: 4839.86, NNZs: 500, Bias: -1117.013609, T: 2729730, Avg. loss: 678.99
4729
Total training time: 3.29 seconds.
-- Epoch 115
Norm: 4861.45, NNZs: 500, Bias: -1159.952066, T: 2753675, Avg. loss: 660.96
2883
Total training time: 3.31 seconds.
-- Epoch 116
Norm: 4969.10, NNZs: 500, Bias: -989.721102, T: 2777620, Avg. loss: 659.940
397
Total training time: 3.34 seconds.
-- Epoch 117
Norm: 4589.36, NNZs: 500, Bias: -1097.323365, T: 2801565, Avg. loss: 636.42
4709
Total training time: 3.37 seconds.
-- Epoch 118
Norm: 4882.67, NNZs: 500, Bias: -1077.296265, T: 2825510, Avg. loss: 651.47
2076
Total training time: 3.40 seconds.
-- Epoch 119
Norm: 4823.46, NNZs: 500, Bias: -983.650064, T: 2849455, Avg. loss: 638.998
130
Total training time: 3.43 seconds.
-- Epoch 120
Norm: 4838.35, NNZs: 500, Bias: -1026.059732, T: 2873400, Avg. loss: 639.04
2445
Total training time: 3.45 seconds.
-- Epoch 121
Norm: 4727.43, NNZs: 500, Bias: -947.538364, T: 2897345, Avg. loss: 635.587
752
Total training time: 3.48 seconds.
-- Epoch 122
Norm: 4666.46, NNZs: 500, Bias: -937.057568, T: 2921290, Avg. loss: 637.207
271
Total training time: 3.51 seconds.
-- Epoch 123
Norm: 4699.36, NNZs: 500, Bias: -964.725700, T: 2945235, Avg. loss: 608.608
997
Total training time: 3.54 seconds.
-- Epoch 124
Norm: 4754.17, NNZs: 500, Bias: -1060.577473, T: 2969180, Avg. loss: 613.43
3692
Total training time: 3.56 seconds.
-- Epoch 125
Norm: 4581.80, NNZs: 500, Bias: -1089.329781, T: 2993125, Avg. loss: 632.06
0416
Total training time: 3.59 seconds.
-- Epoch 126
Norm: 4470.01, NNZs: 500, Bias: -1120.452701, T: 3017070, Avg. loss: 608.71
8993
Total training time: 3.62 seconds.
-- Epoch 127
Norm: 4216.47, NNZs: 500, Bias: -1127.686091, T: 3041015, Avg. loss: 604.10
1512

Total training time: 3.65 seconds.
-- Epoch 128
Norm: 4352.87, NNZs: 500, Bias: -1192.888537, T: 3064960, Avg. loss: 592.566910
Total training time: 3.68 seconds.
-- Epoch 129
Norm: 4356.52, NNZs: 500, Bias: -1043.192395, T: 3088905, Avg. loss: 599.973673
Total training time: 3.70 seconds.
-- Epoch 130
Norm: 4362.70, NNZs: 500, Bias: -934.739447, T: 3112850, Avg. loss: 586.733030
Total training time: 3.73 seconds.
-- Epoch 131
Norm: 4263.29, NNZs: 500, Bias: -882.344273, T: 3136795, Avg. loss: 587.608082
Total training time: 3.76 seconds.
-- Epoch 132
Norm: 4441.70, NNZs: 500, Bias: -863.090563, T: 3160740, Avg. loss: 576.647973
Total training time: 3.79 seconds.
-- Epoch 133
Norm: 4360.72, NNZs: 500, Bias: -826.440931, T: 3184685, Avg. loss: 576.691761
Total training time: 3.82 seconds.
-- Epoch 134
Norm: 4319.94, NNZs: 500, Bias: -918.457149, T: 3208630, Avg. loss: 576.710319
Total training time: 3.84 seconds.
-- Epoch 135
Norm: 4107.63, NNZs: 500, Bias: -1025.794166, T: 3232575, Avg. loss: 580.080387
Total training time: 3.87 seconds.
-- Epoch 136
Norm: 4182.93, NNZs: 500, Bias: -1069.764122, T: 3256520, Avg. loss: 564.527671
Total training time: 3.90 seconds.
-- Epoch 137
Norm: 4156.53, NNZs: 500, Bias: -1042.762719, T: 3280465, Avg. loss: 571.720996
Total training time: 3.93 seconds.
-- Epoch 138
Norm: 4117.05, NNZs: 500, Bias: -995.612378, T: 3304410, Avg. loss: 559.637946
Total training time: 3.95 seconds.
-- Epoch 139
Norm: 4216.20, NNZs: 500, Bias: -874.880567, T: 3328355, Avg. loss: 551.306497
Total training time: 3.98 seconds.
-- Epoch 140
Norm: 4019.33, NNZs: 500, Bias: -837.113892, T: 3352300, Avg. loss: 558.762391
Total training time: 4.01 seconds.
-- Epoch 141
Norm: 4216.42, NNZs: 500, Bias: -789.289819, T: 3376245, Avg. loss: 542.770784
Total training time: 4.04 seconds.

```
-- Epoch 142
Norm: 4032.30, NNZs: 500, Bias: -825.543651, T: 3400190, Avg. loss: 550.150
872
Total training time: 4.06 seconds.
-- Epoch 143
Norm: 3981.95, NNZs: 500, Bias: -792.082949, T: 3424135, Avg. loss: 546.564
208
Total training time: 4.09 seconds.
-- Epoch 144
Norm: 3986.26, NNZs: 500, Bias: -855.672879, T: 3448080, Avg. loss: 547.482
375
Total training time: 4.12 seconds.
-- Epoch 145
Norm: 4094.74, NNZs: 500, Bias: -871.425139, T: 3472025, Avg. loss: 545.918
698
Total training time: 4.15 seconds.
-- Epoch 146
Norm: 4031.33, NNZs: 500, Bias: -787.688330, T: 3495970, Avg. loss: 527.385
875
Total training time: 4.18 seconds.
-- Epoch 147
Norm: 3857.42, NNZs: 500, Bias: -780.049776, T: 3519915, Avg. loss: 528.448
703
Total training time: 4.20 seconds.
-- Epoch 148
Norm: 4057.35, NNZs: 500, Bias: -840.997088, T: 3543860, Avg. loss: 531.360
039
Total training time: 4.23 seconds.
-- Epoch 149
Norm: 3768.14, NNZs: 500, Bias: -886.315805, T: 3567805, Avg. loss: 528.427
361
Total training time: 4.26 seconds.
-- Epoch 150
Norm: 3798.88, NNZs: 500, Bias: -824.117259, T: 3591750, Avg. loss: 523.327
185
Total training time: 4.29 seconds.
-- Epoch 151
Norm: 3754.44, NNZs: 500, Bias: -876.884502, T: 3615695, Avg. loss: 516.573
840
Total training time: 4.31 seconds.
-- Epoch 152
Norm: 3710.93, NNZs: 500, Bias: -868.078155, T: 3639640, Avg. loss: 514.130
407
Total training time: 4.34 seconds.
-- Epoch 153
Norm: 3598.71, NNZs: 500, Bias: -954.754742, T: 3663585, Avg. loss: 514.461
559
Total training time: 4.37 seconds.
-- Epoch 154
Norm: 3596.92, NNZs: 500, Bias: -859.111446, T: 3687530, Avg. loss: 503.294
085
Total training time: 4.40 seconds.
-- Epoch 155
Norm: 3636.46, NNZs: 500, Bias: -821.625741, T: 3711475, Avg. loss: 510.256
148
Total training time: 4.43 seconds.
-- Epoch 156
```


Norm: 3614.82, NNZs: 500, Bias: -806.267506, T: 3735420, Avg. loss: 476.588
331
Total training time: 4.45 seconds.
-- Epoch 157
Norm: 3548.72, NNZs: 500, Bias: -884.669729, T: 3759365, Avg. loss: 488.439
718
Total training time: 4.48 seconds.
-- Epoch 158
Norm: 3631.68, NNZs: 500, Bias: -847.003032, T: 3783310, Avg. loss: 484.882
300
Total training time: 4.51 seconds.
-- Epoch 159
Norm: 3648.85, NNZs: 500, Bias: -783.438726, T: 3807255, Avg. loss: 490.545
327
Total training time: 4.54 seconds.
-- Epoch 160
Norm: 3501.21, NNZs: 500, Bias: -848.262175, T: 3831200, Avg. loss: 486.073
795
Total training time: 4.56 seconds.
-- Epoch 161
Norm: 3540.29, NNZs: 500, Bias: -848.185242, T: 3855145, Avg. loss: 474.256
465
Total training time: 4.59 seconds.
-- Epoch 162
Norm: 3536.13, NNZs: 500, Bias: -850.324849, T: 3879090, Avg. loss: 480.945
990
Total training time: 4.62 seconds.
-- Epoch 163
Norm: 3466.15, NNZs: 500, Bias: -703.207991, T: 3903035, Avg. loss: 477.636
883
Total training time: 4.65 seconds.
-- Epoch 164
Norm: 3628.15, NNZs: 500, Bias: -742.872223, T: 3926980, Avg. loss: 478.822
596
Total training time: 4.68 seconds.
-- Epoch 165
Norm: 3407.99, NNZs: 500, Bias: -720.777949, T: 3950925, Avg. loss: 476.124
955
Total training time: 4.70 seconds.
-- Epoch 166
Norm: 3488.12, NNZs: 500, Bias: -657.982518, T: 3974870, Avg. loss: 468.592
910
Total training time: 4.73 seconds.
-- Epoch 167
Norm: 3464.70, NNZs: 500, Bias: -803.515377, T: 3998815, Avg. loss: 463.534
612
Total training time: 4.76 seconds.
-- Epoch 168
Norm: 3407.14, NNZs: 500, Bias: -730.469370, T: 4022760, Avg. loss: 466.495
081
Total training time: 4.79 seconds.
-- Epoch 169
Norm: 3430.60, NNZs: 500, Bias: -754.921989, T: 4046705, Avg. loss: 468.363
135
Total training time: 4.82 seconds.
-- Epoch 170
Norm: 3487.23, NNZs: 500, Bias: -607.106720, T: 4070650, Avg. loss: 460.658

737

Total training time: 4.85 seconds.

-- Epoch 171

Norm: 3264.94, NNZs: 500, Bias: -717.331989, T: 4094595, Avg. loss: 461.493
398

Total training time: 4.88 seconds.

-- Epoch 172

Norm: 3189.15, NNZs: 500, Bias: -694.541176, T: 4118540, Avg. loss: 453.663
338

Total training time: 4.91 seconds.

-- Epoch 173

Norm: 3312.65, NNZs: 500, Bias: -719.604560, T: 4142485, Avg. loss: 456.813
309

Total training time: 4.93 seconds.

-- Epoch 174

Norm: 3376.10, NNZs: 500, Bias: -738.526454, T: 4166430, Avg. loss: 442.624
100

Total training time: 4.96 seconds.

-- Epoch 175

Norm: 3201.86, NNZs: 500, Bias: -746.994037, T: 4190375, Avg. loss: 453.828
489

Total training time: 4.99 seconds.

-- Epoch 176

Norm: 3202.68, NNZs: 500, Bias: -777.552726, T: 4214320, Avg. loss: 435.433
560

Total training time: 5.02 seconds.

-- Epoch 177

Norm: 3317.56, NNZs: 500, Bias: -728.510284, T: 4238265, Avg. loss: 435.590
627

Total training time: 5.04 seconds.

-- Epoch 178

Norm: 3176.57, NNZs: 500, Bias: -795.141498, T: 4262210, Avg. loss: 438.401
570

Total training time: 5.07 seconds.

-- Epoch 179

Norm: 3164.28, NNZs: 500, Bias: -766.661109, T: 4286155, Avg. loss: 420.099
918

Total training time: 5.10 seconds.

-- Epoch 180

Norm: 3218.08, NNZs: 500, Bias: -750.942662, T: 4310100, Avg. loss: 435.103
513

Total training time: 5.13 seconds.

-- Epoch 181

Norm: 3202.89, NNZs: 500, Bias: -679.140991, T: 4334045, Avg. loss: 422.132
360

Total training time: 5.16 seconds.

-- Epoch 182

Norm: 3213.94, NNZs: 500, Bias: -601.979537, T: 4357990, Avg. loss: 436.383
704

Total training time: 5.18 seconds.

-- Epoch 183

Norm: 3139.03, NNZs: 500, Bias: -655.097478, T: 4381935, Avg. loss: 426.633
522

Total training time: 5.21 seconds.

-- Epoch 184

Norm: 3030.10, NNZs: 500, Bias: -706.556004, T: 4405880, Avg. loss: 417.109
476

Total training time: 5.24 seconds.
-- Epoch 185
Norm: 3190.51, NNZs: 500, Bias: -690.694852, T: 4429825, Avg. loss: 420.384
618
Total training time: 5.27 seconds.
-- Epoch 186
Norm: 3223.40, NNZs: 500, Bias: -713.870742, T: 4453770, Avg. loss: 420.060
384
Total training time: 5.30 seconds.
-- Epoch 187
Norm: 3086.63, NNZs: 500, Bias: -755.872104, T: 4477715, Avg. loss: 427.419
069
Total training time: 5.32 seconds.
-- Epoch 188
Norm: 3048.76, NNZs: 500, Bias: -795.551228, T: 4501660, Avg. loss: 419.673
442
Total training time: 5.35 seconds.
-- Epoch 189
Norm: 3198.64, NNZs: 500, Bias: -709.962502, T: 4525605, Avg. loss: 413.123
117
Total training time: 5.38 seconds.
-- Epoch 190
Norm: 3049.93, NNZs: 500, Bias: -722.029408, T: 4549550, Avg. loss: 429.756
837
Total training time: 5.41 seconds.
-- Epoch 191
Norm: 3036.24, NNZs: 500, Bias: -709.101805, T: 4573495, Avg. loss: 410.082
467
Total training time: 5.44 seconds.
-- Epoch 192
Norm: 3014.19, NNZs: 500, Bias: -700.503806, T: 4597440, Avg. loss: 406.904
526
Total training time: 5.46 seconds.
-- Epoch 193
Norm: 3007.03, NNZs: 500, Bias: -687.858663, T: 4621385, Avg. loss: 402.083
944
Total training time: 5.49 seconds.
-- Epoch 194
Norm: 2919.61, NNZs: 500, Bias: -613.685532, T: 4645330, Avg. loss: 397.873
526
Total training time: 5.52 seconds.
-- Epoch 195
Norm: 2834.61, NNZs: 500, Bias: -638.508933, T: 4669275, Avg. loss: 401.765
010
Total training time: 5.55 seconds.
-- Epoch 196
Norm: 2959.83, NNZs: 500, Bias: -702.816284, T: 4693220, Avg. loss: 392.323
730
Total training time: 5.57 seconds.
-- Epoch 197
Norm: 2983.60, NNZs: 500, Bias: -649.206590, T: 4717165, Avg. loss: 401.249
569
Total training time: 5.60 seconds.
-- Epoch 198
Norm: 2997.17, NNZs: 500, Bias: -719.442155, T: 4741110, Avg. loss: 410.317
007
Total training time: 5.63 seconds.

```
-- Epoch 199
Norm: 2910.29, NNZs: 500, Bias: -743.496795, T: 4765055, Avg. loss: 395.576
196
Total training time: 5.66 seconds.
-- Epoch 200
Norm: 2925.86, NNZs: 500, Bias: -645.908880, T: 4789000, Avg. loss: 392.973
655
Total training time: 5.69 seconds.
-- Epoch 201
Norm: 2900.62, NNZs: 500, Bias: -634.053605, T: 4812945, Avg. loss: 407.333
921
Total training time: 5.71 seconds.
Convergence after 201 epochs took 5.71 seconds
Fitting probability generation and roc auc score generation for training da
ta complete...
Fitting probability generation and roc auc score generation for validation
data complete...
SGDClassifier(alpha=1e-06, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 24865.47, NNZs: 500, Bias: -2496.487922, T: 23945, Avg. loss: 4337.95
4431
Total training time: 0.03 seconds.
-- Epoch 2
Norm: 17606.34, NNZs: 500, Bias: -2758.732625, T: 47890, Avg. loss: 2959.84
8169
Total training time: 0.06 seconds.
-- Epoch 3
Norm: 13720.44, NNZs: 500, Bias: -3221.337927, T: 71835, Avg. loss: 2030.46
1158
Total training time: 0.09 seconds.
-- Epoch 4
Norm: 11079.38, NNZs: 500, Bias: -2772.124144, T: 95780, Avg. loss: 1708.44
2026
Total training time: 0.12 seconds.
-- Epoch 5
Norm: 9488.85, NNZs: 500, Bias: -2622.939932, T: 119725, Avg. loss: 1373.70
7507
Total training time: 0.15 seconds.
-- Epoch 6
Norm: 8314.59, NNZs: 500, Bias: -2300.911809, T: 143670, Avg. loss: 1187.08
0704
Total training time: 0.18 seconds.
-- Epoch 7
Norm: 7320.83, NNZs: 500, Bias: -2174.740979, T: 167615, Avg. loss: 1048.87
4379
Total training time: 0.21 seconds.
-- Epoch 8
Norm: 6492.37, NNZs: 500, Bias: -2019.117404, T: 191560, Avg. loss: 923.491
334
Total training time: 0.24 seconds.
-- Epoch 9
Norm: 5820.42, NNZs: 500, Bias: -1798.571302, T: 215505, Avg. loss: 831.143
```

854

Total training time: 0.26 seconds.

-- Epoch 10

Norm: 5218.23, NNZs: 500, Bias: -1520.640390, T: 239450, Avg. loss: 758.925
115

Total training time: 0.29 seconds.

-- Epoch 11

Norm: 4987.04, NNZs: 500, Bias: -1456.858903, T: 263395, Avg. loss: 704.624
154

Total training time: 0.32 seconds.

-- Epoch 12

Norm: 4564.57, NNZs: 500, Bias: -1228.245592, T: 287340, Avg. loss: 636.715
211

Total training time: 0.35 seconds.

-- Epoch 13

Norm: 4109.19, NNZs: 500, Bias: -1150.477373, T: 311285, Avg. loss: 607.240
596

Total training time: 0.37 seconds.

-- Epoch 14

Norm: 3874.33, NNZs: 500, Bias: -1050.545719, T: 335230, Avg. loss: 549.694
029

Total training time: 0.40 seconds.

-- Epoch 15

Norm: 3810.12, NNZs: 500, Bias: -919.921524, T: 359175, Avg. loss: 506.0020
62

Total training time: 0.43 seconds.

-- Epoch 16

Norm: 3487.26, NNZs: 500, Bias: -890.997474, T: 383120, Avg. loss: 480.2244
00

Total training time: 0.46 seconds.

-- Epoch 17

Norm: 3273.64, NNZs: 500, Bias: -840.761397, T: 407065, Avg. loss: 471.5946
50

Total training time: 0.48 seconds.

-- Epoch 18

Norm: 3053.01, NNZs: 500, Bias: -825.411843, T: 431010, Avg. loss: 429.0430
87

Total training time: 0.51 seconds.

-- Epoch 19

Norm: 2943.63, NNZs: 500, Bias: -758.060207, T: 454955, Avg. loss: 409.3882
04

Total training time: 0.54 seconds.

-- Epoch 20

Norm: 2728.42, NNZs: 500, Bias: -704.165328, T: 478900, Avg. loss: 386.8932
59

Total training time: 0.57 seconds.

-- Epoch 21

Norm: 2582.61, NNZs: 500, Bias: -653.601370, T: 502845, Avg. loss: 367.6160
84

Total training time: 0.60 seconds.

-- Epoch 22

Norm: 2637.10, NNZs: 500, Bias: -634.367700, T: 526790, Avg. loss: 345.5246
89

Total training time: 0.62 seconds.

-- Epoch 23

Norm: 2519.19, NNZs: 500, Bias: -590.589323, T: 550735, Avg. loss: 348.9012
10

Total training time: 0.65 seconds.
-- Epoch 24
Norm: 2336.70, NNZs: 500, Bias: -512.129264, T: 574680, Avg. loss: 322.8814
55
Total training time: 0.68 seconds.
-- Epoch 25
Norm: 2261.98, NNZs: 500, Bias: -494.991017, T: 598625, Avg. loss: 316.5062
28
Total training time: 0.71 seconds.
-- Epoch 26
Norm: 2195.30, NNZs: 500, Bias: -479.797912, T: 622570, Avg. loss: 303.1824
42
Total training time: 0.74 seconds.
-- Epoch 27
Norm: 2151.67, NNZs: 500, Bias: -531.572736, T: 646515, Avg. loss: 300.7437
43
Total training time: 0.76 seconds.
-- Epoch 28
Norm: 2004.12, NNZs: 500, Bias: -502.904732, T: 670460, Avg. loss: 282.5647
38
Total training time: 0.79 seconds.
-- Epoch 29
Norm: 1935.10, NNZs: 500, Bias: -444.232577, T: 694405, Avg. loss: 270.3845
36
Total training time: 0.82 seconds.
-- Epoch 30
Norm: 1963.71, NNZs: 500, Bias: -454.758556, T: 718350, Avg. loss: 263.2985
91
Total training time: 0.85 seconds.
-- Epoch 31
Norm: 1808.55, NNZs: 500, Bias: -413.917526, T: 742295, Avg. loss: 249.8546
93
Total training time: 0.87 seconds.
-- Epoch 32
Norm: 1803.70, NNZs: 500, Bias: -398.876344, T: 766240, Avg. loss: 244.5151
80
Total training time: 0.90 seconds.
-- Epoch 33
Norm: 1732.51, NNZs: 500, Bias: -405.151462, T: 790185, Avg. loss: 244.3140
92
Total training time: 0.93 seconds.
-- Epoch 34
Norm: 1680.83, NNZs: 500, Bias: -443.718583, T: 814130, Avg. loss: 236.1071
56
Total training time: 0.96 seconds.
-- Epoch 35
Norm: 1667.66, NNZs: 500, Bias: -434.534603, T: 838075, Avg. loss: 227.7682
56
Total training time: 0.99 seconds.
-- Epoch 36
Norm: 1626.89, NNZs: 500, Bias: -393.006210, T: 862020, Avg. loss: 220.8082
91
Total training time: 1.01 seconds.
-- Epoch 37
Norm: 1575.61, NNZs: 500, Bias: -351.197128, T: 885965, Avg. loss: 217.8653
44
Total training time: 1.04 seconds.

```
-- Epoch 38
Norm: 1473.41, NNZs: 500, Bias: -363.303876, T: 909910, Avg. loss: 210.7888
12
Total training time: 1.07 seconds.
-- Epoch 39
Norm: 1478.19, NNZs: 500, Bias: -369.328797, T: 933855, Avg. loss: 203.0995
95
Total training time: 1.10 seconds.
-- Epoch 40
Norm: 1459.51, NNZs: 500, Bias: -350.120038, T: 957800, Avg. loss: 203.0031
91
Total training time: 1.12 seconds.
-- Epoch 41
Norm: 1404.79, NNZs: 500, Bias: -349.812000, T: 981745, Avg. loss: 197.2943
33
Total training time: 1.15 seconds.
-- Epoch 42
Norm: 1368.91, NNZs: 500, Bias: -278.454489, T: 1005690, Avg. loss: 187.266
655
Total training time: 1.18 seconds.
-- Epoch 43
Norm: 1351.00, NNZs: 500, Bias: -293.662907, T: 1029635, Avg. loss: 184.157
171
Total training time: 1.21 seconds.
-- Epoch 44
Norm: 1299.29, NNZs: 500, Bias: -281.506783, T: 1053580, Avg. loss: 180.904
861
Total training time: 1.24 seconds.
-- Epoch 45
Norm: 1293.85, NNZs: 500, Bias: -273.287148, T: 1077525, Avg. loss: 178.868
161
Total training time: 1.27 seconds.
-- Epoch 46
Norm: 1279.02, NNZs: 500, Bias: -275.937708, T: 1101470, Avg. loss: 172.296
065
Total training time: 1.30 seconds.
-- Epoch 47
Norm: 1234.65, NNZs: 500, Bias: -277.910792, T: 1125415, Avg. loss: 168.823
253
Total training time: 1.32 seconds.
-- Epoch 48
Norm: 1223.20, NNZs: 500, Bias: -267.418312, T: 1149360, Avg. loss: 163.600
585
Total training time: 1.35 seconds.
-- Epoch 49
Norm: 1180.17, NNZs: 500, Bias: -265.392527, T: 1173305, Avg. loss: 164.332
508
Total training time: 1.38 seconds.
-- Epoch 50
Norm: 1144.12, NNZs: 500, Bias: -282.459372, T: 1197250, Avg. loss: 162.104
042
Total training time: 1.41 seconds.
-- Epoch 51
Norm: 1176.63, NNZs: 500, Bias: -279.166026, T: 1221195, Avg. loss: 157.376
641
Total training time: 1.44 seconds.
-- Epoch 52
```

Norm: 1120.62, NNZs: 500, Bias: -251.387824, T: 1245140, Avg. loss: 153.454
661
Total training time: 1.46 seconds.
-- Epoch 53
Norm: 1094.30, NNZs: 500, Bias: -265.447950, T: 1269085, Avg. loss: 150.584
798
Total training time: 1.49 seconds.
-- Epoch 54
Norm: 1088.18, NNZs: 500, Bias: -267.013608, T: 1293030, Avg. loss: 148.067
487
Total training time: 1.52 seconds.
-- Epoch 55
Norm: 1038.19, NNZs: 500, Bias: -255.909314, T: 1316975, Avg. loss: 147.626
532
Total training time: 1.55 seconds.
-- Epoch 56
Norm: 1067.27, NNZs: 500, Bias: -234.008365, T: 1340920, Avg. loss: 142.432
589
Total training time: 1.58 seconds.
-- Epoch 57
Norm: 1027.32, NNZs: 500, Bias: -229.758863, T: 1364865, Avg. loss: 140.515
547
Total training time: 1.60 seconds.
-- Epoch 58
Norm: 972.10, NNZs: 500, Bias: -231.789921, T: 1388810, Avg. loss: 140.6616
39
Total training time: 1.63 seconds.
-- Epoch 59
Norm: 1011.90, NNZs: 500, Bias: -215.991870, T: 1412755, Avg. loss: 136.016
511
Total training time: 1.66 seconds.
-- Epoch 60
Norm: 984.44, NNZs: 500, Bias: -214.738044, T: 1436700, Avg. loss: 134.0289
02
Total training time: 1.69 seconds.
-- Epoch 61
Norm: 992.46, NNZs: 500, Bias: -234.718849, T: 1460645, Avg. loss: 130.6955
20
Total training time: 1.71 seconds.
-- Epoch 62
Norm: 945.30, NNZs: 500, Bias: -233.365643, T: 1484590, Avg. loss: 129.3396
46
Total training time: 1.74 seconds.
-- Epoch 63
Norm: 942.86, NNZs: 500, Bias: -205.208911, T: 1508535, Avg. loss: 127.9202
59
Total training time: 1.77 seconds.
-- Epoch 64
Norm: 942.18, NNZs: 500, Bias: -209.376363, T: 1532480, Avg. loss: 127.0990
18
Total training time: 1.80 seconds.
-- Epoch 65
Norm: 907.44, NNZs: 500, Bias: -165.183088, T: 1556425, Avg. loss: 122.5537
82
Total training time: 1.83 seconds.
-- Epoch 66
Norm: 894.71, NNZs: 500, Bias: -200.135071, T: 1580370, Avg. loss: 120.0680

65
Total training time: 1.85 seconds.
-- Epoch 67
Norm: 883.87, NNZs: 500, Bias: -185.477985, T: 1604315, Avg. loss: 120.0460
53
Total training time: 1.88 seconds.
-- Epoch 68
Norm: 855.47, NNZs: 500, Bias: -213.734563, T: 1628260, Avg. loss: 122.4476
07
Total training time: 1.91 seconds.
-- Epoch 69
Norm: 832.51, NNZs: 500, Bias: -184.147602, T: 1652205, Avg. loss: 113.5334
10
Total training time: 1.94 seconds.
-- Epoch 70
Norm: 848.06, NNZs: 500, Bias: -186.939625, T: 1676150, Avg. loss: 115.7243
26
Total training time: 1.96 seconds.
-- Epoch 71
Norm: 825.08, NNZs: 500, Bias: -196.305013, T: 1700095, Avg. loss: 115.5014
44
Total training time: 1.99 seconds.
-- Epoch 72
Norm: 813.60, NNZs: 500, Bias: -181.360063, T: 1724040, Avg. loss: 112.0075
01
Total training time: 2.02 seconds.
-- Epoch 73
Norm: 818.59, NNZs: 500, Bias: -178.810585, T: 1747985, Avg. loss: 109.6049
98
Total training time: 2.05 seconds.
-- Epoch 74
Norm: 802.94, NNZs: 500, Bias: -162.668821, T: 1771930, Avg. loss: 111.5092
67
Total training time: 2.08 seconds.
-- Epoch 75
Norm: 787.86, NNZs: 500, Bias: -179.034823, T: 1795875, Avg. loss: 105.7835
03
Total training time: 2.10 seconds.
-- Epoch 76
Norm: 768.38, NNZs: 500, Bias: -179.618496, T: 1819820, Avg. loss: 106.1723
30
Total training time: 2.13 seconds.
-- Epoch 77
Norm: 751.34, NNZs: 500, Bias: -174.395696, T: 1843765, Avg. loss: 105.2528
24
Total training time: 2.16 seconds.
-- Epoch 78
Norm: 735.99, NNZs: 500, Bias: -177.323846, T: 1867710, Avg. loss: 103.5541
26
Total training time: 2.19 seconds.
-- Epoch 79
Norm: 732.56, NNZs: 500, Bias: -182.447426, T: 1891655, Avg. loss: 101.2544
39
Total training time: 2.21 seconds.
-- Epoch 80
Norm: 788.08, NNZs: 500, Bias: -170.690406, T: 1915600, Avg. loss: 102.4778
52

Total training time: 2.24 seconds.
-- Epoch 81
Norm: 733.28, NNZs: 500, Bias: -155.424793, T: 1939545, Avg. loss: 99.373784
Total training time: 2.27 seconds.
-- Epoch 82
Norm: 721.07, NNZs: 500, Bias: -133.529671, T: 1963490, Avg. loss: 98.821561
Total training time: 2.30 seconds.
-- Epoch 83
Norm: 714.93, NNZs: 500, Bias: -140.445001, T: 1987435, Avg. loss: 97.726169
Total training time: 2.32 seconds.
-- Epoch 84
Norm: 677.38, NNZs: 500, Bias: -148.888998, T: 2011380, Avg. loss: 95.416812
Total training time: 2.35 seconds.
-- Epoch 85
Norm: 693.45, NNZs: 500, Bias: -139.535411, T: 2035325, Avg. loss: 93.294690
Total training time: 2.38 seconds.
-- Epoch 86
Norm: 690.04, NNZs: 500, Bias: -110.820471, T: 2059270, Avg. loss: 90.619786
Total training time: 2.41 seconds.
-- Epoch 87
Norm: 686.99, NNZs: 500, Bias: -130.442951, T: 2083215, Avg. loss: 93.554267
Total training time: 2.43 seconds.
-- Epoch 88
Norm: 686.23, NNZs: 500, Bias: -152.401483, T: 2107160, Avg. loss: 91.168873
Total training time: 2.46 seconds.
-- Epoch 89
Norm: 662.81, NNZs: 500, Bias: -161.227552, T: 2131105, Avg. loss: 92.570658
Total training time: 2.49 seconds.
-- Epoch 90
Norm: 660.18, NNZs: 500, Bias: -163.356576, T: 2155050, Avg. loss: 89.544531
Total training time: 2.52 seconds.
-- Epoch 91
Norm: 620.81, NNZs: 500, Bias: -152.527526, T: 2178995, Avg. loss: 90.634781
Total training time: 2.54 seconds.
-- Epoch 92
Norm: 639.33, NNZs: 500, Bias: -149.464329, T: 2202940, Avg. loss: 90.790792
Total training time: 2.57 seconds.
-- Epoch 93
Norm: 633.55, NNZs: 500, Bias: -161.929116, T: 2226885, Avg. loss: 84.090518
Total training time: 2.60 seconds.
-- Epoch 94
Norm: 645.49, NNZs: 500, Bias: -167.683408, T: 2250830, Avg. loss: 86.993795
Total training time: 2.63 seconds.

```
-- Epoch 95
Norm: 641.19, NNZs: 500, Bias: -153.956462, T: 2274775, Avg. loss: 86.14268
5
Total training time: 2.65 seconds.
-- Epoch 96
Norm: 601.86, NNZs: 500, Bias: -171.166247, T: 2298720, Avg. loss: 84.39673
5
Total training time: 2.68 seconds.
-- Epoch 97
Norm: 604.51, NNZs: 500, Bias: -157.813963, T: 2322665, Avg. loss: 82.61326
0
Total training time: 2.71 seconds.
-- Epoch 98
Norm: 620.31, NNZs: 500, Bias: -124.185300, T: 2346610, Avg. loss: 81.30282
2
Total training time: 2.74 seconds.
-- Epoch 99
Norm: 623.28, NNZs: 500, Bias: -142.746677, T: 2370555, Avg. loss: 83.01417
2
Total training time: 2.77 seconds.
-- Epoch 100
Norm: 589.04, NNZs: 500, Bias: -153.753743, T: 2394500, Avg. loss: 79.61605
3
Total training time: 2.80 seconds.
-- Epoch 101
Norm: 580.06, NNZs: 500, Bias: -154.275615, T: 2418445, Avg. loss: 79.05305
3
Total training time: 2.82 seconds.
-- Epoch 102
Norm: 557.14, NNZs: 500, Bias: -145.161471, T: 2442390, Avg. loss: 80.38749
5
Total training time: 2.85 seconds.
-- Epoch 103
Norm: 576.78, NNZs: 500, Bias: -122.630482, T: 2466335, Avg. loss: 76.08172
9
Total training time: 2.88 seconds.
-- Epoch 104
Norm: 562.82, NNZs: 500, Bias: -155.107442, T: 2490280, Avg. loss: 79.36514
0
Total training time: 2.91 seconds.
-- Epoch 105
Norm: 565.23, NNZs: 500, Bias: -134.050083, T: 2514225, Avg. loss: 78.23840
7
Total training time: 2.93 seconds.
-- Epoch 106
Norm: 551.35, NNZs: 500, Bias: -150.227198, T: 2538170, Avg. loss: 77.38961
7
Total training time: 2.96 seconds.
-- Epoch 107
Norm: 549.83, NNZs: 500, Bias: -120.391880, T: 2562115, Avg. loss: 77.64439
8
Total training time: 2.99 seconds.
-- Epoch 108
Norm: 541.97, NNZs: 500, Bias: -117.024484, T: 2586060, Avg. loss: 73.97404
0
Total training time: 3.02 seconds.
-- Epoch 109
```

Norm: 539.27, NNZs: 500, Bias: -121.151972, T: 2610005, Avg. loss: 75.94576
3
Total training time: 3.05 seconds.
-- Epoch 110
Norm: 525.78, NNZs: 500, Bias: -109.224502, T: 2633950, Avg. loss: 73.11850
5
Total training time: 3.07 seconds.
-- Epoch 111
Norm: 533.30, NNZs: 500, Bias: -124.251761, T: 2657895, Avg. loss: 73.53241
1
Total training time: 3.10 seconds.
-- Epoch 112
Norm: 524.42, NNZs: 500, Bias: -110.949629, T: 2681840, Avg. loss: 71.85340
2
Total training time: 3.13 seconds.
-- Epoch 113
Norm: 528.48, NNZs: 500, Bias: -118.502231, T: 2705785, Avg. loss: 72.08103
8
Total training time: 3.16 seconds.
-- Epoch 114
Norm: 513.05, NNZs: 500, Bias: -115.360689, T: 2729730, Avg. loss: 71.45118
8
Total training time: 3.19 seconds.
-- Epoch 115
Norm: 516.01, NNZs: 500, Bias: -112.949281, T: 2753675, Avg. loss: 68.36781
4
Total training time: 3.21 seconds.
-- Epoch 116
Norm: 532.22, NNZs: 500, Bias: -106.775327, T: 2777620, Avg. loss: 70.22762
6
Total training time: 3.24 seconds.
-- Epoch 117
Norm: 495.53, NNZs: 500, Bias: -113.598908, T: 2801565, Avg. loss: 70.25934
6
Total training time: 3.27 seconds.
-- Epoch 118
Norm: 509.29, NNZs: 500, Bias: -123.207196, T: 2825510, Avg. loss: 69.69899
3
Total training time: 3.30 seconds.
-- Epoch 119
Norm: 519.19, NNZs: 500, Bias: -111.366290, T: 2849455, Avg. loss: 66.36085
6
Total training time: 3.33 seconds.
-- Epoch 120
Norm: 496.88, NNZs: 500, Bias: -102.386369, T: 2873400, Avg. loss: 67.44206
9
Total training time: 3.36 seconds.
-- Epoch 121
Norm: 483.77, NNZs: 500, Bias: -90.321108, T: 2897345, Avg. loss: 66.688356
Total training time: 3.38 seconds.
-- Epoch 122
Norm: 494.64, NNZs: 500, Bias: -99.690704, T: 2921290, Avg. loss: 67.438451
Total training time: 3.41 seconds.
-- Epoch 123
Norm: 474.77, NNZs: 500, Bias: -93.268970, T: 2945235, Avg. loss: 63.501069
Total training time: 3.44 seconds.
-- Epoch 124

Norm: 487.21, NNZs: 500, Bias: -96.624089, T: 2969180, Avg. loss: 64.779598
Total training time: 3.47 seconds.
-- Epoch 125
Norm: 469.61, NNZs: 500, Bias: -100.690585, T: 2993125, Avg. loss: 65.68996
1
Total training time: 3.50 seconds.
-- Epoch 126
Norm: 463.71, NNZs: 500, Bias: -103.975245, T: 3017070, Avg. loss: 64.21952
5
Total training time: 3.52 seconds.
-- Epoch 127
Norm: 441.18, NNZs: 500, Bias: -99.739331, T: 3041015, Avg. loss: 63.544470
Total training time: 3.55 seconds.
-- Epoch 128
Norm: 448.03, NNZs: 500, Bias: -114.498501, T: 3064960, Avg. loss: 62.58036
2
Total training time: 3.58 seconds.
-- Epoch 129
Norm: 462.68, NNZs: 500, Bias: -116.004097, T: 3088905, Avg. loss: 64.79256
7
Total training time: 3.61 seconds.
-- Epoch 130
Norm: 473.66, NNZs: 500, Bias: -105.587033, T: 3112850, Avg. loss: 62.32085
8
Total training time: 3.64 seconds.
-- Epoch 131
Norm: 458.77, NNZs: 500, Bias: -96.868938, T: 3136795, Avg. loss: 62.054242
Total training time: 3.67 seconds.
-- Epoch 132
Norm: 456.38, NNZs: 500, Bias: -87.794948, T: 3160740, Avg. loss: 60.435745
Total training time: 3.69 seconds.
-- Epoch 133
Norm: 456.85, NNZs: 500, Bias: -80.002035, T: 3184685, Avg. loss: 62.743960
Total training time: 3.72 seconds.
-- Epoch 134
Norm: 460.69, NNZs: 500, Bias: -95.789804, T: 3208630, Avg. loss: 60.748395
Total training time: 3.75 seconds.
-- Epoch 135
Norm: 434.08, NNZs: 500, Bias: -100.856856, T: 3232575, Avg. loss: 60.74595
9
Total training time: 3.78 seconds.
-- Epoch 136
Norm: 438.15, NNZs: 500, Bias: -110.788372, T: 3256520, Avg. loss: 59.53227
0
Total training time: 3.80 seconds.
-- Epoch 137
Norm: 434.56, NNZs: 500, Bias: -106.692313, T: 3280465, Avg. loss: 59.26604
3
Total training time: 3.83 seconds.
-- Epoch 138
Norm: 437.25, NNZs: 500, Bias: -102.333245, T: 3304410, Avg. loss: 59.68329
3
Total training time: 3.86 seconds.
-- Epoch 139
Norm: 436.53, NNZs: 500, Bias: -97.603751, T: 3328355, Avg. loss: 58.550624
Total training time: 3.89 seconds.
-- Epoch 140

Norm: 410.32, NNZs: 500, Bias: -99.189124, T: 3352300, Avg. loss: 56.604118
Total training time: 3.91 seconds.
-- Epoch 141
Norm: 433.40, NNZs: 500, Bias: -99.928366, T: 3376245, Avg. loss: 57.579128
Total training time: 3.94 seconds.
-- Epoch 142
Norm: 437.81, NNZs: 500, Bias: -100.810239, T: 3400190, Avg. loss: 56.556179
Total training time: 3.97 seconds.
-- Epoch 143
Norm: 412.61, NNZs: 500, Bias: -103.528518, T: 3424135, Avg. loss: 58.608959
Total training time: 4.00 seconds.
-- Epoch 144
Norm: 412.82, NNZs: 500, Bias: -93.056203, T: 3448080, Avg. loss: 55.147840
Total training time: 4.03 seconds.
-- Epoch 145
Norm: 421.80, NNZs: 500, Bias: -85.430609, T: 3472025, Avg. loss: 55.877501
Total training time: 4.05 seconds.
-- Epoch 146
Norm: 413.47, NNZs: 500, Bias: -82.602289, T: 3495970, Avg. loss: 56.137039
Total training time: 4.08 seconds.
-- Epoch 147
Norm: 398.96, NNZs: 500, Bias: -80.814122, T: 3519915, Avg. loss: 54.914353
Total training time: 4.11 seconds.
-- Epoch 148
Norm: 410.33, NNZs: 500, Bias: -78.837230, T: 3543860, Avg. loss: 54.455203
Total training time: 4.14 seconds.
-- Epoch 149
Norm: 396.01, NNZs: 500, Bias: -91.438066, T: 3567805, Avg. loss: 54.516478
Total training time: 4.16 seconds.
-- Epoch 150
Norm: 395.85, NNZs: 500, Bias: -90.555016, T: 3591750, Avg. loss: 54.995474
Total training time: 4.19 seconds.
-- Epoch 151
Norm: 398.01, NNZs: 500, Bias: -92.597526, T: 3615695, Avg. loss: 53.543711
Total training time: 4.22 seconds.
-- Epoch 152
Norm: 391.34, NNZs: 500, Bias: -95.155047, T: 3639640, Avg. loss: 54.688930
Total training time: 4.25 seconds.
-- Epoch 153
Norm: 379.58, NNZs: 500, Bias: -106.575405, T: 3663585, Avg. loss: 53.586857
Total training time: 4.28 seconds.
-- Epoch 154
Norm: 378.67, NNZs: 500, Bias: -102.537249, T: 3687530, Avg. loss: 52.582579
Total training time: 4.31 seconds.
-- Epoch 155
Norm: 389.70, NNZs: 500, Bias: -101.956271, T: 3711475, Avg. loss: 53.390106
Total training time: 4.33 seconds.
-- Epoch 156
Norm: 370.36, NNZs: 500, Bias: -104.711706, T: 3735420, Avg. loss: 51.068991
Total training time: 4.36 seconds.
-- Epoch 157

Norm: 374.05, NNZs: 500, Bias: -95.158368, T: 3759365, Avg. loss: 53.074085
Total training time: 4.39 seconds.
-- Epoch 158
Norm: 389.54, NNZs: 500, Bias: -85.915808, T: 3783310, Avg. loss: 51.401691
Total training time: 4.42 seconds.
-- Epoch 159
Norm: 373.77, NNZs: 500, Bias: -85.244924, T: 3807255, Avg. loss: 50.901176
Total training time: 4.45 seconds.
-- Epoch 160
Norm: 362.68, NNZs: 500, Bias: -78.171077, T: 3831200, Avg. loss: 51.153031
Total training time: 4.47 seconds.
-- Epoch 161
Norm: 368.97, NNZs: 500, Bias: -78.416792, T: 3855145, Avg. loss: 49.372731
Total training time: 4.50 seconds.
-- Epoch 162
Norm: 369.84, NNZs: 500, Bias: -74.125951, T: 3879090, Avg. loss: 50.902701
Total training time: 4.53 seconds.
-- Epoch 163
Norm: 361.34, NNZs: 500, Bias: -72.771448, T: 3903035, Avg. loss: 49.298555
Total training time: 4.56 seconds.
-- Epoch 164
Norm: 370.60, NNZs: 500, Bias: -79.353480, T: 3926980, Avg. loss: 49.542236
Total training time: 4.59 seconds.
-- Epoch 165
Norm: 358.45, NNZs: 500, Bias: -84.026136, T: 3950925, Avg. loss: 50.770905
Total training time: 4.61 seconds.
-- Epoch 166
Norm: 366.20, NNZs: 500, Bias: -78.030351, T: 3974870, Avg. loss: 49.653497
Total training time: 4.64 seconds.
-- Epoch 167
Norm: 362.60, NNZs: 500, Bias: -88.660549, T: 3998815, Avg. loss: 48.798328
Total training time: 4.67 seconds.
-- Epoch 168
Norm: 346.09, NNZs: 500, Bias: -86.210700, T: 4022760, Avg. loss: 49.419176
Total training time: 4.70 seconds.
-- Epoch 169
Norm: 357.60, NNZs: 500, Bias: -84.267302, T: 4046705, Avg. loss: 47.135864
Total training time: 4.72 seconds.
-- Epoch 170
Norm: 346.96, NNZs: 500, Bias: -70.395012, T: 4070650, Avg. loss: 47.154214
Total training time: 4.75 seconds.
-- Epoch 171
Norm: 335.68, NNZs: 500, Bias: -76.468520, T: 4094595, Avg. loss: 48.365370
Total training time: 4.78 seconds.
-- Epoch 172
Norm: 344.94, NNZs: 500, Bias: -79.166861, T: 4118540, Avg. loss: 48.039600
Total training time: 4.81 seconds.
-- Epoch 173
Norm: 334.76, NNZs: 500, Bias: -73.725750, T: 4142485, Avg. loss: 47.685907
Total training time: 4.83 seconds.
-- Epoch 174
Norm: 342.93, NNZs: 500, Bias: -74.103330, T: 4166430, Avg. loss: 45.633604
Total training time: 4.86 seconds.
-- Epoch 175
Norm: 338.95, NNZs: 500, Bias: -75.658146, T: 4190375, Avg. loss: 46.957762
Total training time: 4.89 seconds.
-- Epoch 176

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Norm: 339.59, NNZs: 500, Bias: -79.650042, T: 4214320, Avg. loss: 46.189720
Total training time: 4.92 seconds.
-- Epoch 177
Norm: 335.07, NNZs: 500, Bias: -70.310284, T: 4238265, Avg. loss: 44.424532
Total training time: 4.94 seconds.
-- Epoch 178
Norm: 339.09, NNZs: 500, Bias: -74.155077, T: 4262210, Avg. loss: 46.785927
Total training time: 4.97 seconds.
-- Epoch 179
Norm: 323.22, NNZs: 500, Bias: -74.367070, T: 4286155, Avg. loss: 45.559356
Total training time: 5.00 seconds.
-- Epoch 180
Norm: 332.52, NNZs: 500, Bias: -77.259730, T: 4310100, Avg. loss: 46.290345
Total training time: 5.03 seconds.
-- Epoch 181
Norm: 343.61, NNZs: 500, Bias: -75.945837, T: 4334045, Avg. loss: 44.425926
Total training time: 5.06 seconds.
-- Epoch 182
Norm: 329.07, NNZs: 500, Bias: -69.954425, T: 4357990, Avg. loss: 45.765287
Total training time: 5.09 seconds.
Convergence after 182 epochs took 5.09 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=9.999999999999999e-06, average=False,
               class_weight={0: 5.14, 1: 1}, early_stopping=False, epsilon=0.1,
               eta0=0.0, fit_intercept=True, l1_ratio=0.15,
               learning_rate='optimal', loss='hinge', max_iter=1000, n_iter=None,
               n_iter_no_change=5, n_jobs=None, penalty='l2', power_t=0.5,
               random_state=42, shuffle=True, tol=0.001, validation_fraction=0.1,
               verbose=100, warm_start=False)
-- Epoch 1
Norm: 4654.90, NNZs: 500, Bias: -535.271197, T: 23945, Avg. loss: 1260.0059
06
Total training time: 0.03 seconds.
-- Epoch 2
Norm: 2638.23, NNZs: 500, Bias: -522.662125, T: 47890, Avg. loss: 487.90365
5
Total training time: 0.06 seconds.
-- Epoch 3
Norm: 1795.14, NNZs: 500, Bias: -484.146584, T: 71835, Avg. loss: 298.42416
7
Total training time: 0.09 seconds.
-- Epoch 4
Norm: 1422.75, NNZs: 500, Bias: -399.813428, T: 95780, Avg. loss: 216.79178
7
Total training time: 0.12 seconds.
-- Epoch 5
Norm: 1162.41, NNZs: 500, Bias: -331.587497, T: 119725, Avg. loss: 169.4541
59
Total training time: 0.15 seconds.
-- Epoch 6
Norm: 958.72, NNZs: 500, Bias: -272.821083, T: 143670, Avg. loss: 144.28307
7
Total training time: 0.18 seconds.
-- Epoch 7

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Norm: 836.66, NNZs: 500, Bias: -254.651492, T: 167615, Avg. loss: 123.683225
Total training time: 0.20 seconds.
-- Epoch 8
Norm: 716.31, NNZs: 500, Bias: -216.965155, T: 191560, Avg. loss: 105.624611
Total training time: 0.23 seconds.
-- Epoch 9
Norm: 643.57, NNZs: 500, Bias: -201.941012, T: 215505, Avg. loss: 93.360324
Total training time: 0.26 seconds.
-- Epoch 10
Norm: 569.03, NNZs: 500, Bias: -166.576880, T: 239450, Avg. loss: 84.215018
Total training time: 0.29 seconds.
-- Epoch 11
Norm: 532.76, NNZs: 500, Bias: -152.149602, T: 263395, Avg. loss: 77.075218
Total training time: 0.32 seconds.
-- Epoch 12
Norm: 494.23, NNZs: 500, Bias: -130.472704, T: 287340, Avg. loss: 69.852249
Total training time: 0.34 seconds.
-- Epoch 13
Norm: 439.89, NNZs: 500, Bias: -113.541313, T: 311285, Avg. loss: 64.146324
Total training time: 0.37 seconds.
-- Epoch 14
Norm: 424.93, NNZs: 500, Bias: -108.625413, T: 335230, Avg. loss: 59.665289
Total training time: 0.40 seconds.
-- Epoch 15
Norm: 407.87, NNZs: 500, Bias: -96.249209, T: 359175, Avg. loss: 55.249135
Total training time: 0.43 seconds.
-- Epoch 16
Norm: 383.90, NNZs: 500, Bias: -98.042616, T: 383120, Avg. loss: 52.012377
Total training time: 0.45 seconds.
-- Epoch 17
Norm: 351.59, NNZs: 500, Bias: -91.358598, T: 407065, Avg. loss: 50.554387
Total training time: 0.48 seconds.
-- Epoch 18
Norm: 324.94, NNZs: 500, Bias: -83.808654, T: 431010, Avg. loss: 45.344209
Total training time: 0.51 seconds.
-- Epoch 19
Norm: 307.51, NNZs: 500, Bias: -86.166306, T: 454955, Avg. loss: 44.192918
Total training time: 0.54 seconds.
-- Epoch 20
Norm: 288.11, NNZs: 500, Bias: -75.147877, T: 478900, Avg. loss: 41.585180
Total training time: 0.57 seconds.
-- Epoch 21
Norm: 284.38, NNZs: 500, Bias: -76.275009, T: 502845, Avg. loss: 39.272436
Total training time: 0.59 seconds.
-- Epoch 22
Norm: 278.12, NNZs: 500, Bias: -66.119525, T: 526790, Avg. loss: 37.238426
Total training time: 0.62 seconds.
-- Epoch 23
Norm: 265.77, NNZs: 500, Bias: -64.942342, T: 550735, Avg. loss: 36.451756
Total training time: 0.65 seconds.
-- Epoch 24
Norm: 247.08, NNZs: 500, Bias: -58.295057, T: 574680, Avg. loss: 35.365783
Total training time: 0.68 seconds.
-- Epoch 25
Norm: 242.70, NNZs: 500, Bias: -55.106601, T: 598625, Avg. loss: 32.624179

Total training time: 0.71 seconds.
-- Epoch 26
Norm: 224.41, NNZs: 500, Bias: -52.565045, T: 622570, Avg. loss: 31.832937
Total training time: 0.74 seconds.
-- Epoch 27
Norm: 219.13, NNZs: 500, Bias: -56.731941, T: 646515, Avg. loss: 30.890791
Total training time: 0.76 seconds.
-- Epoch 28
Norm: 210.33, NNZs: 500, Bias: -55.101716, T: 670460, Avg. loss: 29.393769
Total training time: 0.79 seconds.
-- Epoch 29
Norm: 204.02, NNZs: 500, Bias: -47.025191, T: 694405, Avg. loss: 29.613567
Total training time: 0.82 seconds.
-- Epoch 30
Norm: 205.77, NNZs: 500, Bias: -51.188746, T: 718350, Avg. loss: 27.809444
Total training time: 0.85 seconds.
-- Epoch 31
Norm: 192.75, NNZs: 500, Bias: -48.915998, T: 742295, Avg. loss: 27.198309
Total training time: 0.88 seconds.
-- Epoch 32
Norm: 182.78, NNZs: 500, Bias: -49.712478, T: 766240, Avg. loss: 25.828840
Total training time: 0.91 seconds.
-- Epoch 33
Norm: 176.22, NNZs: 500, Bias: -44.510217, T: 790185, Avg. loss: 25.212557
Total training time: 0.93 seconds.
-- Epoch 34
Norm: 172.58, NNZs: 500, Bias: -45.342316, T: 814130, Avg. loss: 24.578748
Total training time: 0.96 seconds.
-- Epoch 35
Norm: 172.54, NNZs: 500, Bias: -41.055505, T: 838075, Avg. loss: 24.203197
Total training time: 0.99 seconds.
-- Epoch 36
Norm: 166.13, NNZs: 500, Bias: -37.447767, T: 862020, Avg. loss: 22.984993
Total training time: 1.02 seconds.
-- Epoch 37
Norm: 160.01, NNZs: 500, Bias: -37.349050, T: 885965, Avg. loss: 22.370533
Total training time: 1.05 seconds.
-- Epoch 38
Norm: 158.10, NNZs: 500, Bias: -37.172108, T: 909910, Avg. loss: 21.986155
Total training time: 1.08 seconds.
-- Epoch 39
Norm: 152.79, NNZs: 500, Bias: -39.032731, T: 933855, Avg. loss: 21.406299
Total training time: 1.10 seconds.
-- Epoch 40
Norm: 151.33, NNZs: 500, Bias: -40.470210, T: 957800, Avg. loss: 21.297621
Total training time: 1.13 seconds.
-- Epoch 41
Norm: 148.59, NNZs: 500, Bias: -39.487852, T: 981745, Avg. loss: 20.717107
Total training time: 1.16 seconds.
-- Epoch 42
Norm: 144.14, NNZs: 500, Bias: -34.387884, T: 1005690, Avg. loss: 20.331644
Total training time: 1.19 seconds.
-- Epoch 43
Norm: 139.70, NNZs: 500, Bias: -33.758544, T: 1029635, Avg. loss: 19.373095
Total training time: 1.22 seconds.
-- Epoch 44
Norm: 137.83, NNZs: 500, Bias: -37.352982, T: 1053580, Avg. loss: 19.229537

Total training time: 1.25 seconds.
-- Epoch 45
Norm: 133.36, NNZs: 500, Bias: -36.392392, T: 1077525, Avg. loss: 18.487660
Total training time: 1.28 seconds.
-- Epoch 46
Norm: 135.17, NNZs: 500, Bias: -34.113140, T: 1101470, Avg. loss: 17.832706
Total training time: 1.30 seconds.
-- Epoch 47
Norm: 126.07, NNZs: 500, Bias: -32.186352, T: 1125415, Avg. loss: 18.133029
Total training time: 1.33 seconds.
-- Epoch 48
Norm: 126.89, NNZs: 500, Bias: -30.517824, T: 1149360, Avg. loss: 17.112701
Total training time: 1.36 seconds.
-- Epoch 49
Norm: 123.35, NNZs: 500, Bias: -30.035288, T: 1173305, Avg. loss: 16.899704
Total training time: 1.39 seconds.
-- Epoch 50
Norm: 118.59, NNZs: 500, Bias: -31.636371, T: 1197250, Avg. loss: 16.602766
Total training time: 1.41 seconds.
-- Epoch 51
Norm: 119.85, NNZs: 500, Bias: -31.093300, T: 1221195, Avg. loss: 16.696949
Total training time: 1.44 seconds.
-- Epoch 52
Norm: 112.79, NNZs: 500, Bias: -27.952990, T: 1245140, Avg. loss: 16.068225
Total training time: 1.47 seconds.
-- Epoch 53
Norm: 112.65, NNZs: 500, Bias: -29.994887, T: 1269085, Avg. loss: 15.590525
Total training time: 1.50 seconds.
-- Epoch 54
Norm: 108.65, NNZs: 500, Bias: -30.094731, T: 1293030, Avg. loss: 15.299706
Total training time: 1.52 seconds.
-- Epoch 55
Norm: 108.81, NNZs: 500, Bias: -24.593854, T: 1316975, Avg. loss: 15.236942
Total training time: 1.55 seconds.
-- Epoch 56
Norm: 107.03, NNZs: 500, Bias: -22.895938, T: 1340920, Avg. loss: 15.093738
Total training time: 1.58 seconds.
-- Epoch 57
Norm: 104.35, NNZs: 500, Bias: -25.042571, T: 1364865, Avg. loss: 14.538520
Total training time: 1.61 seconds.
-- Epoch 58
Norm: 101.72, NNZs: 500, Bias: -24.776316, T: 1388810, Avg. loss: 14.557676
Total training time: 1.63 seconds.
-- Epoch 59
Norm: 102.96, NNZs: 500, Bias: -23.844739, T: 1412755, Avg. loss: 13.804939
Total training time: 1.66 seconds.
-- Epoch 60
Norm: 99.81, NNZs: 500, Bias: -22.592900, T: 1436700, Avg. loss: 14.125914
Total training time: 1.69 seconds.
-- Epoch 61
Norm: 100.32, NNZs: 500, Bias: -21.718204, T: 1460645, Avg. loss: 13.485204
Total training time: 1.72 seconds.
-- Epoch 62
Norm: 101.36, NNZs: 500, Bias: -24.884229, T: 1484590, Avg. loss: 13.468540
Total training time: 1.75 seconds.
-- Epoch 63
Norm: 95.67, NNZs: 500, Bias: -21.273962, T: 1508535, Avg. loss: 13.734561

Total training time: 1.78 seconds.
-- Epoch 64
Norm: 95.01, NNZs: 500, Bias: -21.297331, T: 1532480, Avg. loss: 13.322086
Total training time: 1.81 seconds.
-- Epoch 65
Norm: 96.14, NNZs: 500, Bias: -19.240785, T: 1556425, Avg. loss: 13.010464
Total training time: 1.84 seconds.
-- Epoch 66
Norm: 91.60, NNZs: 500, Bias: -22.482942, T: 1580370, Avg. loss: 12.586003
Total training time: 1.88 seconds.
-- Epoch 67
Norm: 90.27, NNZs: 500, Bias: -19.237913, T: 1604315, Avg. loss: 12.516194
Total training time: 1.91 seconds.
-- Epoch 68
Norm: 86.47, NNZs: 500, Bias: -20.281052, T: 1628260, Avg. loss: 12.373026
Total training time: 1.94 seconds.
-- Epoch 69
Norm: 88.03, NNZs: 500, Bias: -15.668757, T: 1652205, Avg. loss: 11.958413
Total training time: 1.96 seconds.
-- Epoch 70
Norm: 86.46, NNZs: 500, Bias: -15.378276, T: 1676150, Avg. loss: 11.745847
Total training time: 1.99 seconds.
-- Epoch 71
Norm: 84.11, NNZs: 500, Bias: -18.557112, T: 1700095, Avg. loss: 11.992288
Total training time: 2.02 seconds.
-- Epoch 72
Norm: 85.62, NNZs: 500, Bias: -19.182397, T: 1724040, Avg. loss: 11.822543
Total training time: 2.05 seconds.
-- Epoch 73
Norm: 80.64, NNZs: 500, Bias: -17.926108, T: 1747985, Avg. loss: 11.548542
Total training time: 2.08 seconds.
-- Epoch 74
Norm: 83.52, NNZs: 500, Bias: -18.066338, T: 1771930, Avg. loss: 11.602426
Total training time: 2.11 seconds.
-- Epoch 75
Norm: 82.19, NNZs: 500, Bias: -17.292654, T: 1795875, Avg. loss: 11.171317
Total training time: 2.13 seconds.
-- Epoch 76
Norm: 76.57, NNZs: 500, Bias: -18.344285, T: 1819820, Avg. loss: 11.020563
Total training time: 2.16 seconds.
-- Epoch 77
Norm: 76.73, NNZs: 500, Bias: -17.454421, T: 1843765, Avg. loss: 10.944078
Total training time: 2.19 seconds.
-- Epoch 78
Norm: 74.76, NNZs: 500, Bias: -21.253834, T: 1867710, Avg. loss: 10.672506
Total training time: 2.22 seconds.
-- Epoch 79
Norm: 75.81, NNZs: 500, Bias: -20.894159, T: 1891655, Avg. loss: 10.656927
Total training time: 2.24 seconds.
-- Epoch 80
Norm: 80.30, NNZs: 500, Bias: -19.395349, T: 1915600, Avg. loss: 10.724883
Total training time: 2.27 seconds.
-- Epoch 81
Norm: 77.63, NNZs: 500, Bias: -18.612331, T: 1939545, Avg. loss: 10.450566
Total training time: 2.30 seconds.
-- Epoch 82
Norm: 75.76, NNZs: 500, Bias: -16.505818, T: 1963490, Avg. loss: 10.241991

Total training time: 2.33 seconds.
-- Epoch 83
Norm: 74.05, NNZs: 500, Bias: -15.612220, T: 1987435, Avg. loss: 9.838612
Total training time: 2.36 seconds.
-- Epoch 84
Norm: 71.30, NNZs: 500, Bias: -15.977556, T: 2011380, Avg. loss: 9.945787
Total training time: 2.38 seconds.
-- Epoch 85
Norm: 73.43, NNZs: 500, Bias: -15.063265, T: 2035325, Avg. loss: 9.921227
Total training time: 2.41 seconds.
-- Epoch 86
Norm: 69.92, NNZs: 500, Bias: -12.289813, T: 2059270, Avg. loss: 9.554791
Total training time: 2.44 seconds.
-- Epoch 87
Norm: 72.69, NNZs: 500, Bias: -13.508932, T: 2083215, Avg. loss: 9.608114
Total training time: 2.47 seconds.
-- Epoch 88
Norm: 70.58, NNZs: 500, Bias: -15.252105, T: 2107160, Avg. loss: 9.557395
Total training time: 2.49 seconds.
-- Epoch 89
Norm: 67.89, NNZs: 500, Bias: -15.687282, T: 2131105, Avg. loss: 9.413953
Total training time: 2.52 seconds.
-- Epoch 90
Norm: 66.28, NNZs: 500, Bias: -15.389193, T: 2155050, Avg. loss: 9.323171
Total training time: 2.56 seconds.
-- Epoch 91
Norm: 66.02, NNZs: 500, Bias: -14.594168, T: 2178995, Avg. loss: 9.414204
Total training time: 2.59 seconds.
-- Epoch 92
Norm: 67.37, NNZs: 500, Bias: -14.305173, T: 2202940, Avg. loss: 9.388989
Total training time: 2.62 seconds.
-- Epoch 93
Norm: 64.12, NNZs: 500, Bias: -15.619910, T: 2226885, Avg. loss: 9.006052
Total training time: 2.65 seconds.
-- Epoch 94
Norm: 65.71, NNZs: 500, Bias: -14.422985, T: 2250830, Avg. loss: 8.976357
Total training time: 2.68 seconds.
-- Epoch 95
Norm: 64.53, NNZs: 500, Bias: -14.759994, T: 2274775, Avg. loss: 8.955778
Total training time: 2.71 seconds.
-- Epoch 96
Norm: 64.35, NNZs: 500, Bias: -16.919834, T: 2298720, Avg. loss: 9.028282
Total training time: 2.74 seconds.
-- Epoch 97
Norm: 62.04, NNZs: 500, Bias: -15.465524, T: 2322665, Avg. loss: 8.787514
Total training time: 2.77 seconds.
-- Epoch 98
Norm: 63.48, NNZs: 500, Bias: -12.343927, T: 2346610, Avg. loss: 8.447070
Total training time: 2.80 seconds.
-- Epoch 99
Norm: 62.33, NNZs: 500, Bias: -13.096228, T: 2370555, Avg. loss: 8.694479
Total training time: 2.83 seconds.
-- Epoch 100
Norm: 62.10, NNZs: 500, Bias: -14.625343, T: 2394500, Avg. loss: 8.451703
Total training time: 2.86 seconds.
-- Epoch 101
Norm: 60.05, NNZs: 500, Bias: -15.544761, T: 2418445, Avg. loss: 8.137335

Total training time: 2.89 seconds.
-- Epoch 102
Norm: 58.30, NNZs: 500, Bias: -14.934891, T: 2442390, Avg. loss: 8.371885
Total training time: 2.92 seconds.
-- Epoch 103
Norm: 59.39, NNZs: 500, Bias: -14.755784, T: 2466335, Avg. loss: 8.139515
Total training time: 2.95 seconds.
-- Epoch 104
Norm: 56.87, NNZs: 500, Bias: -16.225405, T: 2490280, Avg. loss: 8.043461
Total training time: 2.98 seconds.
-- Epoch 105
Norm: 58.14, NNZs: 500, Bias: -14.811952, T: 2514225, Avg. loss: 8.188577
Total training time: 3.01 seconds.
-- Epoch 106
Norm: 58.33, NNZs: 500, Bias: -15.168071, T: 2538170, Avg. loss: 8.124507
Total training time: 3.04 seconds.
-- Epoch 107
Norm: 57.65, NNZs: 500, Bias: -13.003645, T: 2562115, Avg. loss: 8.072776
Total training time: 3.07 seconds.
-- Epoch 108
Norm: 56.65, NNZs: 500, Bias: -12.715824, T: 2586060, Avg. loss: 7.881629
Total training time: 3.10 seconds.
-- Epoch 109
Norm: 54.63, NNZs: 500, Bias: -12.508612, T: 2610005, Avg. loss: 8.126426
Total training time: 3.13 seconds.
-- Epoch 110
Norm: 54.57, NNZs: 500, Bias: -11.457366, T: 2633950, Avg. loss: 7.778199
Total training time: 3.16 seconds.
-- Epoch 111
Norm: 56.85, NNZs: 500, Bias: -12.210955, T: 2657895, Avg. loss: 7.627495
Total training time: 3.18 seconds.
-- Epoch 112
Norm: 55.80, NNZs: 500, Bias: -13.819672, T: 2681840, Avg. loss: 7.755098
Total training time: 3.21 seconds.
-- Epoch 113
Norm: 54.51, NNZs: 500, Bias: -14.537285, T: 2705785, Avg. loss: 7.634954
Total training time: 3.24 seconds.
-- Epoch 114
Norm: 53.34, NNZs: 500, Bias: -14.000326, T: 2729730, Avg. loss: 7.594654
Total training time: 3.27 seconds.
-- Epoch 115
Norm: 54.63, NNZs: 500, Bias: -15.042213, T: 2753675, Avg. loss: 7.394353
Total training time: 3.31 seconds.
-- Epoch 116
Norm: 53.25, NNZs: 500, Bias: -13.112817, T: 2777620, Avg. loss: 7.553551
Total training time: 3.34 seconds.
-- Epoch 117
Norm: 52.06, NNZs: 500, Bias: -12.499848, T: 2801565, Avg. loss: 7.123578
Total training time: 3.37 seconds.
-- Epoch 118
Norm: 51.52, NNZs: 500, Bias: -13.334567, T: 2825510, Avg. loss: 7.358524
Total training time: 3.40 seconds.
-- Epoch 119
Norm: 52.58, NNZs: 500, Bias: -13.219374, T: 2849455, Avg. loss: 7.082976
Total training time: 3.43 seconds.
-- Epoch 120
Norm: 51.75, NNZs: 500, Bias: -12.231216, T: 2873400, Avg. loss: 7.316257

Total training time: 3.46 seconds.
-- Epoch 121
Norm: 51.77, NNZs: 500, Bias: -11.799920, T: 2897345, Avg. loss: 7.154312
Total training time: 3.49 seconds.
-- Epoch 122
Norm: 50.13, NNZs: 500, Bias: -11.247384, T: 2921290, Avg. loss: 6.946192
Total training time: 3.52 seconds.
-- Epoch 123
Norm: 49.94, NNZs: 500, Bias: -10.996987, T: 2945235, Avg. loss: 6.926372
Total training time: 3.55 seconds.
-- Epoch 124
Norm: 50.65, NNZs: 500, Bias: -10.692527, T: 2969180, Avg. loss: 6.802822
Total training time: 3.59 seconds.
-- Epoch 125
Norm: 48.89, NNZs: 500, Bias: -12.287190, T: 2993125, Avg. loss: 6.971373
Total training time: 3.62 seconds.
-- Epoch 126
Norm: 48.63, NNZs: 500, Bias: -12.449944, T: 3017070, Avg. loss: 6.981228
Total training time: 3.65 seconds.
-- Epoch 127
Norm: 46.89, NNZs: 500, Bias: -11.987824, T: 3041015, Avg. loss: 6.900146
Total training time: 3.68 seconds.
-- Epoch 128
Norm: 46.86, NNZs: 500, Bias: -12.752531, T: 3064960, Avg. loss: 6.757660
Total training time: 3.70 seconds.
-- Epoch 129
Norm: 47.41, NNZs: 500, Bias: -11.269935, T: 3088905, Avg. loss: 6.664586
Total training time: 3.73 seconds.
-- Epoch 130
Norm: 48.62, NNZs: 500, Bias: -11.076411, T: 3112850, Avg. loss: 6.546887
Total training time: 3.76 seconds.
-- Epoch 131
Norm: 46.29, NNZs: 500, Bias: -10.436566, T: 3136795, Avg. loss: 6.521259
Total training time: 3.79 seconds.
-- Epoch 132
Norm: 47.59, NNZs: 500, Bias: -10.263943, T: 3160740, Avg. loss: 6.485626
Total training time: 3.82 seconds.
-- Epoch 133
Norm: 47.69, NNZs: 500, Bias: -9.641520, T: 3184685, Avg. loss: 6.506479
Total training time: 3.84 seconds.
-- Epoch 134
Norm: 48.12, NNZs: 500, Bias: -11.300738, T: 3208630, Avg. loss: 6.460689
Total training time: 3.87 seconds.
-- Epoch 135
Norm: 44.91, NNZs: 500, Bias: -10.990660, T: 3232575, Avg. loss: 6.467321
Total training time: 3.90 seconds.
-- Epoch 136
Norm: 44.93, NNZs: 500, Bias: -10.856651, T: 3256520, Avg. loss: 6.349037
Total training time: 3.93 seconds.
-- Epoch 137
Norm: 45.70, NNZs: 500, Bias: -9.307966, T: 3280465, Avg. loss: 6.336167
Total training time: 3.96 seconds.
-- Epoch 138
Norm: 44.16, NNZs: 500, Bias: -8.963760, T: 3304410, Avg. loss: 6.187544
Total training time: 3.98 seconds.
-- Epoch 139
Norm: 44.90, NNZs: 500, Bias: -8.050583, T: 3328355, Avg. loss: 6.304819

Total training time: 4.01 seconds.
-- Epoch 140
Norm: 43.59, NNZs: 500, Bias: -9.723659, T: 3352300, Avg. loss: 6.153204
Total training time: 4.04 seconds.
-- Epoch 141
Norm: 45.33, NNZs: 500, Bias: -9.206363, T: 3376245, Avg. loss: 6.074218
Total training time: 4.07 seconds.
-- Epoch 142
Norm: 44.11, NNZs: 500, Bias: -9.312610, T: 3400190, Avg. loss: 6.099283
Total training time: 4.10 seconds.
-- Epoch 143
Norm: 43.69, NNZs: 500, Bias: -9.546939, T: 3424135, Avg. loss: 6.287723
Total training time: 4.13 seconds.
-- Epoch 144
Norm: 44.33, NNZs: 500, Bias: -9.891753, T: 3448080, Avg. loss: 5.935380
Total training time: 4.15 seconds.
-- Epoch 145
Norm: 44.57, NNZs: 500, Bias: -9.731379, T: 3472025, Avg. loss: 6.131365
Total training time: 4.18 seconds.
-- Epoch 146
Norm: 43.44, NNZs: 500, Bias: -8.364918, T: 3495970, Avg. loss: 5.868490
Total training time: 4.21 seconds.
-- Epoch 147
Norm: 42.67, NNZs: 500, Bias: -8.306683, T: 3519915, Avg. loss: 5.785335
Total training time: 4.24 seconds.
-- Epoch 148
Norm: 42.24, NNZs: 500, Bias: -8.441515, T: 3543860, Avg. loss: 5.901927
Total training time: 4.27 seconds.
-- Epoch 149
Norm: 41.20, NNZs: 500, Bias: -8.910383, T: 3567805, Avg. loss: 5.879942
Total training time: 4.30 seconds.
-- Epoch 150
Norm: 40.71, NNZs: 500, Bias: -8.247378, T: 3591750, Avg. loss: 5.860148
Total training time: 4.33 seconds.
-- Epoch 151
Norm: 40.37, NNZs: 500, Bias: -8.969849, T: 3615695, Avg. loss: 5.668401
Total training time: 4.36 seconds.
-- Epoch 152
Norm: 40.74, NNZs: 500, Bias: -9.738803, T: 3639640, Avg. loss: 5.646204
Total training time: 4.38 seconds.
-- Epoch 153
Norm: 39.19, NNZs: 500, Bias: -9.694270, T: 3663585, Avg. loss: 5.750121
Total training time: 4.41 seconds.
-- Epoch 154
Norm: 39.28, NNZs: 500, Bias: -10.604503, T: 3687530, Avg. loss: 5.679668
Total training time: 4.44 seconds.
-- Epoch 155
Norm: 40.69, NNZs: 500, Bias: -10.759604, T: 3711475, Avg. loss: 5.748200
Total training time: 4.47 seconds.
-- Epoch 156
Norm: 38.72, NNZs: 500, Bias: -10.642954, T: 3735420, Avg. loss: 5.541898
Total training time: 4.49 seconds.
-- Epoch 157
Norm: 39.12, NNZs: 500, Bias: -10.295985, T: 3759365, Avg. loss: 5.600506
Total training time: 4.52 seconds.
-- Epoch 158
Norm: 39.05, NNZs: 500, Bias: -10.076474, T: 3783310, Avg. loss: 5.470437

Total training time: 4.55 seconds.
-- Epoch 159
Norm: 38.99, NNZs: 500, Bias: -10.498257, T: 3807255, Avg. loss: 5.435302
Total training time: 4.58 seconds.
-- Epoch 160
Norm: 37.45, NNZs: 500, Bias: -10.005034, T: 3831200, Avg. loss: 5.454966
Total training time: 4.60 seconds.
-- Epoch 161
Norm: 37.93, NNZs: 500, Bias: -9.585066, T: 3855145, Avg. loss: 5.364597
Total training time: 4.63 seconds.
-- Epoch 162
Norm: 38.80, NNZs: 500, Bias: -8.651579, T: 3879090, Avg. loss: 5.318731
Total training time: 4.66 seconds.
-- Epoch 163
Norm: 37.84, NNZs: 500, Bias: -7.660865, T: 3903035, Avg. loss: 5.345907
Total training time: 4.69 seconds.
-- Epoch 164
Norm: 38.00, NNZs: 500, Bias: -7.728053, T: 3926980, Avg. loss: 5.288583
Total training time: 4.71 seconds.
-- Epoch 165
Norm: 37.49, NNZs: 500, Bias: -8.592789, T: 3950925, Avg. loss: 5.350853
Total training time: 4.74 seconds.
-- Epoch 166
Norm: 38.14, NNZs: 500, Bias: -7.642751, T: 3974870, Avg. loss: 5.330039
Total training time: 4.77 seconds.
-- Epoch 167
Norm: 37.41, NNZs: 500, Bias: -8.498023, T: 3998815, Avg. loss: 5.216258
Total training time: 4.80 seconds.
-- Epoch 168
Norm: 35.97, NNZs: 500, Bias: -8.873376, T: 4022760, Avg. loss: 5.181288
Total training time: 4.82 seconds.
-- Epoch 169
Norm: 37.55, NNZs: 500, Bias: -8.435879, T: 4046705, Avg. loss: 5.265470
Total training time: 4.85 seconds.
-- Epoch 170
Norm: 36.74, NNZs: 500, Bias: -8.248779, T: 4070650, Avg. loss: 5.223386
Total training time: 4.88 seconds.
-- Epoch 171
Norm: 35.76, NNZs: 500, Bias: -8.905330, T: 4094595, Avg. loss: 5.127901
Total training time: 4.91 seconds.
-- Epoch 172
Norm: 34.90, NNZs: 500, Bias: -8.673841, T: 4118540, Avg. loss: 5.102481
Total training time: 4.94 seconds.
-- Epoch 173
Norm: 35.28, NNZs: 500, Bias: -8.334538, T: 4142485, Avg. loss: 5.139103
Total training time: 4.96 seconds.
-- Epoch 174
Norm: 35.72, NNZs: 500, Bias: -8.775869, T: 4166430, Avg. loss: 4.869402
Total training time: 4.99 seconds.
-- Epoch 175
Norm: 35.35, NNZs: 500, Bias: -9.084219, T: 4190375, Avg. loss: 5.079919
Total training time: 5.02 seconds.
-- Epoch 176
Norm: 35.12, NNZs: 500, Bias: -9.129082, T: 4214320, Avg. loss: 4.962270
Total training time: 5.05 seconds.
-- Epoch 177
Norm: 35.06, NNZs: 500, Bias: -8.715068, T: 4238265, Avg. loss: 4.949952

```
Total training time: 5.07 seconds.
-- Epoch 178
Norm: 35.55, NNZs: 500, Bias: -8.374757, T: 4262210, Avg. loss: 5.031428
Total training time: 5.10 seconds.
-- Epoch 179
Norm: 35.02, NNZs: 500, Bias: -8.385166, T: 4286155, Avg. loss: 4.935328
Total training time: 5.13 seconds.
Convergence after 179 epochs took 5.13 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=9.999999999999999e-05, average=False,
               class_weight={0: 5.14, 1: 1}, early_stopping=False, epsilon=0.1,
               eta0=0.0, fit_intercept=True, l1_ratio=0.15,
               learning_rate='optimal', loss='hinge', max_iter=1000, n_iter=None,
               n_iter_no_change=5, n_jobs=None, penalty='l2', power_t=0.5,
               random_state=42, shuffle=True, tol=0.001, validation_fraction=0.1,
               verbose=100, warm_start=False)
-- Epoch 1
Norm: 565.75, NNZs: 500, Bias: -73.914300, T: 23945, Avg. loss: 232.524606
Total training time: 0.03 seconds.
-- Epoch 2
Norm: 287.88, NNZs: 500, Bias: -71.889614, T: 47890, Avg. loss: 55.198446
Total training time: 0.06 seconds.
-- Epoch 3
Norm: 198.22, NNZs: 500, Bias: -65.237476, T: 71835, Avg. loss: 32.270927
Total training time: 0.09 seconds.
-- Epoch 4
Norm: 151.99, NNZs: 500, Bias: -49.924195, T: 95780, Avg. loss: 23.812241
Total training time: 0.12 seconds.
-- Epoch 5
Norm: 121.34, NNZs: 500, Bias: -40.550534, T: 119725, Avg. loss: 17.967275
Total training time: 0.15 seconds.
-- Epoch 6
Norm: 102.00, NNZs: 500, Bias: -32.171280, T: 143670, Avg. loss: 15.140656
Total training time: 0.18 seconds.
-- Epoch 7
Norm: 88.32, NNZs: 500, Bias: -28.014480, T: 167615, Avg. loss: 13.005504
Total training time: 0.21 seconds.
-- Epoch 8
Norm: 75.60, NNZs: 500, Bias: -25.496142, T: 191560, Avg. loss: 11.025209
Total training time: 0.24 seconds.
-- Epoch 9
Norm: 67.29, NNZs: 500, Bias: -23.581381, T: 215505, Avg. loss: 9.988162
Total training time: 0.27 seconds.
-- Epoch 10
Norm: 61.36, NNZs: 500, Bias: -20.201818, T: 239450, Avg. loss: 8.979486
Total training time: 0.29 seconds.
-- Epoch 11
Norm: 54.32, NNZs: 500, Bias: -17.070446, T: 263395, Avg. loss: 8.053644
Total training time: 0.32 seconds.
-- Epoch 12
Norm: 51.00, NNZs: 500, Bias: -14.470701, T: 287340, Avg. loss: 7.320183
Total training time: 0.35 seconds.
-- Epoch 13
Norm: 46.28, NNZs: 500, Bias: -13.436771, T: 311285, Avg. loss: 6.760474
```

Total training time: 0.38 seconds.
-- Epoch 14
Norm: 44.52, NNZs: 500, Bias: -12.410024, T: 335230, Avg. loss: 6.304857
Total training time: 0.40 seconds.
-- Epoch 15
Norm: 43.15, NNZs: 500, Bias: -10.572209, T: 359175, Avg. loss: 5.973784
Total training time: 0.43 seconds.
-- Epoch 16
Norm: 40.10, NNZs: 500, Bias: -10.650546, T: 383120, Avg. loss: 5.610107
Total training time: 0.46 seconds.
-- Epoch 17
Norm: 37.19, NNZs: 500, Bias: -9.028258, T: 407065, Avg. loss: 5.411276
Total training time: 0.49 seconds.
-- Epoch 18
Norm: 34.80, NNZs: 500, Bias: -9.581431, T: 431010, Avg. loss: 5.039022
Total training time: 0.51 seconds.
-- Epoch 19
Norm: 33.70, NNZs: 500, Bias: -8.781955, T: 454955, Avg. loss: 4.695036
Total training time: 0.54 seconds.
-- Epoch 20
Norm: 30.57, NNZs: 500, Bias: -7.766686, T: 478900, Avg. loss: 4.451905
Total training time: 0.57 seconds.
-- Epoch 21
Norm: 30.31, NNZs: 500, Bias: -7.616324, T: 502845, Avg. loss: 4.367022
Total training time: 0.60 seconds.
-- Epoch 22
Norm: 28.78, NNZs: 500, Bias: -7.263112, T: 526790, Avg. loss: 4.162213
Total training time: 0.62 seconds.
-- Epoch 23
Norm: 28.01, NNZs: 500, Bias: -6.907694, T: 550735, Avg. loss: 3.996636
Total training time: 0.65 seconds.
-- Epoch 24
Norm: 26.20, NNZs: 500, Bias: -6.234714, T: 574680, Avg. loss: 3.854595
Total training time: 0.68 seconds.
-- Epoch 25
Norm: 25.56, NNZs: 500, Bias: -6.051815, T: 598625, Avg. loss: 3.685145
Total training time: 0.71 seconds.
-- Epoch 26
Norm: 24.95, NNZs: 500, Bias: -5.887781, T: 622570, Avg. loss: 3.575528
Total training time: 0.74 seconds.
-- Epoch 27
Norm: 23.48, NNZs: 500, Bias: -5.729628, T: 646515, Avg. loss: 3.452860
Total training time: 0.76 seconds.
-- Epoch 28
Norm: 22.47, NNZs: 500, Bias: -6.037473, T: 670460, Avg. loss: 3.271629
Total training time: 0.79 seconds.
-- Epoch 29
Norm: 21.91, NNZs: 500, Bias: -5.921211, T: 694405, Avg. loss: 3.220909
Total training time: 0.82 seconds.
-- Epoch 30
Norm: 21.65, NNZs: 500, Bias: -6.000371, T: 718350, Avg. loss: 3.133463
Total training time: 0.85 seconds.
-- Epoch 31
Norm: 20.83, NNZs: 500, Bias: -5.497572, T: 742295, Avg. loss: 3.001017
Total training time: 0.88 seconds.
-- Epoch 32
Norm: 20.07, NNZs: 500, Bias: -5.248863, T: 766240, Avg. loss: 2.922669

Total training time: 0.90 seconds.
-- Epoch 33
Norm: 19.23, NNZs: 500, Bias: -4.993951, T: 790185, Avg. loss: 2.851674
Total training time: 0.93 seconds.
-- Epoch 34
Norm: 18.61, NNZs: 500, Bias: -4.731472, T: 814130, Avg. loss: 2.787188
Total training time: 0.96 seconds.
-- Epoch 35
Norm: 18.56, NNZs: 500, Bias: -4.757934, T: 838075, Avg. loss: 2.717453
Total training time: 0.99 seconds.
-- Epoch 36
Norm: 18.24, NNZs: 500, Bias: -4.389945, T: 862020, Avg. loss: 2.671620
Total training time: 1.02 seconds.
-- Epoch 37
Norm: 18.38, NNZs: 500, Bias: -4.301951, T: 885965, Avg. loss: 2.585515
Total training time: 1.04 seconds.
-- Epoch 38
Norm: 16.92, NNZs: 500, Bias: -4.083216, T: 909910, Avg. loss: 2.510307
Total training time: 1.07 seconds.
-- Epoch 39
Norm: 16.47, NNZs: 500, Bias: -4.042160, T: 933855, Avg. loss: 2.510905
Total training time: 1.10 seconds.
-- Epoch 40
Norm: 16.53, NNZs: 500, Bias: -4.035119, T: 957800, Avg. loss: 2.418822
Total training time: 1.13 seconds.
-- Epoch 41
Norm: 16.27, NNZs: 500, Bias: -4.397207, T: 981745, Avg. loss: 2.434382
Total training time: 1.16 seconds.
-- Epoch 42
Norm: 15.66, NNZs: 500, Bias: -4.012141, T: 1005690, Avg. loss: 2.355329
Total training time: 1.18 seconds.
-- Epoch 43
Norm: 15.20, NNZs: 500, Bias: -3.860565, T: 1029635, Avg. loss: 2.289661
Total training time: 1.21 seconds.
-- Epoch 44
Norm: 15.01, NNZs: 500, Bias: -3.914393, T: 1053580, Avg. loss: 2.192238
Total training time: 1.24 seconds.
-- Epoch 45
Norm: 14.80, NNZs: 500, Bias: -3.692609, T: 1077525, Avg. loss: 2.228060
Total training time: 1.27 seconds.
-- Epoch 46
Norm: 14.90, NNZs: 500, Bias: -3.561445, T: 1101470, Avg. loss: 2.083611
Total training time: 1.30 seconds.
-- Epoch 47
Norm: 14.03, NNZs: 500, Bias: -3.558588, T: 1125415, Avg. loss: 2.124726
Total training time: 1.33 seconds.
-- Epoch 48
Norm: 14.25, NNZs: 500, Bias: -3.802770, T: 1149360, Avg. loss: 2.095867
Total training time: 1.35 seconds.
-- Epoch 49
Norm: 13.57, NNZs: 500, Bias: -3.450270, T: 1173305, Avg. loss: 2.025470
Total training time: 1.38 seconds.
-- Epoch 50
Norm: 13.16, NNZs: 500, Bias: -3.436753, T: 1197250, Avg. loss: 2.013543
Total training time: 1.41 seconds.
-- Epoch 51
Norm: 13.40, NNZs: 500, Bias: -3.254331, T: 1221195, Avg. loss: 1.956732

Total training time: 1.44 seconds.
-- Epoch 52
Norm: 12.72, NNZs: 500, Bias: -3.164948, T: 1245140, Avg. loss: 1.919218
Total training time: 1.47 seconds.
-- Epoch 53
Norm: 13.00, NNZs: 500, Bias: -3.476658, T: 1269085, Avg. loss: 1.934143
Total training time: 1.50 seconds.
-- Epoch 54
Norm: 12.72, NNZs: 500, Bias: -3.587656, T: 1293030, Avg. loss: 1.911355
Total training time: 1.53 seconds.
-- Epoch 55
Norm: 12.15, NNZs: 500, Bias: -3.127592, T: 1316975, Avg. loss: 1.893671
Total training time: 1.55 seconds.
-- Epoch 56
Norm: 12.40, NNZs: 500, Bias: -3.301570, T: 1340920, Avg. loss: 1.847528
Total training time: 1.58 seconds.
-- Epoch 57
Norm: 11.85, NNZs: 500, Bias: -2.986637, T: 1364865, Avg. loss: 1.814291
Total training time: 1.61 seconds.
-- Epoch 58
Norm: 11.83, NNZs: 500, Bias: -3.083254, T: 1388810, Avg. loss: 1.805263
Total training time: 1.64 seconds.
-- Epoch 59
Norm: 11.80, NNZs: 500, Bias: -2.930647, T: 1412755, Avg. loss: 1.735154
Total training time: 1.67 seconds.
-- Epoch 60
Norm: 11.50, NNZs: 500, Bias: -2.711027, T: 1436700, Avg. loss: 1.757127
Total training time: 1.70 seconds.
-- Epoch 61
Norm: 11.81, NNZs: 500, Bias: -2.794830, T: 1460645, Avg. loss: 1.678815
Total training time: 1.72 seconds.
-- Epoch 62
Norm: 11.40, NNZs: 500, Bias: -3.033541, T: 1484590, Avg. loss: 1.687068
Total training time: 1.75 seconds.
-- Epoch 63
Norm: 10.85, NNZs: 500, Bias: -2.767596, T: 1508535, Avg. loss: 1.672610
Total training time: 1.78 seconds.
-- Epoch 64
Norm: 10.94, NNZs: 500, Bias: -2.667469, T: 1532480, Avg. loss: 1.680428
Total training time: 1.81 seconds.
-- Epoch 65
Norm: 10.90, NNZs: 500, Bias: -2.410000, T: 1556425, Avg. loss: 1.649812
Total training time: 1.84 seconds.
-- Epoch 66
Norm: 10.72, NNZs: 500, Bias: -2.643922, T: 1580370, Avg. loss: 1.634374
Total training time: 1.86 seconds.
-- Epoch 67
Norm: 10.62, NNZs: 500, Bias: -2.442850, T: 1604315, Avg. loss: 1.582758
Total training time: 1.89 seconds.
-- Epoch 68
Norm: 10.40, NNZs: 500, Bias: -2.782097, T: 1628260, Avg. loss: 1.584792
Total training time: 1.92 seconds.
-- Epoch 69
Norm: 10.27, NNZs: 500, Bias: -2.130217, T: 1652205, Avg. loss: 1.546112
Total training time: 1.95 seconds.
-- Epoch 70
Norm: 10.12, NNZs: 500, Bias: -2.078562, T: 1676150, Avg. loss: 1.497066

Total training time: 1.98 seconds.
-- Epoch 71
Norm: 9.78, NNZs: 500, Bias: -2.360891, T: 1700095, Avg. loss: 1.524933
Total training time: 2.01 seconds.
-- Epoch 72
Norm: 10.04, NNZs: 500, Bias: -2.339363, T: 1724040, Avg. loss: 1.509215
Total training time: 2.03 seconds.
-- Epoch 73
Norm: 9.89, NNZs: 500, Bias: -2.266647, T: 1747985, Avg. loss: 1.518793
Total training time: 2.06 seconds.
-- Epoch 74
Norm: 9.62, NNZs: 500, Bias: -1.927163, T: 1771930, Avg. loss: 1.477366
Total training time: 2.09 seconds.
-- Epoch 75
Norm: 9.61, NNZs: 500, Bias: -2.060026, T: 1795875, Avg. loss: 1.412731
Total training time: 2.12 seconds.
-- Epoch 76
Norm: 9.04, NNZs: 500, Bias: -2.191510, T: 1819820, Avg. loss: 1.409524
Total training time: 2.15 seconds.
-- Epoch 77
Norm: 9.07, NNZs: 500, Bias: -2.201058, T: 1843765, Avg. loss: 1.438298
Total training time: 2.17 seconds.
-- Epoch 78
Norm: 8.96, NNZs: 500, Bias: -2.297522, T: 1867710, Avg. loss: 1.404135
Total training time: 2.20 seconds.
-- Epoch 79
Norm: 8.91, NNZs: 500, Bias: -2.470628, T: 1891655, Avg. loss: 1.418930
Total training time: 2.23 seconds.
-- Epoch 80
Norm: 9.51, NNZs: 500, Bias: -2.403506, T: 1915600, Avg. loss: 1.411521
Total training time: 2.26 seconds.
-- Epoch 81
Norm: 9.14, NNZs: 500, Bias: -2.290263, T: 1939545, Avg. loss: 1.371630
Total training time: 2.29 seconds.
-- Epoch 82
Norm: 8.81, NNZs: 500, Bias: -2.098975, T: 1963490, Avg. loss: 1.366333
Total training time: 2.32 seconds.
-- Epoch 83
Norm: 9.00, NNZs: 500, Bias: -2.147827, T: 1987435, Avg. loss: 1.371895
Total training time: 2.35 seconds.
-- Epoch 84
Norm: 8.47, NNZs: 500, Bias: -2.245180, T: 2011380, Avg. loss: 1.338994
Total training time: 2.37 seconds.
-- Epoch 85
Norm: 8.55, NNZs: 500, Bias: -2.250805, T: 2035325, Avg. loss: 1.307302
Total training time: 2.40 seconds.
-- Epoch 86
Norm: 8.56, NNZs: 500, Bias: -1.714780, T: 2059270, Avg. loss: 1.273492
Total training time: 2.43 seconds.
-- Epoch 87
Norm: 8.38, NNZs: 500, Bias: -1.826732, T: 2083215, Avg. loss: 1.298765
Total training time: 2.46 seconds.
-- Epoch 88
Norm: 8.34, NNZs: 500, Bias: -1.928877, T: 2107160, Avg. loss: 1.308877
Total training time: 2.49 seconds.
-- Epoch 89
Norm: 8.19, NNZs: 500, Bias: -2.034328, T: 2131105, Avg. loss: 1.298435

Total training time: 2.52 seconds.
-- Epoch 90
Norm: 8.11, NNZs: 500, Bias: -1.879219, T: 2155050, Avg. loss: 1.270229
Total training time: 2.55 seconds.
-- Epoch 91
Norm: 8.00, NNZs: 500, Bias: -2.034533, T: 2178995, Avg. loss: 1.256689
Total training time: 2.58 seconds.
-- Epoch 92
Norm: 8.03, NNZs: 500, Bias: -1.704572, T: 2202940, Avg. loss: 1.268909
Total training time: 2.61 seconds.
-- Epoch 93
Norm: 7.79, NNZs: 500, Bias: -1.785447, T: 2226885, Avg. loss: 1.210419
Total training time: 2.64 seconds.
-- Epoch 94
Norm: 7.92, NNZs: 500, Bias: -1.873840, T: 2250830, Avg. loss: 1.254168
Total training time: 2.67 seconds.
-- Epoch 95
Norm: 7.68, NNZs: 500, Bias: -1.732697, T: 2274775, Avg. loss: 1.210582
Total training time: 2.70 seconds.
-- Epoch 96
Norm: 7.55, NNZs: 500, Bias: -1.875389, T: 2298720, Avg. loss: 1.240223
Total training time: 2.72 seconds.
-- Epoch 97
Norm: 7.63, NNZs: 500, Bias: -1.820640, T: 2322665, Avg. loss: 1.219256
Total training time: 2.75 seconds.
-- Epoch 98
Norm: 7.75, NNZs: 500, Bias: -1.762070, T: 2346610, Avg. loss: 1.163934
Total training time: 2.78 seconds.
-- Epoch 99
Norm: 7.67, NNZs: 500, Bias: -1.931297, T: 2370555, Avg. loss: 1.217804
Total training time: 2.81 seconds.
-- Epoch 100
Norm: 7.56, NNZs: 500, Bias: -1.930658, T: 2394500, Avg. loss: 1.183603
Total training time: 2.84 seconds.
-- Epoch 101
Norm: 7.46, NNZs: 500, Bias: -2.009441, T: 2418445, Avg. loss: 1.147095
Total training time: 2.86 seconds.
-- Epoch 102
Norm: 7.14, NNZs: 500, Bias: -1.978521, T: 2442390, Avg. loss: 1.164870
Total training time: 2.90 seconds.
-- Epoch 103
Norm: 7.33, NNZs: 500, Bias: -1.929480, T: 2466335, Avg. loss: 1.150792
Total training time: 2.94 seconds.
-- Epoch 104
Norm: 7.08, NNZs: 500, Bias: -2.078304, T: 2490280, Avg. loss: 1.158581
Total training time: 2.96 seconds.
-- Epoch 105
Norm: 7.18, NNZs: 500, Bias: -1.922799, T: 2514225, Avg. loss: 1.132229
Total training time: 2.99 seconds.
-- Epoch 106
Norm: 7.01, NNZs: 500, Bias: -1.952613, T: 2538170, Avg. loss: 1.143472
Total training time: 3.02 seconds.
-- Epoch 107
Norm: 6.99, NNZs: 500, Bias: -1.825459, T: 2562115, Avg. loss: 1.152238
Total training time: 3.05 seconds.
-- Epoch 108
Norm: 7.04, NNZs: 500, Bias: -1.775878, T: 2586060, Avg. loss: 1.139459

Total training time: 3.08 seconds.
-- Epoch 109
Norm: 6.75, NNZs: 500, Bias: -1.720286, T: 2610005, Avg. loss: 1.129043
Total training time: 3.10 seconds.
-- Epoch 110
Norm: 6.79, NNZs: 500, Bias: -1.554790, T: 2633950, Avg. loss: 1.111418
Total training time: 3.13 seconds.
-- Epoch 111
Norm: 6.87, NNZs: 500, Bias: -1.595006, T: 2657895, Avg. loss: 1.102743
Total training time: 3.16 seconds.
-- Epoch 112
Norm: 7.02, NNZs: 500, Bias: -1.709202, T: 2681840, Avg. loss: 1.111070
Total training time: 3.19 seconds.
-- Epoch 113
Norm: 6.86, NNZs: 500, Bias: -1.780819, T: 2705785, Avg. loss: 1.081203
Total training time: 3.22 seconds.
-- Epoch 114
Norm: 6.59, NNZs: 500, Bias: -1.744116, T: 2729730, Avg. loss: 1.090997
Total training time: 3.25 seconds.
-- Epoch 115
Norm: 6.80, NNZs: 500, Bias: -1.675085, T: 2753675, Avg. loss: 1.068719
Total training time: 3.28 seconds.
-- Epoch 116
Norm: 6.80, NNZs: 500, Bias: -1.649471, T: 2777620, Avg. loss: 1.083439
Total training time: 3.30 seconds.
-- Epoch 117
Norm: 6.43, NNZs: 500, Bias: -1.648094, T: 2801565, Avg. loss: 1.057931
Total training time: 3.33 seconds.
-- Epoch 118
Norm: 6.65, NNZs: 500, Bias: -1.680975, T: 2825510, Avg. loss: 1.062821
Total training time: 3.36 seconds.
-- Epoch 119
Norm: 6.82, NNZs: 500, Bias: -1.656951, T: 2849455, Avg. loss: 1.053683
Total training time: 3.39 seconds.
-- Epoch 120
Norm: 6.62, NNZs: 500, Bias: -1.702634, T: 2873400, Avg. loss: 1.071324
Total training time: 3.42 seconds.
-- Epoch 121
Norm: 6.33, NNZs: 500, Bias: -1.614728, T: 2897345, Avg. loss: 1.050919
Total training time: 3.45 seconds.
-- Epoch 122
Norm: 6.43, NNZs: 500, Bias: -1.592089, T: 2921290, Avg. loss: 1.024225
Total training time: 3.47 seconds.
-- Epoch 123
Norm: 6.40, NNZs: 500, Bias: -1.506707, T: 2945235, Avg. loss: 1.008536
Total training time: 3.50 seconds.
-- Epoch 124
Norm: 6.51, NNZs: 500, Bias: -1.626933, T: 2969180, Avg. loss: 1.031084
Total training time: 3.53 seconds.
-- Epoch 125
Norm: 6.28, NNZs: 500, Bias: -1.685623, T: 2993125, Avg. loss: 1.036307
Total training time: 3.56 seconds.
-- Epoch 126
Norm: 6.28, NNZs: 500, Bias: -1.720728, T: 3017070, Avg. loss: 1.030847
Total training time: 3.59 seconds.
-- Epoch 127
Norm: 5.91, NNZs: 500, Bias: -1.629830, T: 3041015, Avg. loss: 1.019310


```
Total training time: 3.61 seconds.
-- Epoch 128
Norm: 6.09, NNZs: 500, Bias: -1.710055, T: 3064960, Avg. loss: 1.010167
Total training time: 3.64 seconds.
Convergence after 128 epochs took 3.65 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=0.001, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 59.74, NNZs: 500, Bias: -8.383417, T: 23945, Avg. loss: 34.026840
Total training time: 0.03 seconds.
-- Epoch 2
Norm: 30.99, NNZs: 500, Bias: -9.107700, T: 47890, Avg. loss: 5.995315
Total training time: 0.06 seconds.
-- Epoch 3
Norm: 21.70, NNZs: 500, Bias: -7.619750, T: 71835, Avg. loss: 3.631372
Total training time: 0.09 seconds.
-- Epoch 4
Norm: 16.08, NNZs: 500, Bias: -5.943324, T: 95780, Avg. loss: 2.726129
Total training time: 0.12 seconds.
-- Epoch 5
Norm: 13.67, NNZs: 500, Bias: -4.689475, T: 119725, Avg. loss: 2.156117
Total training time: 0.15 seconds.
-- Epoch 6
Norm: 11.75, NNZs: 500, Bias: -4.049188, T: 143670, Avg. loss: 1.884133
Total training time: 0.18 seconds.
-- Epoch 7
Norm: 10.23, NNZs: 500, Bias: -3.526607, T: 167615, Avg. loss: 1.636816
Total training time: 0.21 seconds.
-- Epoch 8
Norm: 9.08, NNZs: 500, Bias: -3.103747, T: 191560, Avg. loss: 1.461949
Total training time: 0.23 seconds.
-- Epoch 9
Norm: 8.13, NNZs: 500, Bias: -2.713701, T: 215505, Avg. loss: 1.319913
Total training time: 0.26 seconds.
-- Epoch 10
Norm: 7.42, NNZs: 500, Bias: -2.447038, T: 239450, Avg. loss: 1.224075
Total training time: 0.29 seconds.
-- Epoch 11
Norm: 6.95, NNZs: 500, Bias: -2.312584, T: 263395, Avg. loss: 1.171350
Total training time: 0.32 seconds.
-- Epoch 12
Norm: 6.62, NNZs: 500, Bias: -2.016308, T: 287340, Avg. loss: 1.083279
Total training time: 0.35 seconds.
-- Epoch 13
Norm: 6.02, NNZs: 500, Bias: -1.725409, T: 311285, Avg. loss: 1.011693
Total training time: 0.38 seconds.
-- Epoch 14
Norm: 5.80, NNZs: 500, Bias: -1.656272, T: 335230, Avg. loss: 0.971056
Total training time: 0.41 seconds.
```

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-- Epoch 15
Norm: 5.59, NNZs: 500, Bias: -1.556363, T: 359175, Avg. loss: 0.926923
Total training time: 0.43 seconds.
-- Epoch 16
Norm: 5.35, NNZs: 500, Bias: -1.462245, T: 383120, Avg. loss: 0.912460
Total training time: 0.46 seconds.
-- Epoch 17
Norm: 5.14, NNZs: 500, Bias: -1.483085, T: 407065, Avg. loss: 0.899634
Total training time: 0.49 seconds.
-- Epoch 18
Norm: 4.86, NNZs: 500, Bias: -1.437864, T: 431010, Avg. loss: 0.845686
Total training time: 0.52 seconds.
-- Epoch 19
Norm: 4.66, NNZs: 500, Bias: -1.411450, T: 454955, Avg. loss: 0.802191
Total training time: 0.55 seconds.
-- Epoch 20
Norm: 4.42, NNZs: 500, Bias: -1.386089, T: 478900, Avg. loss: 0.796546
Total training time: 0.58 seconds.
-- Epoch 21
Norm: 4.36, NNZs: 500, Bias: -1.277769, T: 502845, Avg. loss: 0.783742
Total training time: 0.60 seconds.
-- Epoch 22
Norm: 4.29, NNZs: 500, Bias: -1.185707, T: 526790, Avg. loss: 0.759092
Total training time: 0.63 seconds.
-- Epoch 23
Norm: 4.17, NNZs: 500, Bias: -1.174366, T: 550735, Avg. loss: 0.733905
Total training time: 0.66 seconds.
-- Epoch 24
Norm: 3.98, NNZs: 500, Bias: -1.094682, T: 574680, Avg. loss: 0.726123
Total training time: 0.69 seconds.
-- Epoch 25
Norm: 3.79, NNZs: 500, Bias: -1.084019, T: 598625, Avg. loss: 0.713619
Total training time: 0.72 seconds.
-- Epoch 26
Norm: 3.82, NNZs: 500, Bias: -1.028398, T: 622570, Avg. loss: 0.692685
Total training time: 0.75 seconds.
-- Epoch 27
Norm: 3.73, NNZs: 500, Bias: -1.086017, T: 646515, Avg. loss: 0.695263
Total training time: 0.78 seconds.
-- Epoch 28
Norm: 3.55, NNZs: 500, Bias: -1.086864, T: 670460, Avg. loss: 0.677442
Total training time: 0.80 seconds.
-- Epoch 29
Norm: 3.61, NNZs: 500, Bias: -1.006250, T: 694405, Avg. loss: 0.670248
Total training time: 0.83 seconds.
-- Epoch 30
Norm: 3.59, NNZs: 500, Bias: -1.070375, T: 718350, Avg. loss: 0.663343
Total training time: 0.86 seconds.
-- Epoch 31
Norm: 3.41, NNZs: 500, Bias: -1.047225, T: 742295, Avg. loss: 0.644766
Total training time: 0.89 seconds.
-- Epoch 32
Norm: 3.39, NNZs: 500, Bias: -0.989795, T: 766240, Avg. loss: 0.639176
Total training time: 0.92 seconds.
-- Epoch 33
Norm: 3.29, NNZs: 500, Bias: -0.975468, T: 790185, Avg. loss: 0.630854
Total training time: 0.95 seconds.
```

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-- Epoch 34
Norm: 3.25, NNZs: 500, Bias: -0.995306, T: 814130, Avg. loss: 0.616541
Total training time: 0.98 seconds.
-- Epoch 35
Norm: 3.21, NNZs: 500, Bias: -1.023581, T: 838075, Avg. loss: 0.618526
Total training time: 1.01 seconds.
-- Epoch 36
Norm: 3.13, NNZs: 500, Bias: -0.960855, T: 862020, Avg. loss: 0.610345
Total training time: 1.03 seconds.
-- Epoch 37
Norm: 3.17, NNZs: 500, Bias: -0.963074, T: 885965, Avg. loss: 0.600771
Total training time: 1.06 seconds.
-- Epoch 38
Norm: 3.04, NNZs: 500, Bias: -1.009022, T: 909910, Avg. loss: 0.603343
Total training time: 1.09 seconds.
-- Epoch 39
Norm: 3.02, NNZs: 500, Bias: -0.967351, T: 933855, Avg. loss: 0.602408
Total training time: 1.12 seconds.
-- Epoch 40
Norm: 3.01, NNZs: 500, Bias: -0.970845, T: 957800, Avg. loss: 0.593852
Total training time: 1.15 seconds.
-- Epoch 41
Norm: 2.97, NNZs: 500, Bias: -0.952928, T: 981745, Avg. loss: 0.589565
Total training time: 1.18 seconds.
-- Epoch 42
Norm: 2.97, NNZs: 500, Bias: -0.889310, T: 1005690, Avg. loss: 0.579245
Total training time: 1.21 seconds.
-- Epoch 43
Norm: 2.96, NNZs: 500, Bias: -0.911350, T: 1029635, Avg. loss: 0.582806
Total training time: 1.24 seconds.
-- Epoch 44
Norm: 2.93, NNZs: 500, Bias: -0.921630, T: 1053580, Avg. loss: 0.572206
Total training time: 1.27 seconds.
-- Epoch 45
Norm: 2.84, NNZs: 500, Bias: -0.907739, T: 1077525, Avg. loss: 0.577348
Total training time: 1.30 seconds.
-- Epoch 46
Norm: 2.88, NNZs: 500, Bias: -0.893200, T: 1101470, Avg. loss: 0.563345
Total training time: 1.33 seconds.
-- Epoch 47
Norm: 2.75, NNZs: 500, Bias: -0.906137, T: 1125415, Avg. loss: 0.566122
Total training time: 1.36 seconds.
-- Epoch 48
Norm: 2.78, NNZs: 500, Bias: -0.903109, T: 1149360, Avg. loss: 0.555319
Total training time: 1.38 seconds.
-- Epoch 49
Norm: 2.84, NNZs: 500, Bias: -0.869910, T: 1173305, Avg. loss: 0.553307
Total training time: 1.41 seconds.
-- Epoch 50
Norm: 2.76, NNZs: 500, Bias: -0.915984, T: 1197250, Avg. loss: 0.558654
Total training time: 1.44 seconds.
-- Epoch 51
Norm: 2.74, NNZs: 500, Bias: -0.856052, T: 1221195, Avg. loss: 0.553407
Total training time: 1.47 seconds.
-- Epoch 52
Norm: 2.69, NNZs: 500, Bias: -0.829812, T: 1245140, Avg. loss: 0.544347
Total training time: 1.50 seconds.
```

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-- Epoch 53
Norm: 2.66, NNZs: 500, Bias: -0.845748, T: 1269085, Avg. loss: 0.539115
Total training time: 1.53 seconds.
-- Epoch 54
Norm: 2.66, NNZs: 500, Bias: -0.839300, T: 1293030, Avg. loss: 0.532114
Total training time: 1.56 seconds.
-- Epoch 55
Norm: 2.62, NNZs: 500, Bias: -0.839241, T: 1316975, Avg. loss: 0.538031
Total training time: 1.59 seconds.
-- Epoch 56
Norm: 2.61, NNZs: 500, Bias: -0.845173, T: 1340920, Avg. loss: 0.533409
Total training time: 1.62 seconds.
-- Epoch 57
Norm: 2.59, NNZs: 500, Bias: -0.808396, T: 1364865, Avg. loss: 0.535567
Total training time: 1.65 seconds.
-- Epoch 58
Norm: 2.55, NNZs: 500, Bias: -0.814741, T: 1388810, Avg. loss: 0.534857
Total training time: 1.68 seconds.
-- Epoch 59
Norm: 2.54, NNZs: 500, Bias: -0.822143, T: 1412755, Avg. loss: 0.521183
Total training time: 1.71 seconds.
-- Epoch 60
Norm: 2.54, NNZs: 500, Bias: -0.800528, T: 1436700, Avg. loss: 0.527233
Total training time: 1.73 seconds.
-- Epoch 61
Norm: 2.55, NNZs: 500, Bias: -0.767926, T: 1460645, Avg. loss: 0.529724
Total training time: 1.76 seconds.
-- Epoch 62
Norm: 2.54, NNZs: 500, Bias: -0.789760, T: 1484590, Avg. loss: 0.525065
Total training time: 1.79 seconds.
-- Epoch 63
Norm: 2.51, NNZs: 500, Bias: -0.792576, T: 1508535, Avg. loss: 0.527212
Total training time: 1.82 seconds.
-- Epoch 64
Norm: 2.51, NNZs: 500, Bias: -0.778260, T: 1532480, Avg. loss: 0.520921
Total training time: 1.85 seconds.
Convergence after 64 epochs took 1.85 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=0.01, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 6.93, NNZs: 500, Bias: -3.505599, T: 23945, Avg. loss: 4.587546
Total training time: 0.03 seconds.
-- Epoch 2
Norm: 4.29, NNZs: 500, Bias: -2.623607, T: 47890, Avg. loss: 0.948162
Total training time: 0.06 seconds.
-- Epoch 3
Norm: 3.41, NNZs: 500, Bias: -2.055132, T: 71835, Avg. loss: 0.721103
Total training time: 0.09 seconds.
-- Epoch 4
```

Norm: 2.94, NNZs: 500, Bias: -1.669219, T: 95780, Avg. loss: 0.628767
Total training time: 0.13 seconds.
-- Epoch 5
Norm: 2.64, NNZs: 500, Bias: -1.392301, T: 119725, Avg. loss: 0.570793
Total training time: 0.16 seconds.
-- Epoch 6
Norm: 2.43, NNZs: 500, Bias: -1.201521, T: 143670, Avg. loss: 0.544523
Total training time: 0.18 seconds.
-- Epoch 7
Norm: 2.30, NNZs: 500, Bias: -1.057064, T: 167615, Avg. loss: 0.516366
Total training time: 0.21 seconds.
-- Epoch 8
Norm: 2.19, NNZs: 500, Bias: -0.979719, T: 191560, Avg. loss: 0.508194
Total training time: 0.24 seconds.
-- Epoch 9
Norm: 2.14, NNZs: 500, Bias: -0.906709, T: 215505, Avg. loss: 0.491594
Total training time: 0.27 seconds.
-- Epoch 10
Norm: 2.04, NNZs: 500, Bias: -0.848993, T: 239450, Avg. loss: 0.482487
Total training time: 0.30 seconds.
-- Epoch 11
Norm: 2.00, NNZs: 500, Bias: -0.811032, T: 263395, Avg. loss: 0.474561
Total training time: 0.33 seconds.
-- Epoch 12
Norm: 1.97, NNZs: 500, Bias: -0.767827, T: 287340, Avg. loss: 0.469813
Total training time: 0.36 seconds.
-- Epoch 13
Norm: 1.94, NNZs: 500, Bias: -0.740570, T: 311285, Avg. loss: 0.457302
Total training time: 0.39 seconds.
-- Epoch 14
Norm: 1.90, NNZs: 500, Bias: -0.711970, T: 335230, Avg. loss: 0.459215
Total training time: 0.42 seconds.
-- Epoch 15
Norm: 1.88, NNZs: 500, Bias: -0.702518, T: 359175, Avg. loss: 0.451029
Total training time: 0.45 seconds.
-- Epoch 16
Norm: 1.87, NNZs: 500, Bias: -0.681996, T: 383120, Avg. loss: 0.450079
Total training time: 0.48 seconds.
-- Epoch 17
Norm: 1.84, NNZs: 500, Bias: -0.671221, T: 407065, Avg. loss: 0.447881
Total training time: 0.51 seconds.
-- Epoch 18
Norm: 1.82, NNZs: 500, Bias: -0.654161, T: 431010, Avg. loss: 0.444216
Total training time: 0.54 seconds.
-- Epoch 19
Norm: 1.80, NNZs: 500, Bias: -0.645634, T: 454955, Avg. loss: 0.435731
Total training time: 0.57 seconds.
-- Epoch 20
Norm: 1.77, NNZs: 500, Bias: -0.648040, T: 478900, Avg. loss: 0.432817
Total training time: 0.60 seconds.
-- Epoch 21
Norm: 1.76, NNZs: 500, Bias: -0.638466, T: 502845, Avg. loss: 0.435722
Total training time: 0.64 seconds.
-- Epoch 22
Norm: 1.76, NNZs: 500, Bias: -0.615216, T: 526790, Avg. loss: 0.434396
Total training time: 0.67 seconds.
-- Epoch 23

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Norm: 1.76, NNZs: 500, Bias: -0.611339, T: 550735, Avg. loss: 0.434247
Total training time: 0.69 seconds.
-- Epoch 24
Norm: 1.75, NNZs: 500, Bias: -0.605584, T: 574680, Avg. loss: 0.433790
Total training time: 0.72 seconds.
-- Epoch 25
Norm: 1.74, NNZs: 500, Bias: -0.591341, T: 598625, Avg. loss: 0.433582
Total training time: 0.75 seconds.
Convergence after 25 epochs took 0.75 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=0.1, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 1.74, NNZs: 500, Bias: -2.361376, T: 23945, Avg. loss: 0.959001
Total training time: 0.03 seconds.
-- Epoch 2
Norm: 1.50, NNZs: 500, Bias: -1.959025, T: 47890, Avg. loss: 0.515356
Total training time: 0.07 seconds.
-- Epoch 3
Norm: 1.43, NNZs: 500, Bias: -1.734384, T: 71835, Avg. loss: 0.487691
Total training time: 0.10 seconds.
-- Epoch 4
Norm: 1.38, NNZs: 500, Bias: -1.593686, T: 95780, Avg. loss: 0.469984
Total training time: 0.14 seconds.
-- Epoch 5
Norm: 1.35, NNZs: 500, Bias: -1.490484, T: 119725, Avg. loss: 0.461116
Total training time: 0.17 seconds.
-- Epoch 6
Norm: 1.34, NNZs: 500, Bias: -1.405033, T: 143670, Avg. loss: 0.459052
Total training time: 0.20 seconds.
-- Epoch 7
Norm: 1.32, NNZs: 500, Bias: -1.342093, T: 167615, Avg. loss: 0.449054
Total training time: 0.23 seconds.
-- Epoch 8
Norm: 1.30, NNZs: 500, Bias: -1.292075, T: 191560, Avg. loss: 0.445516
Total training time: 0.26 seconds.
-- Epoch 9
Norm: 1.29, NNZs: 500, Bias: -1.241765, T: 215505, Avg. loss: 0.444399
Total training time: 0.29 seconds.
-- Epoch 10
Norm: 1.29, NNZs: 500, Bias: -1.200749, T: 239450, Avg. loss: 0.444648
Total training time: 0.32 seconds.
-- Epoch 11
Norm: 1.28, NNZs: 500, Bias: -1.167044, T: 263395, Avg. loss: 0.440076
Total training time: 0.36 seconds.
-- Epoch 12
Norm: 1.27, NNZs: 500, Bias: -1.138202, T: 287340, Avg. loss: 0.438036
Total training time: 0.39 seconds.
-- Epoch 13
Norm: 1.26, NNZs: 500, Bias: -1.112673, T: 311285, Avg. loss: 0.436257
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Total training time: 0.42 seconds.
-- Epoch 14
Norm: 1.26, NNZs: 500, Bias: -1.083923, T: 335230, Avg. loss: 0.437059
Total training time: 0.45 seconds.
-- Epoch 15
Norm: 1.26, NNZs: 500, Bias: -1.065246, T: 359175, Avg. loss: 0.433475
Total training time: 0.48 seconds.
-- Epoch 16
Norm: 1.25, NNZs: 500, Bias: -1.043154, T: 383120, Avg. loss: 0.434661
Total training time: 0.51 seconds.
-- Epoch 17
Norm: 1.25, NNZs: 500, Bias: -1.025221, T: 407065, Avg. loss: 0.431363
Total training time: 0.54 seconds.
-- Epoch 18
Norm: 1.25, NNZs: 500, Bias: -1.007061, T: 431010, Avg. loss: 0.431592
Total training time: 0.57 seconds.
-- Epoch 19
Norm: 1.24, NNZs: 500, Bias: -0.992000, T: 454955, Avg. loss: 0.430948
Total training time: 0.60 seconds.
-- Epoch 20
Norm: 1.24, NNZs: 500, Bias: -0.978238, T: 478900, Avg. loss: 0.428192
Total training time: 0.64 seconds.
-- Epoch 21
Norm: 1.24, NNZs: 500, Bias: -0.965309, T: 502845, Avg. loss: 0.427600
Total training time: 0.67 seconds.
-- Epoch 22
Norm: 1.24, NNZs: 500, Bias: -0.951067, T: 526790, Avg. loss: 0.429986
Total training time: 0.70 seconds.
-- Epoch 23
Norm: 1.23, NNZs: 500, Bias: -0.940104, T: 550735, Avg. loss: 0.428849
Total training time: 0.73 seconds.
-- Epoch 24
Norm: 1.23, NNZs: 500, Bias: -0.930660, T: 574680, Avg. loss: 0.425720
Total training time: 0.76 seconds.
-- Epoch 25
Norm: 1.23, NNZs: 500, Bias: -0.917040, T: 598625, Avg. loss: 0.430321
Total training time: 0.79 seconds.
-- Epoch 26
Norm: 1.23, NNZs: 500, Bias: -0.908307, T: 622570, Avg. loss: 0.424613
Total training time: 0.82 seconds.
-- Epoch 27
Norm: 1.23, NNZs: 500, Bias: -0.898040, T: 646515, Avg. loss: 0.427622
Total training time: 0.85 seconds.
-- Epoch 28
Norm: 1.22, NNZs: 500, Bias: -0.890337, T: 670460, Avg. loss: 0.424358
Total training time: 0.89 seconds.
-- Epoch 29
Norm: 1.22, NNZs: 500, Bias: -0.881223, T: 694405, Avg. loss: 0.426511
Total training time: 0.92 seconds.
-- Epoch 30
Norm: 1.22, NNZs: 500, Bias: -0.873474, T: 718350, Avg. loss: 0.425017
Total training time: 0.95 seconds.
-- Epoch 31
Norm: 1.22, NNZs: 500, Bias: -0.866203, T: 742295, Avg. loss: 0.423993
Total training time: 0.98 seconds.
Convergence after 31 epochs took 0.98 seconds
Fitting probability generation and roc auc score generation for training da
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ta complete...

Fitting probability generation and roc auc score generation for validation data complete...

```
SGDClassifier(alpha=1.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
```

-- Epoch 1

Norm: 0.65, NNZs: 500, Bias: -0.468336, T: 23945, Avg. loss: 0.595523

Total training time: 0.04 seconds.

-- Epoch 2

Norm: 0.64, NNZs: 500, Bias: -0.422790, T: 47890, Avg. loss: 0.535058

Total training time: 0.08 seconds.

-- Epoch 3

Norm: 0.64, NNZs: 500, Bias: -0.396170, T: 71835, Avg. loss: 0.532602

Total training time: 0.12 seconds.

-- Epoch 4

Norm: 0.64, NNZs: 500, Bias: -0.379324, T: 95780, Avg. loss: 0.528621

Total training time: 0.15 seconds.

-- Epoch 5

Norm: 0.64, NNZs: 500, Bias: -0.367295, T: 119725, Avg. loss: 0.522542

Total training time: 0.19 seconds.

-- Epoch 6

Norm: 0.63, NNZs: 500, Bias: -0.357515, T: 143670, Avg. loss: 0.522530

Total training time: 0.22 seconds.

-- Epoch 7

Norm: 0.63, NNZs: 500, Bias: -0.348387, T: 167615, Avg. loss: 0.525352

Total training time: 0.26 seconds.

-- Epoch 8

Norm: 0.63, NNZs: 500, Bias: -0.341380, T: 191560, Avg. loss: 0.520744

Total training time: 0.30 seconds.

-- Epoch 9

Norm: 0.63, NNZs: 500, Bias: -0.334456, T: 215505, Avg. loss: 0.522771

Total training time: 0.33 seconds.

-- Epoch 10

Norm: 0.63, NNZs: 500, Bias: -0.328243, T: 239450, Avg. loss: 0.522917

Total training time: 0.37 seconds.

-- Epoch 11

Norm: 0.63, NNZs: 500, Bias: -0.323335, T: 263395, Avg. loss: 0.520269

Total training time: 0.40 seconds.

-- Epoch 12

Norm: 0.63, NNZs: 500, Bias: -0.318831, T: 287340, Avg. loss: 0.520501

Total training time: 0.44 seconds.

-- Epoch 13

Norm: 0.63, NNZs: 500, Bias: -0.314755, T: 311285, Avg. loss: 0.519249

Total training time: 0.47 seconds.

-- Epoch 14

Norm: 0.63, NNZs: 500, Bias: -0.310429, T: 335230, Avg. loss: 0.521646

Total training time: 0.51 seconds.

-- Epoch 15

Norm: 0.63, NNZs: 500, Bias: -0.307126, T: 359175, Avg. loss: 0.518405

Total training time: 0.54 seconds.

-- Epoch 16

Norm: 0.63, NNZs: 500, Bias: -0.303943, T: 383120, Avg. loss: 0.518308

Total training time: 0.58 seconds.


```

-- Epoch 17
Norm: 0.63, NNZs: 500, Bias: -0.300717, T: 407065, Avg. loss: 0.519407
Total training time: 0.61 seconds.
-- Epoch 18
Norm: 0.63, NNZs: 500, Bias: -0.297728, T: 431010, Avg. loss: 0.519232
Total training time: 0.65 seconds.
Convergence after 18 epochs took 0.65 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=10.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.19, NNZs: 500, Bias: 0.235109, T: 23945, Avg. loss: 0.780061
Total training time: 0.04 seconds.
-- Epoch 2
Norm: 0.19, NNZs: 500, Bias: 0.235331, T: 47890, Avg. loss: 0.762380
Total training time: 0.08 seconds.
-- Epoch 3
Norm: 0.19, NNZs: 500, Bias: 0.235322, T: 71835, Avg. loss: 0.766643
Total training time: 0.12 seconds.
-- Epoch 4
Norm: 0.19, NNZs: 500, Bias: 0.235335, T: 95780, Avg. loss: 0.766264
Total training time: 0.17 seconds.
-- Epoch 5
Norm: 0.19, NNZs: 500, Bias: 0.235366, T: 119725, Avg. loss: 0.765099
Total training time: 0.21 seconds.
-- Epoch 6
Norm: 0.19, NNZs: 500, Bias: 0.235415, T: 143670, Avg. loss: 0.763474
Total training time: 0.25 seconds.
-- Epoch 7
Norm: 0.19, NNZs: 500, Bias: 0.235447, T: 167615, Avg. loss: 0.764296
Total training time: 0.29 seconds.
Convergence after 7 epochs took 0.29 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=100.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.02, NNZs: 500, Bias: 0.269374, T: 23945, Avg. loss: 0.813498
Total training time: 0.04 seconds.
-- Epoch 2
Norm: 0.02, NNZs: 500, Bias: 0.269381, T: 47890, Avg. loss: 0.810966
Total training time: 0.08 seconds.
-- Epoch 3
Norm: 0.02, NNZs: 500, Bias: 0.269371, T: 71835, Avg. loss: 0.811302

```

```

Total training time: 0.12 seconds.
-- Epoch 4
Norm: 0.02, NNZs: 500, Bias: 0.269364, T: 95780, Avg. loss: 0.811255
Total training time: 0.17 seconds.
-- Epoch 5
Norm: 0.02, NNZs: 500, Bias: 0.269361, T: 119725, Avg. loss: 0.811132
Total training time: 0.21 seconds.
-- Epoch 6
Norm: 0.02, NNZs: 500, Bias: 0.269362, T: 143670, Avg. loss: 0.810956
Total training time: 0.25 seconds.
-- Epoch 7
Norm: 0.02, NNZs: 500, Bias: 0.269361, T: 167615, Avg. loss: 0.811034
Total training time: 0.29 seconds.
Convergence after 7 epochs took 0.29 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=1000.0, average=False, class_weight={0: 5.14, 1: 1},
               early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
               l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
               n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
               power_t=0.5, random_state=42, shuffle=True, tol=0.001,
               validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 500, Bias: 0.173106, T: 23945, Avg. loss: 0.882794
Total training time: 0.04 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 500, Bias: 0.173106, T: 47890, Avg. loss: 0.882567
Total training time: 0.08 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 500, Bias: 0.173105, T: 71835, Avg. loss: 0.882600
Total training time: 0.13 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 500, Bias: 0.173105, T: 95780, Avg. loss: 0.882595
Total training time: 0.17 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 500, Bias: 0.173104, T: 119725, Avg. loss: 0.882583
Total training time: 0.21 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 500, Bias: 0.173104, T: 143670, Avg. loss: 0.882565
Total training time: 0.25 seconds.
Convergence after 6 epochs took 0.25 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=10000.0, average=False, class_weight={0: 5.14, 1: 1},
               early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
               l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
               n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
               power_t=0.5, random_state=42, shuffle=True, tol=0.001,
               validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 500, Bias: 0.099527, T: 23945, Avg. loss: 0.932828
Total training time: 0.04 seconds.
-- Epoch 2

```

```

Norm: 0.00, NNZs: 500, Bias: 0.099527, T: 47890, Avg. loss: 0.932836
Total training time: 0.09 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 500, Bias: 0.099527, T: 71835, Avg. loss: 0.932839
Total training time: 0.13 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 500, Bias: 0.099527, T: 95780, Avg. loss: 0.932838
Total training time: 0.17 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 500, Bias: 0.099527, T: 119725, Avg. loss: 0.932837
Total training time: 0.21 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 500, Bias: 0.099527, T: 143670, Avg. loss: 0.932835
Total training time: 0.25 seconds.
Convergence after 6 epochs took 0.25 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=100000.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 500, Bias: 0.056197, T: 23945, Avg. loss: 0.962085
Total training time: 0.04 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 500, Bias: 0.056197, T: 47890, Avg. loss: 0.962111
Total training time: 0.09 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 500, Bias: 0.056197, T: 71835, Avg. loss: 0.962111
Total training time: 0.13 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 500, Bias: 0.056197, T: 95780, Avg. loss: 0.962111
Total training time: 0.17 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 500, Bias: 0.056197, T: 119725, Avg. loss: 0.962111
Total training time: 0.21 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 500, Bias: 0.056197, T: 143670, Avg. loss: 0.962111
Total training time: 0.25 seconds.
Convergence after 6 epochs took 0.25 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=1000000.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 500, Bias: 0.031619, T: 23945, Avg. loss: 0.978670
Total training time: 0.04 seconds.

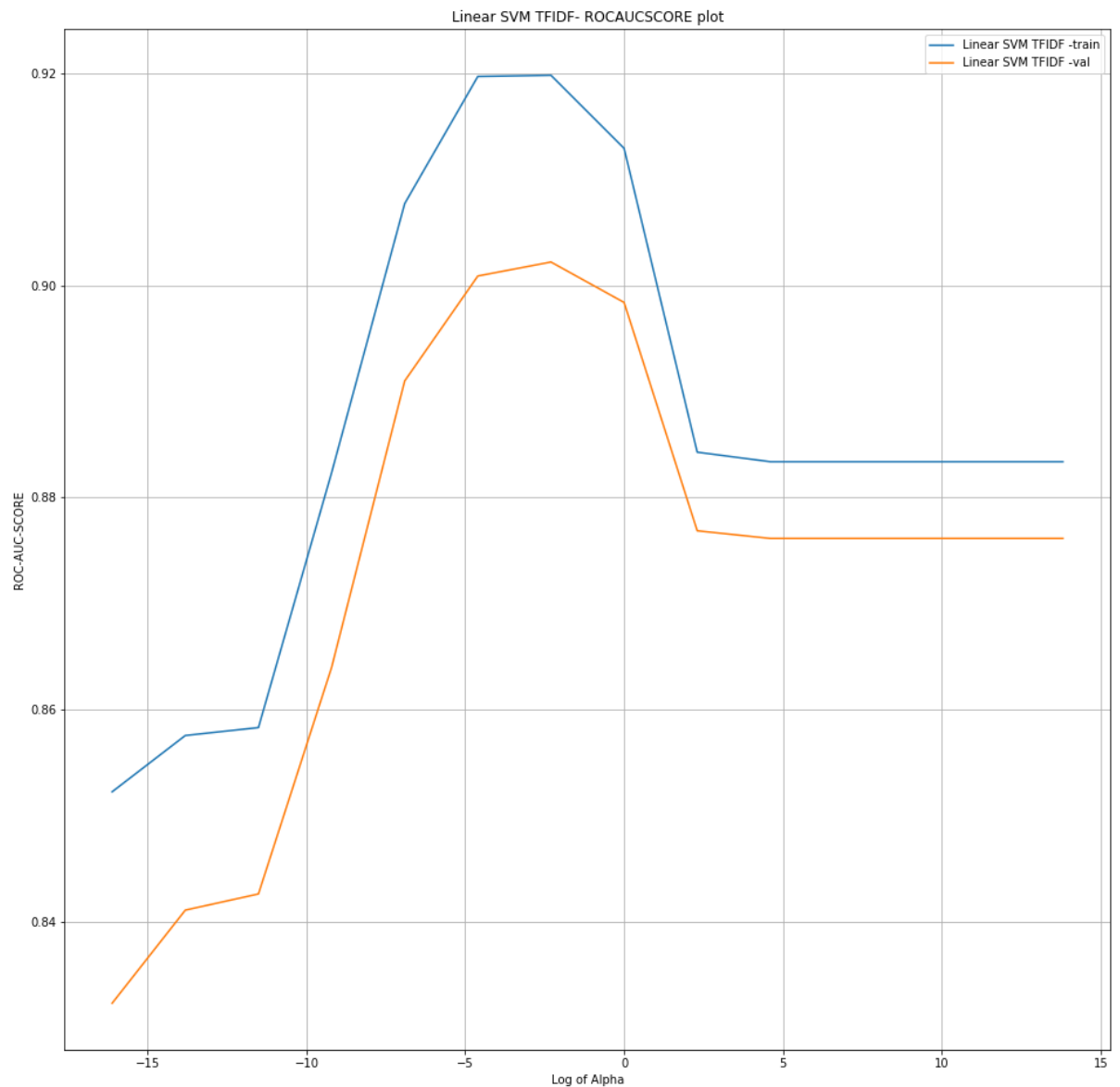
```

```
-- Epoch 2
Norm: 0.00, NNZs: 500, Bias: 0.031619, T: 47890, Avg. loss: 0.978685
Total training time: 0.08 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 500, Bias: 0.031619, T: 71835, Avg. loss: 0.978685
Total training time: 0.13 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 500, Bias: 0.031619, T: 95780, Avg. loss: 0.978685
Total training time: 0.17 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 500, Bias: 0.031619, T: 119725, Avg. loss: 0.978685
Total training time: 0.21 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 500, Bias: 0.031619, T: 143670, Avg. loss: 0.978685
Total training time: 0.25 seconds.
Convergence after 6 epochs took 0.25 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
Function exiting...
```

```
In [22]: print(lnrsvm_tidf.rocaucscoretrn)
print(lnrsvm_tidf.rocaucscoreval)
print(lnrsvm_tidf.SVM_alpha)

[0.8522283382373208, 0.8575372214219182, 0.8582824285551314, 0.882318641522
4694, 0.9077156397190429, 0.9197094839125097, 0.9198184372589194, 0.9129229
601257348, 0.884261657784303, 0.8833642663148653, 0.8833642535284147, 0.883
3642535284147, 0.8833653659496254, 0.8833653659496254]
[0.8322837568596146, 0.8410622568029475, 0.8425883722037985, 0.863950497440
1175, 0.8909857149192614, 0.9008835988482582, 0.9022011129781199, 0.8983869
537151558, 0.8768494884341272, 0.8761251328395889, 0.8761253381558004, 0.87
61253381558004, 0.8761259541044354, 0.8761259541044354]
[1e-07, 1e-06, 9.999999999999999e-06, 9.999999999999999e-05, 0.001, 0.01,
0.1, 1.0, 10.0, 100.0, 1000.0, 10000.0, 100000.0, 1000000.0]
```

```
In [28]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='Linear SVM TFIDF- ROCAUCSCORE plot'
displaygraph.legnd_1 = 'Linear SVM TFIDF -train'
displaygraph.legnd_2 = 'Linear SVM TFIDF -val'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='Log of Alpha'
displaygraph.label_y='ROC-AUC-SCORE'
displaygraph.Xdata = lnrsvm_tfidf.SVM_alpha
displaygraph.ydatatrn = lnrsvm_tfidf.rocaucscoretrn
displaygraph.ydataval = lnrsvm_tfidf.rocaucscoreval
displaygraph.rocacscoregraph()
```



```
In [58]: lnrsvm_tidf.SVM_actualClasifier(0.01)
```

```
-- Epoch 1
Norm: 33.32, NNZs: 500, Bias: -86.744240, T: 23945, Avg. loss: 37.217504
Total training time: 0.03 seconds.
-- Epoch 2
Norm: 26.96, NNZs: 500, Bias: -75.625871, T: 47890, Avg. loss: 10.610571
Total training time: 0.07 seconds.
-- Epoch 3
Norm: 24.72, NNZs: 500, Bias: -68.708731, T: 71835, Avg. loss: 8.656406
Total training time: 0.10 seconds.
-- Epoch 4
Norm: 22.90, NNZs: 500, Bias: -63.958557, T: 95780, Avg. loss: 7.622002
Total training time: 0.13 seconds.
-- Epoch 5
Norm: 22.01, NNZs: 500, Bias: -60.221799, T: 119725, Avg. loss: 7.038346
Total training time: 0.17 seconds.
-- Epoch 6
Norm: 20.62, NNZs: 500, Bias: -57.446239, T: 143670, Avg. loss: 6.530150
Total training time: 0.20 seconds.
-- Epoch 7
Norm: 19.94, NNZs: 500, Bias: -54.971734, T: 167615, Avg. loss: 6.213746
Total training time: 0.23 seconds.
-- Epoch 8
Norm: 19.37, NNZs: 500, Bias: -52.838291, T: 191560, Avg. loss: 5.852129
Total training time: 0.27 seconds.
-- Epoch 9
Norm: 18.82, NNZs: 500, Bias: -50.996802, T: 215505, Avg. loss: 5.659253
Total training time: 0.30 seconds.
-- Epoch 10
Norm: 18.38, NNZs: 500, Bias: -49.345037, T: 239450, Avg. loss: 5.375201
Total training time: 0.34 seconds.
-- Epoch 11
Norm: 17.78, NNZs: 500, Bias: -47.952971, T: 263395, Avg. loss: 5.174473
Total training time: 0.37 seconds.
-- Epoch 12
Norm: 17.25, NNZs: 500, Bias: -46.683760, T: 287340, Avg. loss: 5.012655
Total training time: 0.40 seconds.
-- Epoch 13
Norm: 16.81, NNZs: 500, Bias: -45.507606, T: 311285, Avg. loss: 4.900051
Total training time: 0.44 seconds.
-- Epoch 14
Norm: 16.60, NNZs: 500, Bias: -44.350403, T: 335230, Avg. loss: 4.730517
Total training time: 0.47 seconds.
-- Epoch 15
Norm: 16.31, NNZs: 500, Bias: -43.326343, T: 359175, Avg. loss: 4.708837
Total training time: 0.50 seconds.
-- Epoch 16
Norm: 15.97, NNZs: 500, Bias: -42.396246, T: 383120, Avg. loss: 4.580065
Total training time: 0.53 seconds.
-- Epoch 17
Norm: 15.70, NNZs: 500, Bias: -41.507008, T: 407065, Avg. loss: 4.464911
Total training time: 0.56 seconds.
-- Epoch 18
Norm: 15.40, NNZs: 500, Bias: -40.695921, T: 431010, Avg. loss: 4.374113
Total training time: 0.60 seconds.
-- Epoch 19
Norm: 15.11, NNZs: 500, Bias: -39.936941, T: 454955, Avg. loss: 4.316660
Total training time: 0.63 seconds.
```

```
-- Epoch 20
Norm: 14.81, NNZs: 500, Bias: -39.232001, T: 478900, Avg. loss: 4.211784
Total training time: 0.67 seconds.
-- Epoch 21
Norm: 14.70, NNZs: 500, Bias: -38.493151, T: 502845, Avg. loss: 4.120529
Total training time: 0.70 seconds.
-- Epoch 22
Norm: 14.50, NNZs: 500, Bias: -37.832769, T: 526790, Avg. loss: 4.064330
Total training time: 0.73 seconds.
-- Epoch 23
Norm: 14.29, NNZs: 500, Bias: -37.207498, T: 550735, Avg. loss: 3.988483
Total training time: 0.76 seconds.
-- Epoch 24
Norm: 14.11, NNZs: 500, Bias: -36.612375, T: 574680, Avg. loss: 3.957774
Total training time: 0.80 seconds.
-- Epoch 25
Norm: 13.94, NNZs: 500, Bias: -36.037513, T: 598625, Avg. loss: 3.918740
Total training time: 0.84 seconds.
-- Epoch 26
Norm: 13.68, NNZs: 500, Bias: -35.527122, T: 622570, Avg. loss: 3.802791
Total training time: 0.87 seconds.
-- Epoch 27
Norm: 13.65, NNZs: 500, Bias: -34.953174, T: 646515, Avg. loss: 3.783648
Total training time: 0.90 seconds.
-- Epoch 28
Norm: 13.37, NNZs: 500, Bias: -34.503447, T: 670460, Avg. loss: 3.679027
Total training time: 0.93 seconds.
-- Epoch 29
Norm: 13.22, NNZs: 500, Bias: -34.018078, T: 694405, Avg. loss: 3.647050
Total training time: 0.97 seconds.
-- Epoch 30
Norm: 13.02, NNZs: 500, Bias: -33.574896, T: 718350, Avg. loss: 3.597009
Total training time: 1.00 seconds.
-- Epoch 31
Norm: 12.91, NNZs: 500, Bias: -33.115129, T: 742295, Avg. loss: 3.573682
Total training time: 1.03 seconds.
-- Epoch 32
Norm: 12.78, NNZs: 500, Bias: -32.683674, T: 766240, Avg. loss: 3.545396
Total training time: 1.07 seconds.
-- Epoch 33
Norm: 12.66, NNZs: 500, Bias: -32.261323, T: 790185, Avg. loss: 3.485110
Total training time: 1.10 seconds.
-- Epoch 34
Norm: 12.46, NNZs: 500, Bias: -31.890582, T: 814130, Avg. loss: 3.450918
Total training time: 1.13 seconds.
-- Epoch 35
Norm: 12.33, NNZs: 500, Bias: -31.502414, T: 838075, Avg. loss: 3.402257
Total training time: 1.17 seconds.
-- Epoch 36
Norm: 12.25, NNZs: 500, Bias: -31.111571, T: 862020, Avg. loss: 3.346610
Total training time: 1.20 seconds.
-- Epoch 37
Norm: 12.11, NNZs: 500, Bias: -30.755795, T: 885965, Avg. loss: 3.312700
Total training time: 1.23 seconds.
-- Epoch 38
Norm: 11.98, NNZs: 500, Bias: -30.410340, T: 909910, Avg. loss: 3.295161
Total training time: 1.27 seconds.
```



```
-- Epoch 39
Norm: 11.93, NNZs: 500, Bias: -30.040458, T: 933855, Avg. loss: 3.242713
Total training time: 1.30 seconds.
-- Epoch 40
Norm: 11.79, NNZs: 500, Bias: -29.716807, T: 957800, Avg. loss: 3.234980
Total training time: 1.34 seconds.
-- Epoch 41
Norm: 11.64, NNZs: 500, Bias: -29.411095, T: 981745, Avg. loss: 3.198322
Total training time: 1.37 seconds.
-- Epoch 42
Norm: 11.54, NNZs: 500, Bias: -29.096110, T: 1005690, Avg. loss: 3.158798
Total training time: 1.40 seconds.
-- Epoch 43
Norm: 11.43, NNZs: 500, Bias: -28.791716, T: 1029635, Avg. loss: 3.108895
Total training time: 1.43 seconds.
-- Epoch 44
Norm: 11.32, NNZs: 500, Bias: -28.498260, T: 1053580, Avg. loss: 3.081596
Total training time: 1.47 seconds.
-- Epoch 45
Norm: 11.27, NNZs: 500, Bias: -28.188536, T: 1077525, Avg. loss: 3.092740
Total training time: 1.50 seconds.
-- Epoch 46
Norm: 11.17, NNZs: 500, Bias: -27.906886, T: 1101470, Avg. loss: 3.047749
Total training time: 1.53 seconds.
-- Epoch 47
Norm: 11.05, NNZs: 500, Bias: -27.640338, T: 1125415, Avg. loss: 3.014496
Total training time: 1.56 seconds.
-- Epoch 48
Norm: 10.94, NNZs: 500, Bias: -27.380608, T: 1149360, Avg. loss: 2.989083
Total training time: 1.59 seconds.
-- Epoch 49
Norm: 10.90, NNZs: 500, Bias: -27.092846, T: 1173305, Avg. loss: 2.977927
Total training time: 1.62 seconds.
-- Epoch 50
Norm: 10.77, NNZs: 500, Bias: -26.854398, T: 1197250, Avg. loss: 2.922527
Total training time: 1.65 seconds.
-- Epoch 51
Norm: 10.66, NNZs: 500, Bias: -26.613537, T: 1221195, Avg. loss: 2.899605
Total training time: 1.69 seconds.
-- Epoch 52
Norm: 10.59, NNZs: 500, Bias: -26.363124, T: 1245140, Avg. loss: 2.898696
Total training time: 1.72 seconds.
-- Epoch 53
Norm: 10.52, NNZs: 500, Bias: -26.113438, T: 1269085, Avg. loss: 2.870116
Total training time: 1.75 seconds.
-- Epoch 54
Norm: 10.46, NNZs: 500, Bias: -25.870869, T: 1293030, Avg. loss: 2.861557
Total training time: 1.78 seconds.
-- Epoch 55
Norm: 10.35, NNZs: 500, Bias: -25.652664, T: 1316975, Avg. loss: 2.813138
Total training time: 1.82 seconds.
-- Epoch 56
Norm: 10.31, NNZs: 500, Bias: -25.413450, T: 1340920, Avg. loss: 2.819470
Total training time: 1.85 seconds.
-- Epoch 57
Norm: 10.24, NNZs: 500, Bias: -25.188179, T: 1364865, Avg. loss: 2.790917
Total training time: 1.88 seconds.
```

```
-- Epoch 58
Norm: 10.14, NNZs: 500, Bias: -24.983348, T: 1388810, Avg. loss: 2.749075
Total training time: 1.91 seconds.
-- Epoch 59
Norm: 10.07, NNZs: 500, Bias: -24.768310, T: 1412755, Avg. loss: 2.741206
Total training time: 1.94 seconds.
-- Epoch 60
Norm: 10.01, NNZs: 500, Bias: -24.553450, T: 1436700, Avg. loss: 2.708544
Total training time: 1.97 seconds.
-- Epoch 61
Norm: 9.93, NNZs: 500, Bias: -24.348782, T: 1460645, Avg. loss: 2.683030
Total training time: 2.00 seconds.
-- Epoch 62
Norm: 9.82, NNZs: 500, Bias: -24.167313, T: 1484590, Avg. loss: 2.681703
Total training time: 2.03 seconds.
-- Epoch 63
Norm: 9.77, NNZs: 500, Bias: -23.963958, T: 1508535, Avg. loss: 2.659038
Total training time: 2.06 seconds.
-- Epoch 64
Norm: 9.73, NNZs: 500, Bias: -23.754710, T: 1532480, Avg. loss: 2.647863
Total training time: 2.09 seconds.
-- Epoch 65
Norm: 9.67, NNZs: 500, Bias: -23.565445, T: 1556425, Avg. loss: 2.630737
Total training time: 2.12 seconds.
-- Epoch 66
Norm: 9.58, NNZs: 500, Bias: -23.387502, T: 1580370, Avg. loss: 2.610255
Total training time: 2.15 seconds.
-- Epoch 67
Norm: 9.53, NNZs: 500, Bias: -23.198240, T: 1604315, Avg. loss: 2.597315
Total training time: 2.19 seconds.
-- Epoch 68
Norm: 9.46, NNZs: 500, Bias: -23.019774, T: 1628260, Avg. loss: 2.575526
Total training time: 2.22 seconds.
-- Epoch 69
Norm: 9.39, NNZs: 500, Bias: -22.846444, T: 1652205, Avg. loss: 2.560027
Total training time: 2.25 seconds.
-- Epoch 70
Norm: 9.34, NNZs: 500, Bias: -22.666421, T: 1676150, Avg. loss: 2.548392
Total training time: 2.28 seconds.
-- Epoch 71
Norm: 9.27, NNZs: 500, Bias: -22.497960, T: 1700095, Avg. loss: 2.526268
Total training time: 2.31 seconds.
-- Epoch 72
Norm: 9.21, NNZs: 500, Bias: -22.330721, T: 1724040, Avg. loss: 2.504345
Total training time: 2.34 seconds.
-- Epoch 73
Norm: 9.16, NNZs: 500, Bias: -22.157598, T: 1747985, Avg. loss: 2.507933
Total training time: 2.37 seconds.
-- Epoch 74
Norm: 9.08, NNZs: 500, Bias: -22.003694, T: 1771930, Avg. loss: 2.481744
Total training time: 2.40 seconds.
-- Epoch 75
Norm: 9.04, NNZs: 500, Bias: -21.837668, T: 1795875, Avg. loss: 2.470466
Total training time: 2.43 seconds.
-- Epoch 76
Norm: 8.96, NNZs: 500, Bias: -21.685607, T: 1819820, Avg. loss: 2.442201
Total training time: 2.46 seconds.
```

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-- Epoch 77
Norm: 8.93, NNZs: 500, Bias: -21.520268, T: 1843765, Avg. loss: 2.431624
Total training time: 2.49 seconds.
-- Epoch 78
Norm: 8.89, NNZs: 500, Bias: -21.358466, T: 1867710, Avg. loss: 2.434319
Total training time: 2.52 seconds.
-- Epoch 79
Norm: 8.81, NNZs: 500, Bias: -21.216970, T: 1891655, Avg. loss: 2.414123
Total training time: 2.55 seconds.
-- Epoch 80
Norm: 8.77, NNZs: 500, Bias: -21.065377, T: 1915600, Avg. loss: 2.396824
Total training time: 2.58 seconds.
-- Epoch 81
Norm: 8.71, NNZs: 500, Bias: -20.921521, T: 1939545, Avg. loss: 2.372302
Total training time: 2.62 seconds.
-- Epoch 82
Norm: 8.67, NNZs: 500, Bias: -20.769011, T: 1963490, Avg. loss: 2.373226
Total training time: 2.64 seconds.
-- Epoch 83
Norm: 8.61, NNZs: 500, Bias: -20.629291, T: 1987435, Avg. loss: 2.351158
Total training time: 2.67 seconds.
-- Epoch 84
Norm: 8.54, NNZs: 500, Bias: -20.497376, T: 2011380, Avg. loss: 2.330760
Total training time: 2.70 seconds.
-- Epoch 85
Norm: 8.51, NNZs: 500, Bias: -20.347246, T: 2035325, Avg. loss: 2.330973
Total training time: 2.74 seconds.
-- Epoch 86
Norm: 8.47, NNZs: 500, Bias: -20.207946, T: 2059270, Avg. loss: 2.319491
Total training time: 2.77 seconds.
-- Epoch 87
Norm: 8.42, NNZs: 500, Bias: -20.069735, T: 2083215, Avg. loss: 2.306938
Total training time: 2.80 seconds.
-- Epoch 88
Norm: 8.37, NNZs: 500, Bias: -19.938026, T: 2107160, Avg. loss: 2.294633
Total training time: 2.83 seconds.
-- Epoch 89
Norm: 8.30, NNZs: 500, Bias: -19.817354, T: 2131105, Avg. loss: 2.283742
Total training time: 2.86 seconds.
-- Epoch 90
Norm: 8.27, NNZs: 500, Bias: -19.677137, T: 2155050, Avg. loss: 2.273283
Total training time: 2.89 seconds.
-- Epoch 91
Norm: 8.22, NNZs: 500, Bias: -19.552801, T: 2178995, Avg. loss: 2.255436
Total training time: 2.92 seconds.
-- Epoch 92
Norm: 8.18, NNZs: 500, Bias: -19.419989, T: 2202940, Avg. loss: 2.245514
Total training time: 2.95 seconds.
-- Epoch 93
Norm: 8.12, NNZs: 500, Bias: -19.304002, T: 2226885, Avg. loss: 2.226480
Total training time: 2.98 seconds.
-- Epoch 94
Norm: 8.08, NNZs: 500, Bias: -19.175014, T: 2250830, Avg. loss: 2.221760
Total training time: 3.01 seconds.
-- Epoch 95
Norm: 8.03, NNZs: 500, Bias: -19.057573, T: 2274775, Avg. loss: 2.202790
Total training time: 3.04 seconds.
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-- Epoch 96
Norm: 7.98, NNZs: 500, Bias: -18.937987, T: 2298720, Avg. loss: 2.202051
Total training time: 3.07 seconds.
-- Epoch 97
Norm: 7.96, NNZs: 500, Bias: -18.810022, T: 2322665, Avg. loss: 2.195360
Total training time: 3.10 seconds.
-- Epoch 98
Norm: 7.91, NNZs: 500, Bias: -18.696557, T: 2346610, Avg. loss: 2.178749
Total training time: 3.13 seconds.
-- Epoch 99
Norm: 7.87, NNZs: 500, Bias: -18.577561, T: 2370555, Avg. loss: 2.171128
Total training time: 3.16 seconds.
-- Epoch 100
Norm: 7.83, NNZs: 500, Bias: -18.459553, T: 2394500, Avg. loss: 2.168242
Total training time: 3.19 seconds.
-- Epoch 101
Norm: 7.79, NNZs: 500, Bias: -18.344360, T: 2418445, Avg. loss: 2.142192
Total training time: 3.22 seconds.
-- Epoch 102
Norm: 7.75, NNZs: 500, Bias: -18.233887, T: 2442390, Avg. loss: 2.134370
Total training time: 3.25 seconds.
-- Epoch 103
Norm: 7.69, NNZs: 500, Bias: -18.129382, T: 2466335, Avg. loss: 2.119950
Total training time: 3.29 seconds.
-- Epoch 104
Norm: 7.67, NNZs: 500, Bias: -18.010187, T: 2490280, Avg. loss: 2.114427
Total training time: 3.32 seconds.
-- Epoch 105
Norm: 7.63, NNZs: 500, Bias: -17.901852, T: 2514225, Avg. loss: 2.103627
Total training time: 3.35 seconds.
-- Epoch 106
Norm: 7.58, NNZs: 500, Bias: -17.796873, T: 2538170, Avg. loss: 2.096961
Total training time: 3.38 seconds.
-- Epoch 107
Norm: 7.54, NNZs: 500, Bias: -17.694040, T: 2562115, Avg. loss: 2.081747
Total training time: 3.41 seconds.
-- Epoch 108
Norm: 7.49, NNZs: 500, Bias: -17.591359, T: 2586060, Avg. loss: 2.075686
Total training time: 3.44 seconds.
-- Epoch 109
Norm: 7.47, NNZs: 500, Bias: -17.481997, T: 2610005, Avg. loss: 2.075429
Total training time: 3.47 seconds.
-- Epoch 110
Norm: 7.43, NNZs: 500, Bias: -17.377659, T: 2633950, Avg. loss: 2.056773
Total training time: 3.50 seconds.
-- Epoch 111
Norm: 7.38, NNZs: 500, Bias: -17.281454, T: 2657895, Avg. loss: 2.045486
Total training time: 3.53 seconds.
-- Epoch 112
Norm: 7.36, NNZs: 500, Bias: -17.173431, T: 2681840, Avg. loss: 2.045417
Total training time: 3.56 seconds.
-- Epoch 113
Norm: 7.31, NNZs: 500, Bias: -17.081552, T: 2705785, Avg. loss: 2.027031
Total training time: 3.59 seconds.
-- Epoch 114
Norm: 7.29, NNZs: 500, Bias: -16.974924, T: 2729730, Avg. loss: 2.029200
Total training time: 3.62 seconds.
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-- Epoch 115
Norm: 7.24, NNZs: 500, Bias: -16.880612, T: 2753675, Avg. loss: 2.015667
Total training time: 3.65 seconds.
-- Epoch 116
Norm: 7.22, NNZs: 500, Bias: -16.779244, T: 2777620, Avg. loss: 2.010331
Total training time: 3.68 seconds.
-- Epoch 117
Norm: 7.16, NNZs: 500, Bias: -16.693848, T: 2801565, Avg. loss: 1.988242
Total training time: 3.71 seconds.
-- Epoch 118
Norm: 7.13, NNZs: 500, Bias: -16.594027, T: 2825510, Avg. loss: 1.991829
Total training time: 3.74 seconds.
-- Epoch 119
Norm: 7.10, NNZs: 500, Bias: -16.498945, T: 2849455, Avg. loss: 1.981404
Total training time: 3.77 seconds.
-- Epoch 120
Norm: 7.06, NNZs: 500, Bias: -16.408029, T: 2873400, Avg. loss: 1.971287
Total training time: 3.80 seconds.
-- Epoch 121
Norm: 7.02, NNZs: 500, Bias: -16.318517, T: 2897345, Avg. loss: 1.954490
Total training time: 3.83 seconds.
-- Epoch 122
Norm: 7.00, NNZs: 500, Bias: -16.223310, T: 2921290, Avg. loss: 1.956042
Total training time: 3.86 seconds.
-- Epoch 123
Norm: 6.97, NNZs: 500, Bias: -16.130038, T: 2945235, Avg. loss: 1.951202
Total training time: 3.90 seconds.
-- Epoch 124
Norm: 6.93, NNZs: 500, Bias: -16.045575, T: 2969180, Avg. loss: 1.937709
Total training time: 3.93 seconds.
-- Epoch 125
Norm: 6.90, NNZs: 500, Bias: -15.955778, T: 2993125, Avg. loss: 1.941938
Total training time: 3.96 seconds.
-- Epoch 126
Norm: 6.87, NNZs: 500, Bias: -15.867929, T: 3017070, Avg. loss: 1.925266
Total training time: 3.99 seconds.
-- Epoch 127
Norm: 6.83, NNZs: 500, Bias: -15.781219, T: 3041015, Avg. loss: 1.916698
Total training time: 4.02 seconds.
-- Epoch 128
Norm: 6.80, NNZs: 500, Bias: -15.698513, T: 3064960, Avg. loss: 1.907401
Total training time: 4.05 seconds.
-- Epoch 129
Norm: 6.76, NNZs: 500, Bias: -15.616590, T: 3088905, Avg. loss: 1.895391
Total training time: 4.08 seconds.
-- Epoch 130
Norm: 6.75, NNZs: 500, Bias: -15.522690, T: 3112850, Avg. loss: 1.899200
Total training time: 4.11 seconds.
-- Epoch 131
Norm: 6.72, NNZs: 500, Bias: -15.437393, T: 3136795, Avg. loss: 1.883207
Total training time: 4.14 seconds.
-- Epoch 132
Norm: 6.69, NNZs: 500, Bias: -15.352604, T: 3160740, Avg. loss: 1.874109
Total training time: 4.17 seconds.
-- Epoch 133
Norm: 6.65, NNZs: 500, Bias: -15.274730, T: 3184685, Avg. loss: 1.874548
Total training time: 4.20 seconds.
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-- Epoch 134
Norm: 6.62, NNZs: 500, Bias: -15.195211, T: 3208630, Avg. loss: 1.865319
Total training time: 4.23 seconds.
-- Epoch 135
Norm: 6.59, NNZs: 500, Bias: -15.113712, T: 3232575, Avg. loss: 1.856718
Total training time: 4.26 seconds.
-- Epoch 136
Norm: 6.55, NNZs: 500, Bias: -15.036573, T: 3256520, Avg. loss: 1.853197
Total training time: 4.29 seconds.
-- Epoch 137
Norm: 6.54, NNZs: 500, Bias: -14.950816, T: 3280465, Avg. loss: 1.845483
Total training time: 4.32 seconds.
-- Epoch 138
Norm: 6.48, NNZs: 500, Bias: -14.885984, T: 3304410, Avg. loss: 1.828894
Total training time: 4.35 seconds.
-- Epoch 139
Norm: 6.48, NNZs: 500, Bias: -14.794764, T: 3328355, Avg. loss: 1.839483
Total training time: 4.38 seconds.
-- Epoch 140
Norm: 6.44, NNZs: 500, Bias: -14.720617, T: 3352300, Avg. loss: 1.817058
Total training time: 4.41 seconds.
-- Epoch 141
Norm: 6.42, NNZs: 500, Bias: -14.640108, T: 3376245, Avg. loss: 1.816287
Total training time: 4.45 seconds.
-- Epoch 142
Norm: 6.41, NNZs: 500, Bias: -14.556856, T: 3400190, Avg. loss: 1.806668
Total training time: 4.48 seconds.
-- Epoch 143
Norm: 6.35, NNZs: 500, Bias: -14.494493, T: 3424135, Avg. loss: 1.794664
Total training time: 4.51 seconds.
-- Epoch 144
Norm: 6.33, NNZs: 500, Bias: -14.416565, T: 3448080, Avg. loss: 1.790630
Total training time: 4.54 seconds.
-- Epoch 145
Norm: 6.30, NNZs: 500, Bias: -14.341140, T: 3472025, Avg. loss: 1.785782
Total training time: 4.57 seconds.
-- Epoch 146
Norm: 6.27, NNZs: 500, Bias: -14.270749, T: 3495970, Avg. loss: 1.783458
Total training time: 4.60 seconds.
-- Epoch 147
Norm: 6.25, NNZs: 500, Bias: -14.195968, T: 3519915, Avg. loss: 1.783203
Total training time: 4.63 seconds.
-- Epoch 148
Norm: 6.22, NNZs: 500, Bias: -14.121570, T: 3543860, Avg. loss: 1.769094
Total training time: 4.66 seconds.
-- Epoch 149
Norm: 6.19, NNZs: 500, Bias: -14.053379, T: 3567805, Avg. loss: 1.761347
Total training time: 4.69 seconds.
-- Epoch 150
Norm: 6.17, NNZs: 500, Bias: -13.979561, T: 3591750, Avg. loss: 1.760650
Total training time: 4.72 seconds.
-- Epoch 151
Norm: 6.13, NNZs: 500, Bias: -13.913104, T: 3615695, Avg. loss: 1.747666
Total training time: 4.75 seconds.
-- Epoch 152
Norm: 6.11, NNZs: 500, Bias: -13.839524, T: 3639640, Avg. loss: 1.747164
Total training time: 4.78 seconds.
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-- Epoch 153
Norm: 6.08, NNZs: 500, Bias: -13.770753, T: 3663585, Avg. loss: 1.736838
Total training time: 4.81 seconds.
-- Epoch 154
Norm: 6.05, NNZs: 500, Bias: -13.704465, T: 3687530, Avg. loss: 1.729359
Total training time: 4.84 seconds.
-- Epoch 155
Norm: 6.04, NNZs: 500, Bias: -13.631992, T: 3711475, Avg. loss: 1.730871
Total training time: 4.87 seconds.
-- Epoch 156
Norm: 6.00, NNZs: 500, Bias: -13.566658, T: 3735420, Avg. loss: 1.714525
Total training time: 4.90 seconds.
-- Epoch 157
Norm: 5.98, NNZs: 500, Bias: -13.499579, T: 3759365, Avg. loss: 1.717809
Total training time: 4.93 seconds.
-- Epoch 158
Norm: 5.96, NNZs: 500, Bias: -13.429106, T: 3783310, Avg. loss: 1.713384
Total training time: 4.96 seconds.
-- Epoch 159
Norm: 5.93, NNZs: 500, Bias: -13.366522, T: 3807255, Avg. loss: 1.706978
Total training time: 5.00 seconds.
-- Epoch 160
Norm: 5.90, NNZs: 500, Bias: -13.300546, T: 3831200, Avg. loss: 1.700745
Total training time: 5.03 seconds.
-- Epoch 161
Norm: 5.89, NNZs: 500, Bias: -13.231859, T: 3855145, Avg. loss: 1.692269
Total training time: 5.06 seconds.
-- Epoch 162
Norm: 5.86, NNZs: 500, Bias: -13.169957, T: 3879090, Avg. loss: 1.688227
Total training time: 5.09 seconds.
-- Epoch 163
Norm: 5.84, NNZs: 500, Bias: -13.102783, T: 3903035, Avg. loss: 1.681963
Total training time: 5.12 seconds.
-- Epoch 164
Norm: 5.81, NNZs: 500, Bias: -13.039301, T: 3926980, Avg. loss: 1.674137
Total training time: 5.15 seconds.
-- Epoch 165
Norm: 5.79, NNZs: 500, Bias: -12.976597, T: 3950925, Avg. loss: 1.669731
Total training time: 5.18 seconds.
-- Epoch 166
Norm: 5.76, NNZs: 500, Bias: -12.913686, T: 3974870, Avg. loss: 1.664057
Total training time: 5.21 seconds.
-- Epoch 167
Norm: 5.73, NNZs: 500, Bias: -12.854752, T: 3998815, Avg. loss: 1.654462
Total training time: 5.24 seconds.
-- Epoch 168
Norm: 5.71, NNZs: 500, Bias: -12.791443, T: 4022760, Avg. loss: 1.651155
Total training time: 5.27 seconds.
-- Epoch 169
Norm: 5.69, NNZs: 500, Bias: -12.727580, T: 4046705, Avg. loss: 1.654257
Total training time: 5.30 seconds.
-- Epoch 170
Norm: 5.67, NNZs: 500, Bias: -12.668316, T: 4070650, Avg. loss: 1.644673
Total training time: 5.33 seconds.
-- Epoch 171
Norm: 5.64, NNZs: 500, Bias: -12.607733, T: 4094595, Avg. loss: 1.643831
Total training time: 5.36 seconds.
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-- Epoch 172
Norm: 5.62, NNZs: 500, Bias: -12.547464, T: 4118540, Avg. loss: 1.634681
Total training time: 5.39 seconds.
-- Epoch 173
Norm: 5.60, NNZs: 500, Bias: -12.487786, T: 4142485, Avg. loss: 1.628067
Total training time: 5.42 seconds.
-- Epoch 174
Norm: 5.58, NNZs: 500, Bias: -12.428004, T: 4166430, Avg. loss: 1.623845
Total training time: 5.45 seconds.
-- Epoch 175
Norm: 5.56, NNZs: 500, Bias: -12.367867, T: 4190375, Avg. loss: 1.619442
Total training time: 5.49 seconds.
-- Epoch 176
Norm: 5.54, NNZs: 500, Bias: -12.307022, T: 4214320, Avg. loss: 1.613878
Total training time: 5.52 seconds.
-- Epoch 177
Norm: 5.51, NNZs: 500, Bias: -12.252647, T: 4238265, Avg. loss: 1.610369
Total training time: 5.55 seconds.
-- Epoch 178
Norm: 5.50, NNZs: 500, Bias: -12.190285, T: 4262210, Avg. loss: 1.603770
Total training time: 5.58 seconds.
-- Epoch 179
Norm: 5.46, NNZs: 500, Bias: -12.138329, T: 4286155, Avg. loss: 1.595306
Total training time: 5.61 seconds.
-- Epoch 180
Norm: 5.45, NNZs: 500, Bias: -12.079472, T: 4310100, Avg. loss: 1.593587
Total training time: 5.64 seconds.
-- Epoch 181
Norm: 5.43, NNZs: 500, Bias: -12.019875, T: 4334045, Avg. loss: 1.589309
Total training time: 5.67 seconds.
-- Epoch 182
Norm: 5.41, NNZs: 500, Bias: -11.964959, T: 4357990, Avg. loss: 1.583006
Total training time: 5.70 seconds.
-- Epoch 183
Norm: 5.39, NNZs: 500, Bias: -11.906503, T: 4381935, Avg. loss: 1.580336
Total training time: 5.73 seconds.
-- Epoch 184
Norm: 5.37, NNZs: 500, Bias: -11.852228, T: 4405880, Avg. loss: 1.572399
Total training time: 5.76 seconds.
-- Epoch 185
Norm: 5.34, NNZs: 500, Bias: -11.799279, T: 4429825, Avg. loss: 1.564783
Total training time: 5.79 seconds.
-- Epoch 186
Norm: 5.32, NNZs: 500, Bias: -11.746166, T: 4453770, Avg. loss: 1.559995
Total training time: 5.82 seconds.
-- Epoch 187
Norm: 5.29, NNZs: 500, Bias: -11.694734, T: 4477715, Avg. loss: 1.556287
Total training time: 5.85 seconds.
-- Epoch 188
Norm: 5.27, NNZs: 500, Bias: -11.640217, T: 4501660, Avg. loss: 1.553463
Total training time: 5.88 seconds.
-- Epoch 189
Norm: 5.26, NNZs: 500, Bias: -11.579300, T: 4525605, Avg. loss: 1.552421
Total training time: 5.92 seconds.
-- Epoch 190
Norm: 5.24, NNZs: 500, Bias: -11.528587, T: 4549550, Avg. loss: 1.545040
Total training time: 5.95 seconds.
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-- Epoch 191
Norm: 5.22, NNZs: 500, Bias: -11.477342, T: 4573495, Avg. loss: 1.541107
Total training time: 5.98 seconds.
-- Epoch 192
Norm: 5.20, NNZs: 500, Bias: -11.421218, T: 4597440, Avg. loss: 1.539919
Total training time: 6.01 seconds.
-- Epoch 193
Norm: 5.18, NNZs: 500, Bias: -11.370754, T: 4621385, Avg. loss: 1.531295
Total training time: 6.04 seconds.
-- Epoch 194
Norm: 5.15, NNZs: 500, Bias: -11.323552, T: 4645330, Avg. loss: 1.519237
Total training time: 6.07 seconds.
-- Epoch 195
Norm: 5.13, NNZs: 500, Bias: -11.269904, T: 4669275, Avg. loss: 1.522949
Total training time: 6.10 seconds.
-- Epoch 196
Norm: 5.12, NNZs: 500, Bias: -11.217309, T: 4693220, Avg. loss: 1.515038
Total training time: 6.13 seconds.
-- Epoch 197
Norm: 5.10, NNZs: 500, Bias: -11.165342, T: 4717165, Avg. loss: 1.515013
Total training time: 6.16 seconds.
-- Epoch 198
Norm: 5.08, NNZs: 500, Bias: -11.113049, T: 4741110, Avg. loss: 1.511287
Total training time: 6.19 seconds.
-- Epoch 199
Norm: 5.06, NNZs: 500, Bias: -11.063158, T: 4765055, Avg. loss: 1.504492
Total training time: 6.22 seconds.
-- Epoch 200
Norm: 5.04, NNZs: 500, Bias: -11.017785, T: 4789000, Avg. loss: 1.502305
Total training time: 6.25 seconds.
-- Epoch 201
Norm: 5.02, NNZs: 500, Bias: -10.967898, T: 4812945, Avg. loss: 1.496503
Total training time: 6.29 seconds.
-- Epoch 202
Norm: 5.00, NNZs: 500, Bias: -10.916446, T: 4836890, Avg. loss: 1.491598
Total training time: 6.32 seconds.
-- Epoch 203
Norm: 4.98, NNZs: 500, Bias: -10.868887, T: 4860835, Avg. loss: 1.491612
Total training time: 6.35 seconds.
-- Epoch 204
Norm: 4.96, NNZs: 500, Bias: -10.819485, T: 4884780, Avg. loss: 1.487007
Total training time: 6.38 seconds.
-- Epoch 205
Norm: 4.94, NNZs: 500, Bias: -10.773185, T: 4908725, Avg. loss: 1.479611
Total training time: 6.41 seconds.
-- Epoch 206
Norm: 4.94, NNZs: 500, Bias: -10.718357, T: 4932670, Avg. loss: 1.479533
Total training time: 6.44 seconds.
-- Epoch 207
Norm: 4.92, NNZs: 500, Bias: -10.670230, T: 4956615, Avg. loss: 1.472622
Total training time: 6.47 seconds.
-- Epoch 208
Norm: 4.90, NNZs: 500, Bias: -10.624204, T: 4980560, Avg. loss: 1.468859
Total training time: 6.50 seconds.
-- Epoch 209
Norm: 4.87, NNZs: 500, Bias: -10.580138, T: 5004505, Avg. loss: 1.462196
Total training time: 6.53 seconds.
```

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-- Epoch 210
Norm: 4.85, NNZs: 500, Bias: -10.533380, T: 5028450, Avg. loss: 1.459120
Total training time: 6.57 seconds.
-- Epoch 211
Norm: 4.84, NNZs: 500, Bias: -10.486856, T: 5052395, Avg. loss: 1.460767
Total training time: 6.60 seconds.
-- Epoch 212
Norm: 4.82, NNZs: 500, Bias: -10.436733, T: 5076340, Avg. loss: 1.455358
Total training time: 6.63 seconds.
-- Epoch 213
Norm: 4.80, NNZs: 500, Bias: -10.392404, T: 5100285, Avg. loss: 1.446135
Total training time: 6.66 seconds.
-- Epoch 214
Norm: 4.79, NNZs: 500, Bias: -10.342248, T: 5124230, Avg. loss: 1.446470
Total training time: 6.69 seconds.
-- Epoch 215
Norm: 4.77, NNZs: 500, Bias: -10.297864, T: 5148175, Avg. loss: 1.449979
Total training time: 6.73 seconds.
-- Epoch 216
Norm: 4.76, NNZs: 500, Bias: -10.252590, T: 5172120, Avg. loss: 1.438455
Total training time: 6.76 seconds.
-- Epoch 217
Norm: 4.74, NNZs: 500, Bias: -10.208696, T: 5196065, Avg. loss: 1.439996
Total training time: 6.79 seconds.
-- Epoch 218
Norm: 4.71, NNZs: 500, Bias: -10.168870, T: 5220010, Avg. loss: 1.425205
Total training time: 6.82 seconds.
-- Epoch 219
Norm: 4.70, NNZs: 500, Bias: -10.121175, T: 5243955, Avg. loss: 1.429448
Total training time: 6.85 seconds.
-- Epoch 220
Norm: 4.68, NNZs: 500, Bias: -10.075325, T: 5267900, Avg. loss: 1.420532
Total training time: 6.89 seconds.
-- Epoch 221
Norm: 4.67, NNZs: 500, Bias: -10.029843, T: 5291845, Avg. loss: 1.420324
Total training time: 6.92 seconds.
-- Epoch 222
Norm: 4.65, NNZs: 500, Bias: -9.986149, T: 5315790, Avg. loss: 1.413856
Total training time: 6.95 seconds.
-- Epoch 223
Norm: 4.63, NNZs: 500, Bias: -9.944661, T: 5339735, Avg. loss: 1.410834
Total training time: 6.98 seconds.
-- Epoch 224
Norm: 4.62, NNZs: 500, Bias: -9.898187, T: 5363680, Avg. loss: 1.408691
Total training time: 7.01 seconds.
-- Epoch 225
Norm: 4.60, NNZs: 500, Bias: -9.855762, T: 5387625, Avg. loss: 1.401366
Total training time: 7.05 seconds.
-- Epoch 226
Norm: 4.59, NNZs: 500, Bias: -9.812671, T: 5411570, Avg. loss: 1.398498
Total training time: 7.08 seconds.
-- Epoch 227
Norm: 4.57, NNZs: 500, Bias: -9.772225, T: 5435515, Avg. loss: 1.394785
Total training time: 7.11 seconds.
-- Epoch 228
Norm: 4.55, NNZs: 500, Bias: -9.730252, T: 5459460, Avg. loss: 1.391692
Total training time: 7.14 seconds.
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-- Epoch 229
Norm: 4.53, NNZs: 500, Bias: -9.689072, T: 5483405, Avg. loss: 1.387987
Total training time: 7.17 seconds.
-- Epoch 230
Norm: 4.52, NNZs: 500, Bias: -9.646191, T: 5507350, Avg. loss: 1.385165
Total training time: 7.20 seconds.
-- Epoch 231
Norm: 4.50, NNZs: 500, Bias: -9.607281, T: 5531295, Avg. loss: 1.383620
Total training time: 7.23 seconds.
-- Epoch 232
Norm: 4.48, NNZs: 500, Bias: -9.564401, T: 5555240, Avg. loss: 1.377127
Total training time: 7.27 seconds.
-- Epoch 233
Norm: 4.47, NNZs: 500, Bias: -9.521789, T: 5579185, Avg. loss: 1.377521
Total training time: 7.30 seconds.
-- Epoch 234
Norm: 4.45, NNZs: 500, Bias: -9.483363, T: 5603130, Avg. loss: 1.370588
Total training time: 7.33 seconds.
-- Epoch 235
Norm: 4.44, NNZs: 500, Bias: -9.438274, T: 5627075, Avg. loss: 1.371864
Total training time: 7.36 seconds.
-- Epoch 236
Norm: 4.42, NNZs: 500, Bias: -9.403651, T: 5651020, Avg. loss: 1.362064
Total training time: 7.40 seconds.
-- Epoch 237
Norm: 4.41, NNZs: 500, Bias: -9.357591, T: 5674965, Avg. loss: 1.361558
Total training time: 7.43 seconds.
-- Epoch 238
Norm: 4.39, NNZs: 500, Bias: -9.319712, T: 5698910, Avg. loss: 1.365406
Total training time: 7.46 seconds.
-- Epoch 239
Norm: 4.38, NNZs: 500, Bias: -9.277559, T: 5722855, Avg. loss: 1.359747
Total training time: 7.49 seconds.
-- Epoch 240
Norm: 4.36, NNZs: 500, Bias: -9.242541, T: 5746800, Avg. loss: 1.354939
Total training time: 7.52 seconds.
-- Epoch 241
Norm: 4.34, NNZs: 500, Bias: -9.203028, T: 5770745, Avg. loss: 1.353188
Total training time: 7.56 seconds.
-- Epoch 242
Norm: 4.33, NNZs: 500, Bias: -9.161619, T: 5794690, Avg. loss: 1.344509
Total training time: 7.59 seconds.
-- Epoch 243
Norm: 4.32, NNZs: 500, Bias: -9.121606, T: 5818635, Avg. loss: 1.345937
Total training time: 7.62 seconds.
-- Epoch 244
Norm: 4.30, NNZs: 500, Bias: -9.084521, T: 5842580, Avg. loss: 1.339686
Total training time: 7.65 seconds.
-- Epoch 245
Norm: 4.29, NNZs: 500, Bias: -9.045563, T: 5866525, Avg. loss: 1.333471
Total training time: 7.68 seconds.
-- Epoch 246
Norm: 4.27, NNZs: 500, Bias: -9.007581, T: 5890470, Avg. loss: 1.335382
Total training time: 7.72 seconds.
-- Epoch 247
Norm: 4.25, NNZs: 500, Bias: -8.974581, T: 5914415, Avg. loss: 1.323783
Total training time: 7.75 seconds.
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-- Epoch 248
Norm: 4.24, NNZs: 500, Bias: -8.931648, T: 5938360, Avg. loss: 1.325918
Total training time: 7.78 seconds.
-- Epoch 249
Norm: 4.23, NNZs: 500, Bias: -8.891549, T: 5962305, Avg. loss: 1.324352
Total training time: 7.82 seconds.
-- Epoch 250
Norm: 4.21, NNZs: 500, Bias: -8.858077, T: 5986250, Avg. loss: 1.317604
Total training time: 7.85 seconds.
-- Epoch 251
Norm: 4.20, NNZs: 500, Bias: -8.818610, T: 6010195, Avg. loss: 1.316233
Total training time: 7.88 seconds.
-- Epoch 252
Norm: 4.18, NNZs: 500, Bias: -8.786951, T: 6034140, Avg. loss: 1.311916
Total training time: 7.92 seconds.
-- Epoch 253
Norm: 4.16, NNZs: 500, Bias: -8.750302, T: 6058085, Avg. loss: 1.310850
Total training time: 7.95 seconds.
-- Epoch 254
Norm: 4.16, NNZs: 500, Bias: -8.709595, T: 6082030, Avg. loss: 1.313325
Total training time: 7.98 seconds.
-- Epoch 255
Norm: 4.14, NNZs: 500, Bias: -8.677045, T: 6105975, Avg. loss: 1.304407
Total training time: 8.01 seconds.
-- Epoch 256
Norm: 4.12, NNZs: 500, Bias: -8.640842, T: 6129920, Avg. loss: 1.299333
Total training time: 8.04 seconds.
-- Epoch 257
Norm: 4.11, NNZs: 500, Bias: -8.601033, T: 6153865, Avg. loss: 1.298278
Total training time: 8.08 seconds.
-- Epoch 258
Norm: 4.10, NNZs: 500, Bias: -8.566235, T: 6177810, Avg. loss: 1.296591
Total training time: 8.11 seconds.
-- Epoch 259
Norm: 4.09, NNZs: 500, Bias: -8.528751, T: 6201755, Avg. loss: 1.294921
Total training time: 8.14 seconds.
-- Epoch 260
Norm: 4.07, NNZs: 500, Bias: -8.493859, T: 6225700, Avg. loss: 1.290864
Total training time: 8.17 seconds.
-- Epoch 261
Norm: 4.05, NNZs: 500, Bias: -8.463274, T: 6249645, Avg. loss: 1.285036
Total training time: 8.21 seconds.
-- Epoch 262
Norm: 4.05, NNZs: 500, Bias: -8.421975, T: 6273590, Avg. loss: 1.290288
Total training time: 8.24 seconds.
-- Epoch 263
Norm: 4.03, NNZs: 500, Bias: -8.387722, T: 6297535, Avg. loss: 1.284616
Total training time: 8.27 seconds.
-- Epoch 264
Norm: 4.02, NNZs: 500, Bias: -8.355117, T: 6321480, Avg. loss: 1.279773
Total training time: 8.30 seconds.
-- Epoch 265
Norm: 4.01, NNZs: 500, Bias: -8.318451, T: 6345425, Avg. loss: 1.275234
Total training time: 8.33 seconds.
-- Epoch 266
Norm: 3.99, NNZs: 500, Bias: -8.284210, T: 6369370, Avg. loss: 1.275972
Total training time: 8.36 seconds.
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-- Epoch 267
Norm: 3.99, NNZs: 500, Bias: -8.247046, T: 6393315, Avg. loss: 1.273719
Total training time: 8.39 seconds.
-- Epoch 268
Norm: 3.96, NNZs: 500, Bias: -8.217917, T: 6417260, Avg. loss: 1.263246
Total training time: 8.42 seconds.
-- Epoch 269
Norm: 3.95, NNZs: 500, Bias: -8.183212, T: 6441205, Avg. loss: 1.270156
Total training time: 8.46 seconds.
-- Epoch 270
Norm: 3.94, NNZs: 500, Bias: -8.149961, T: 6465150, Avg. loss: 1.261011
Total training time: 8.49 seconds.
-- Epoch 271
Norm: 3.93, NNZs: 500, Bias: -8.116270, T: 6489095, Avg. loss: 1.258262
Total training time: 8.52 seconds.
-- Epoch 272
Norm: 3.92, NNZs: 500, Bias: -8.079811, T: 6513040, Avg. loss: 1.258124
Total training time: 8.55 seconds.
-- Epoch 273
Norm: 3.90, NNZs: 500, Bias: -8.050761, T: 6536985, Avg. loss: 1.249269
Total training time: 8.58 seconds.
-- Epoch 274
Norm: 3.89, NNZs: 500, Bias: -8.017963, T: 6560930, Avg. loss: 1.252186
Total training time: 8.61 seconds.
-- Epoch 275
Norm: 3.87, NNZs: 500, Bias: -7.987679, T: 6584875, Avg. loss: 1.248535
Total training time: 8.64 seconds.
-- Epoch 276
Norm: 3.85, NNZs: 500, Bias: -7.956124, T: 6608820, Avg. loss: 1.242870
Total training time: 8.67 seconds.
-- Epoch 277
Norm: 3.84, NNZs: 500, Bias: -7.922065, T: 6632765, Avg. loss: 1.246997
Total training time: 8.70 seconds.
-- Epoch 278
Norm: 3.84, NNZs: 500, Bias: -7.885238, T: 6656710, Avg. loss: 1.242507
Total training time: 8.74 seconds.
-- Epoch 279
Norm: 3.83, NNZs: 500, Bias: -7.853669, T: 6680655, Avg. loss: 1.240298
Total training time: 8.77 seconds.
-- Epoch 280
Norm: 3.82, NNZs: 500, Bias: -7.818383, T: 6704600, Avg. loss: 1.235879
Total training time: 8.80 seconds.
-- Epoch 281
Norm: 3.80, NNZs: 500, Bias: -7.789100, T: 6728545, Avg. loss: 1.234440
Total training time: 8.83 seconds.
-- Epoch 282
Norm: 3.79, NNZs: 500, Bias: -7.758870, T: 6752490, Avg. loss: 1.228562
Total training time: 8.86 seconds.
-- Epoch 283
Norm: 3.78, NNZs: 500, Bias: -7.726076, T: 6776435, Avg. loss: 1.226139
Total training time: 8.89 seconds.
-- Epoch 284
Norm: 3.76, NNZs: 500, Bias: -7.697694, T: 6800380, Avg. loss: 1.223795
Total training time: 8.92 seconds.
-- Epoch 285
Norm: 3.75, NNZs: 500, Bias: -7.664134, T: 6824325, Avg. loss: 1.223451
Total training time: 8.95 seconds.
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-- Epoch 286
Norm: 3.74, NNZs: 500, Bias: -7.634886, T: 6848270, Avg. loss: 1.220396
Total training time: 8.98 seconds.
-- Epoch 287
Norm: 3.73, NNZs: 500, Bias: -7.600015, T: 6872215, Avg. loss: 1.219775
Total training time: 9.02 seconds.
-- Epoch 288
Norm: 3.72, NNZs: 500, Bias: -7.571355, T: 6896160, Avg. loss: 1.214043
Total training time: 9.05 seconds.
-- Epoch 289
Norm: 3.71, NNZs: 500, Bias: -7.540815, T: 6920105, Avg. loss: 1.218292
Total training time: 9.08 seconds.
-- Epoch 290
Norm: 3.69, NNZs: 500, Bias: -7.510447, T: 6944050, Avg. loss: 1.214565
Total training time: 9.11 seconds.
-- Epoch 291
Norm: 3.68, NNZs: 500, Bias: -7.479052, T: 6967995, Avg. loss: 1.207274
Total training time: 9.14 seconds.
-- Epoch 292
Norm: 3.67, NNZs: 500, Bias: -7.451084, T: 6991940, Avg. loss: 1.207905
Total training time: 9.17 seconds.
-- Epoch 293
Norm: 3.66, NNZs: 500, Bias: -7.419690, T: 7015885, Avg. loss: 1.203071
Total training time: 9.20 seconds.
-- Epoch 294
Norm: 3.64, NNZs: 500, Bias: -7.393999, T: 7039830, Avg. loss: 1.204942
Total training time: 9.23 seconds.
-- Epoch 295
Norm: 3.64, NNZs: 500, Bias: -7.360769, T: 7063775, Avg. loss: 1.198935
Total training time: 9.27 seconds.
-- Epoch 296
Norm: 3.62, NNZs: 500, Bias: -7.332153, T: 7087720, Avg. loss: 1.190770
Total training time: 9.30 seconds.
-- Epoch 297
Norm: 3.61, NNZs: 500, Bias: -7.303760, T: 7111665, Avg. loss: 1.191605
Total training time: 9.33 seconds.
-- Epoch 298
Norm: 3.60, NNZs: 500, Bias: -7.273773, T: 7135610, Avg. loss: 1.191882
Total training time: 9.36 seconds.
-- Epoch 299
Norm: 3.58, NNZs: 500, Bias: -7.246979, T: 7159555, Avg. loss: 1.186535
Total training time: 9.39 seconds.
-- Epoch 300
Norm: 3.58, NNZs: 500, Bias: -7.216181, T: 7183500, Avg. loss: 1.191862
Total training time: 9.42 seconds.
-- Epoch 301
Norm: 3.56, NNZs: 500, Bias: -7.187726, T: 7207445, Avg. loss: 1.186594
Total training time: 9.45 seconds.
-- Epoch 302
Norm: 3.55, NNZs: 500, Bias: -7.159694, T: 7231390, Avg. loss: 1.184937
Total training time: 9.49 seconds.
-- Epoch 303
Norm: 3.55, NNZs: 500, Bias: -7.128618, T: 7255335, Avg. loss: 1.183753
Total training time: 9.52 seconds.
-- Epoch 304
Norm: 3.53, NNZs: 500, Bias: -7.104565, T: 7279280, Avg. loss: 1.179151
Total training time: 9.56 seconds.
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-- Epoch 305
Norm: 3.53, NNZs: 500, Bias: -7.071537, T: 7303225, Avg. loss: 1.181070
Total training time: 9.59 seconds.
-- Epoch 306
Norm: 3.51, NNZs: 500, Bias: -7.047030, T: 7327170, Avg. loss: 1.173162
Total training time: 9.63 seconds.
-- Epoch 307
Norm: 3.50, NNZs: 500, Bias: -7.017942, T: 7351115, Avg. loss: 1.179853
Total training time: 9.66 seconds.
-- Epoch 308
Norm: 3.49, NNZs: 500, Bias: -6.988845, T: 7375060, Avg. loss: 1.173676
Total training time: 9.69 seconds.
-- Epoch 309
Norm: 3.48, NNZs: 500, Bias: -6.963974, T: 7399005, Avg. loss: 1.164818
Total training time: 9.73 seconds.
-- Epoch 310
Norm: 3.47, NNZs: 500, Bias: -6.935887, T: 7422950, Avg. loss: 1.166953
Total training time: 9.76 seconds.
-- Epoch 311
Norm: 3.46, NNZs: 500, Bias: -6.906842, T: 7446895, Avg. loss: 1.163305
Total training time: 9.79 seconds.
-- Epoch 312
Norm: 3.45, NNZs: 500, Bias: -6.878635, T: 7470840, Avg. loss: 1.161528
Total training time: 9.82 seconds.
-- Epoch 313
Norm: 3.44, NNZs: 500, Bias: -6.852382, T: 7494785, Avg. loss: 1.154754
Total training time: 9.86 seconds.
-- Epoch 314
Norm: 3.42, NNZs: 500, Bias: -6.828019, T: 7518730, Avg. loss: 1.161727
Total training time: 9.89 seconds.
-- Epoch 315
Norm: 3.41, NNZs: 500, Bias: -6.800921, T: 7542675, Avg. loss: 1.155857
Total training time: 9.92 seconds.
-- Epoch 316
Norm: 3.40, NNZs: 500, Bias: -6.773704, T: 7566620, Avg. loss: 1.152408
Total training time: 9.95 seconds.
-- Epoch 317
Norm: 3.39, NNZs: 500, Bias: -6.747977, T: 7590565, Avg. loss: 1.153037
Total training time: 9.99 seconds.
-- Epoch 318
Norm: 3.38, NNZs: 500, Bias: -6.719277, T: 7614510, Avg. loss: 1.152175
Total training time: 10.03 seconds.
-- Epoch 319
Norm: 3.37, NNZs: 500, Bias: -6.693643, T: 7638455, Avg. loss: 1.150212
Total training time: 10.06 seconds.
-- Epoch 320
Norm: 3.36, NNZs: 500, Bias: -6.669210, T: 7662400, Avg. loss: 1.141141
Total training time: 10.09 seconds.
-- Epoch 321
Norm: 3.35, NNZs: 500, Bias: -6.642706, T: 7686345, Avg. loss: 1.143507
Total training time: 10.12 seconds.
-- Epoch 322
Norm: 3.34, NNZs: 500, Bias: -6.618259, T: 7710290, Avg. loss: 1.140902
Total training time: 10.16 seconds.
-- Epoch 323
Norm: 3.33, NNZs: 500, Bias: -6.588952, T: 7734235, Avg. loss: 1.143769
Total training time: 10.19 seconds.
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-- Epoch 324
Norm: 3.32, NNZs: 500, Bias: -6.562413, T: 7758180, Avg. loss: 1.138516
Total training time: 10.22 seconds.
-- Epoch 325
Norm: 3.31, NNZs: 500, Bias: -6.537962, T: 7782125, Avg. loss: 1.135687
Total training time: 10.26 seconds.
-- Epoch 326
Norm: 3.30, NNZs: 500, Bias: -6.513361, T: 7806070, Avg. loss: 1.132975
Total training time: 10.29 seconds.
-- Epoch 327
Norm: 3.29, NNZs: 500, Bias: -6.487716, T: 7830015, Avg. loss: 1.133853
Total training time: 10.32 seconds.
-- Epoch 328
Norm: 3.28, NNZs: 500, Bias: -6.463223, T: 7853960, Avg. loss: 1.128603
Total training time: 10.36 seconds.
-- Epoch 329
Norm: 3.28, NNZs: 500, Bias: -6.436057, T: 7877905, Avg. loss: 1.128615
Total training time: 10.39 seconds.
-- Epoch 330
Norm: 3.26, NNZs: 500, Bias: -6.413021, T: 7901850, Avg. loss: 1.122100
Total training time: 10.42 seconds.
-- Epoch 331
Norm: 3.26, NNZs: 500, Bias: -6.386282, T: 7925795, Avg. loss: 1.125218
Total training time: 10.46 seconds.
-- Epoch 332
Norm: 3.25, NNZs: 500, Bias: -6.361565, T: 7949740, Avg. loss: 1.117825
Total training time: 10.50 seconds.
-- Epoch 333
Norm: 3.23, NNZs: 500, Bias: -6.338540, T: 7973685, Avg. loss: 1.120392
Total training time: 10.53 seconds.
-- Epoch 334
Norm: 3.22, NNZs: 500, Bias: -6.313606, T: 7997630, Avg. loss: 1.116806
Total training time: 10.57 seconds.
-- Epoch 335
Norm: 3.22, NNZs: 500, Bias: -6.288634, T: 8021575, Avg. loss: 1.116259
Total training time: 10.60 seconds.
-- Epoch 336
Norm: 3.21, NNZs: 500, Bias: -6.263064, T: 8045520, Avg. loss: 1.119348
Total training time: 10.63 seconds.
-- Epoch 337
Norm: 3.20, NNZs: 500, Bias: -6.237280, T: 8069465, Avg. loss: 1.112817
Total training time: 10.66 seconds.
-- Epoch 338
Norm: 3.19, NNZs: 500, Bias: -6.215813, T: 8093410, Avg. loss: 1.108448
Total training time: 10.70 seconds.
-- Epoch 339
Norm: 3.18, NNZs: 500, Bias: -6.190637, T: 8117355, Avg. loss: 1.107510
Total training time: 10.73 seconds.
-- Epoch 340
Norm: 3.17, NNZs: 500, Bias: -6.165533, T: 8141300, Avg. loss: 1.107442
Total training time: 10.76 seconds.
-- Epoch 341
Norm: 3.17, NNZs: 500, Bias: -6.141503, T: 8165245, Avg. loss: 1.107540
Total training time: 10.79 seconds.
-- Epoch 342
Norm: 3.15, NNZs: 500, Bias: -6.120257, T: 8189190, Avg. loss: 1.101903
Total training time: 10.82 seconds.
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-- Epoch 343
Norm: 3.14, NNZs: 500, Bias: -6.097561, T: 8213135, Avg. loss: 1.101578
Total training time: 10.85 seconds.
-- Epoch 344
Norm: 3.13, NNZs: 500, Bias: -6.073545, T: 8237080, Avg. loss: 1.096889
Total training time: 10.89 seconds.
-- Epoch 345
Norm: 3.13, NNZs: 500, Bias: -6.049314, T: 8261025, Avg. loss: 1.098526
Total training time: 10.92 seconds.
-- Epoch 346
Norm: 3.12, NNZs: 500, Bias: -6.024276, T: 8284970, Avg. loss: 1.098514
Total training time: 10.95 seconds.
-- Epoch 347
Norm: 3.11, NNZs: 500, Bias: -6.004581, T: 8308915, Avg. loss: 1.090357
Total training time: 10.98 seconds.
-- Epoch 348
Norm: 3.10, NNZs: 500, Bias: -5.980337, T: 8332860, Avg. loss: 1.097179
Total training time: 11.01 seconds.
-- Epoch 349
Norm: 3.09, NNZs: 500, Bias: -5.956467, T: 8356805, Avg. loss: 1.091219
Total training time: 11.04 seconds.
-- Epoch 350
Norm: 3.08, NNZs: 500, Bias: -5.932198, T: 8380750, Avg. loss: 1.088600
Total training time: 11.07 seconds.
-- Epoch 351
Norm: 3.08, NNZs: 500, Bias: -5.908995, T: 8404695, Avg. loss: 1.088269
Total training time: 11.10 seconds.
-- Epoch 352
Norm: 3.07, NNZs: 500, Bias: -5.884093, T: 8428640, Avg. loss: 1.084755
Total training time: 11.14 seconds.
-- Epoch 353
Norm: 3.06, NNZs: 500, Bias: -5.865910, T: 8452585, Avg. loss: 1.080203
Total training time: 11.17 seconds.
-- Epoch 354
Norm: 3.05, NNZs: 500, Bias: -5.842497, T: 8476530, Avg. loss: 1.081605
Total training time: 11.20 seconds.
-- Epoch 355
Norm: 3.04, NNZs: 500, Bias: -5.822597, T: 8500475, Avg. loss: 1.081179
Total training time: 11.23 seconds.
-- Epoch 356
Norm: 3.03, NNZs: 500, Bias: -5.798730, T: 8524420, Avg. loss: 1.081368
Total training time: 11.26 seconds.
-- Epoch 357
Norm: 3.02, NNZs: 500, Bias: -5.778362, T: 8548365, Avg. loss: 1.076868
Total training time: 11.30 seconds.
-- Epoch 358
Norm: 3.01, NNZs: 500, Bias: -5.754907, T: 8572310, Avg. loss: 1.075504
Total training time: 11.33 seconds.
-- Epoch 359
Norm: 3.01, NNZs: 500, Bias: -5.731474, T: 8596255, Avg. loss: 1.076170
Total training time: 11.36 seconds.
-- Epoch 360
Norm: 3.00, NNZs: 500, Bias: -5.713187, T: 8620200, Avg. loss: 1.071852
Total training time: 11.39 seconds.
-- Epoch 361
Norm: 2.99, NNZs: 500, Bias: -5.690089, T: 8644145, Avg. loss: 1.070548
Total training time: 11.42 seconds.
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-- Epoch 362
Norm: 2.98, NNZs: 500, Bias: -5.669667, T: 8668090, Avg. loss: 1.068570
Total training time: 11.45 seconds.
-- Epoch 363
Norm: 2.97, NNZs: 500, Bias: -5.649457, T: 8692035, Avg. loss: 1.068905
Total training time: 11.49 seconds.
-- Epoch 364
Norm: 2.96, NNZs: 500, Bias: -5.625641, T: 8715980, Avg. loss: 1.064598
Total training time: 11.52 seconds.
-- Epoch 365
Norm: 2.95, NNZs: 500, Bias: -5.606542, T: 8739925, Avg. loss: 1.058812
Total training time: 11.55 seconds.
-- Epoch 366
Norm: 2.95, NNZs: 500, Bias: -5.583884, T: 8763870, Avg. loss: 1.065883
Total training time: 11.58 seconds.
-- Epoch 367
Norm: 2.94, NNZs: 500, Bias: -5.563563, T: 8787815, Avg. loss: 1.061980
Total training time: 11.61 seconds.
-- Epoch 368
Norm: 2.93, NNZs: 500, Bias: -5.542590, T: 8811760, Avg. loss: 1.059299
Total training time: 11.64 seconds.
-- Epoch 369
Norm: 2.92, NNZs: 500, Bias: -5.522718, T: 8835705, Avg. loss: 1.057139
Total training time: 11.67 seconds.
-- Epoch 370
Norm: 2.91, NNZs: 500, Bias: -5.501924, T: 8859650, Avg. loss: 1.057021
Total training time: 11.71 seconds.
-- Epoch 371
Norm: 2.91, NNZs: 500, Bias: -5.481085, T: 8883595, Avg. loss: 1.055047
Total training time: 11.74 seconds.
-- Epoch 372
Norm: 2.90, NNZs: 500, Bias: -5.459828, T: 8907540, Avg. loss: 1.057521
Total training time: 11.77 seconds.
-- Epoch 373
Norm: 2.89, NNZs: 500, Bias: -5.439003, T: 8931485, Avg. loss: 1.053119
Total training time: 11.80 seconds.
-- Epoch 374
Norm: 2.88, NNZs: 500, Bias: -5.421743, T: 8955430, Avg. loss: 1.048980
Total training time: 11.83 seconds.
-- Epoch 375
Norm: 2.87, NNZs: 500, Bias: -5.399340, T: 8979375, Avg. loss: 1.049517
Total training time: 11.87 seconds.
-- Epoch 376
Norm: 2.87, NNZs: 500, Bias: -5.376569, T: 9003320, Avg. loss: 1.049869
Total training time: 11.90 seconds.
-- Epoch 377
Norm: 2.86, NNZs: 500, Bias: -5.359410, T: 9027265, Avg. loss: 1.046663
Total training time: 11.93 seconds.
-- Epoch 378
Norm: 2.85, NNZs: 500, Bias: -5.339261, T: 9051210, Avg. loss: 1.044230
Total training time: 11.96 seconds.
-- Epoch 379
Norm: 2.85, NNZs: 500, Bias: -5.318634, T: 9075155, Avg. loss: 1.045145
Total training time: 11.99 seconds.
-- Epoch 380
Norm: 2.83, NNZs: 500, Bias: -5.300705, T: 9099100, Avg. loss: 1.044298
Total training time: 12.02 seconds.
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-- Epoch 381
Norm: 2.83, NNZs: 500, Bias: -5.279079, T: 9123045, Avg. loss: 1.045536
Total training time: 12.05 seconds.
-- Epoch 382
Norm: 2.82, NNZs: 500, Bias: -5.261111, T: 9146990, Avg. loss: 1.038918
Total training time: 12.09 seconds.
-- Epoch 383
Norm: 2.81, NNZs: 500, Bias: -5.243803, T: 9170935, Avg. loss: 1.036197
Total training time: 12.12 seconds.
-- Epoch 384
Norm: 2.81, NNZs: 500, Bias: -5.221414, T: 9194880, Avg. loss: 1.040920
Total training time: 12.15 seconds.
-- Epoch 385
Norm: 2.80, NNZs: 500, Bias: -5.200661, T: 9218825, Avg. loss: 1.036961
Total training time: 12.18 seconds.
-- Epoch 386
Norm: 2.79, NNZs: 500, Bias: -5.181536, T: 9242770, Avg. loss: 1.034160
Total training time: 12.21 seconds.
-- Epoch 387
Norm: 2.79, NNZs: 500, Bias: -5.162200, T: 9266715, Avg. loss: 1.034019
Total training time: 12.24 seconds.
-- Epoch 388
Norm: 2.78, NNZs: 500, Bias: -5.145113, T: 9290660, Avg. loss: 1.033253
Total training time: 12.28 seconds.
-- Epoch 389
Norm: 2.77, NNZs: 500, Bias: -5.125481, T: 9314605, Avg. loss: 1.032159
Total training time: 12.31 seconds.
-- Epoch 390
Norm: 2.76, NNZs: 500, Bias: -5.111005, T: 9338550, Avg. loss: 1.029179
Total training time: 12.34 seconds.
-- Epoch 391
Norm: 2.76, NNZs: 500, Bias: -5.085894, T: 9362495, Avg. loss: 1.032935
Total training time: 12.37 seconds.
-- Epoch 392
Norm: 2.75, NNZs: 500, Bias: -5.069731, T: 9386440, Avg. loss: 1.028024
Total training time: 12.40 seconds.
-- Epoch 393
Norm: 2.75, NNZs: 500, Bias: -5.048969, T: 9410385, Avg. loss: 1.028620
Total training time: 12.43 seconds.
-- Epoch 394
Norm: 2.74, NNZs: 500, Bias: -5.030986, T: 9434330, Avg. loss: 1.031648
Total training time: 12.47 seconds.
-- Epoch 395
Norm: 2.73, NNZs: 500, Bias: -5.012456, T: 9458275, Avg. loss: 1.023341
Total training time: 12.50 seconds.
-- Epoch 396
Norm: 2.72, NNZs: 500, Bias: -4.996991, T: 9482220, Avg. loss: 1.020040
Total training time: 12.53 seconds.
-- Epoch 397
Norm: 2.72, NNZs: 500, Bias: -4.976481, T: 9506165, Avg. loss: 1.022825
Total training time: 12.56 seconds.
-- Epoch 398
Norm: 2.71, NNZs: 500, Bias: -4.958232, T: 9530110, Avg. loss: 1.019312
Total training time: 12.59 seconds.
-- Epoch 399
Norm: 2.70, NNZs: 500, Bias: -4.940115, T: 9554055, Avg. loss: 1.017482
Total training time: 12.63 seconds.
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-- Epoch 400
Norm: 2.70, NNZs: 500, Bias: -4.921588, T: 9578000, Avg. loss: 1.017784
Total training time: 12.66 seconds.
-- Epoch 401
Norm: 2.69, NNZs: 500, Bias: -4.902265, T: 9601945, Avg. loss: 1.017552
Total training time: 12.69 seconds.
-- Epoch 402
Norm: 2.69, NNZs: 500, Bias: -4.883396, T: 9625890, Avg. loss: 1.015727
Total training time: 12.72 seconds.
-- Epoch 403
Norm: 2.67, NNZs: 500, Bias: -4.869938, T: 9649835, Avg. loss: 1.014075
Total training time: 12.75 seconds.
-- Epoch 404
Norm: 2.67, NNZs: 500, Bias: -4.852786, T: 9673780, Avg. loss: 1.013748
Total training time: 12.79 seconds.
-- Epoch 405
Norm: 2.66, NNZs: 500, Bias: -4.836511, T: 9697725, Avg. loss: 1.010633
Total training time: 12.82 seconds.
-- Epoch 406
Norm: 2.65, NNZs: 500, Bias: -4.818655, T: 9721670, Avg. loss: 1.013093
Total training time: 12.85 seconds.
-- Epoch 407
Norm: 2.65, NNZs: 500, Bias: -4.801167, T: 9745615, Avg. loss: 1.012180
Total training time: 12.88 seconds.
-- Epoch 408
Norm: 2.64, NNZs: 500, Bias: -4.781618, T: 9769560, Avg. loss: 1.006557
Total training time: 12.91 seconds.
-- Epoch 409
Norm: 2.64, NNZs: 500, Bias: -4.763701, T: 9793505, Avg. loss: 1.010060
Total training time: 12.94 seconds.
-- Epoch 410
Norm: 2.63, NNZs: 500, Bias: -4.747738, T: 9817450, Avg. loss: 1.005890
Total training time: 12.98 seconds.
-- Epoch 411
Norm: 2.62, NNZs: 500, Bias: -4.731412, T: 9841395, Avg. loss: 1.004050
Total training time: 13.01 seconds.
-- Epoch 412
Norm: 2.62, NNZs: 500, Bias: -4.712884, T: 9865340, Avg. loss: 1.004638
Total training time: 13.04 seconds.
-- Epoch 413
Norm: 2.61, NNZs: 500, Bias: -4.697418, T: 9889285, Avg. loss: 1.001673
Total training time: 13.07 seconds.
-- Epoch 414
Norm: 2.61, NNZs: 500, Bias: -4.679043, T: 9913230, Avg. loss: 1.004967
Total training time: 13.10 seconds.
-- Epoch 415
Norm: 2.60, NNZs: 500, Bias: -4.663289, T: 9937175, Avg. loss: 0.999613
Total training time: 13.13 seconds.
-- Epoch 416
Norm: 2.59, NNZs: 500, Bias: -4.648407, T: 9961120, Avg. loss: 0.999183
Total training time: 13.17 seconds.
-- Epoch 417
Norm: 2.58, NNZs: 500, Bias: -4.630701, T: 9985065, Avg. loss: 0.999055
Total training time: 13.20 seconds.
-- Epoch 418
Norm: 2.58, NNZs: 500, Bias: -4.613659, T: 10009010, Avg. loss: 0.996445
Total training time: 13.23 seconds.
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-- Epoch 419
Norm: 2.57, NNZs: 500, Bias: -4.599790, T: 10032955, Avg. loss: 0.994142
Total training time: 13.26 seconds.
-- Epoch 420
Norm: 2.57, NNZs: 500, Bias: -4.582091, T: 10056900, Avg. loss: 0.991443
Total training time: 13.29 seconds.
-- Epoch 421
Norm: 2.56, NNZs: 500, Bias: -4.566412, T: 10080845, Avg. loss: 0.993462
Total training time: 13.32 seconds.
-- Epoch 422
Norm: 2.56, NNZs: 500, Bias: -4.547868, T: 10104790, Avg. loss: 0.994324
Total training time: 13.35 seconds.
-- Epoch 423
Norm: 2.54, NNZs: 500, Bias: -4.536041, T: 10128735, Avg. loss: 0.991309
Total training time: 13.39 seconds.
-- Epoch 424
Norm: 2.54, NNZs: 500, Bias: -4.519045, T: 10152680, Avg. loss: 0.989133
Total training time: 13.42 seconds.
-- Epoch 425
Norm: 2.54, NNZs: 500, Bias: -4.500720, T: 10176625, Avg. loss: 0.990056
Total training time: 13.45 seconds.
-- Epoch 426
Norm: 2.53, NNZs: 500, Bias: -4.487182, T: 10200570, Avg. loss: 0.987457
Total training time: 13.48 seconds.
-- Epoch 427
Norm: 2.52, NNZs: 500, Bias: -4.473275, T: 10224515, Avg. loss: 0.986580
Total training time: 13.52 seconds.
-- Epoch 428
Norm: 2.52, NNZs: 500, Bias: -4.454481, T: 10248460, Avg. loss: 0.991078
Total training time: 13.55 seconds.
-- Epoch 429
Norm: 2.51, NNZs: 500, Bias: -4.438232, T: 10272405, Avg. loss: 0.982523
Total training time: 13.58 seconds.
-- Epoch 430
Norm: 2.51, NNZs: 500, Bias: -4.422103, T: 10296350, Avg. loss: 0.987304
Total training time: 13.62 seconds.
-- Epoch 431
Norm: 2.50, NNZs: 500, Bias: -4.406439, T: 10320295, Avg. loss: 0.984135
Total training time: 13.65 seconds.
-- Epoch 432
Norm: 2.49, NNZs: 500, Bias: -4.392855, T: 10344240, Avg. loss: 0.981166
Total training time: 13.68 seconds.
-- Epoch 433
Norm: 2.49, NNZs: 500, Bias: -4.376307, T: 10368185, Avg. loss: 0.980843
Total training time: 13.71 seconds.
-- Epoch 434
Norm: 2.48, NNZs: 500, Bias: -4.361520, T: 10392130, Avg. loss: 0.978160
Total training time: 13.74 seconds.
-- Epoch 435
Norm: 2.48, NNZs: 500, Bias: -4.348461, T: 10416075, Avg. loss: 0.978952
Total training time: 13.78 seconds.
-- Epoch 436
Norm: 2.47, NNZs: 500, Bias: -4.332472, T: 10440020, Avg. loss: 0.981652
Total training time: 13.81 seconds.
-- Epoch 437
Norm: 2.46, NNZs: 500, Bias: -4.318140, T: 10463965, Avg. loss: 0.980480
Total training time: 13.84 seconds.
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-- Epoch 438
Norm: 2.46, NNZs: 500, Bias: -4.302238, T: 10487910, Avg. loss: 0.978625
Total training time: 13.87 seconds.
-- Epoch 439
Norm: 2.45, NNZs: 500, Bias: -4.288310, T: 10511855, Avg. loss: 0.977670
Total training time: 13.90 seconds.
Convergence after 439 epochs took 13.90 seconds
-- Epoch 1
Norm: 29.46, NNZs: 500, Bias: -76.696224, T: 29932, Avg. loss: 34.385417
Total training time: 0.04 seconds.
-- Epoch 2
Norm: 24.41, NNZs: 500, Bias: -65.461535, T: 59864, Avg. loss: 9.354050
Total training time: 0.08 seconds.
-- Epoch 3
Norm: 21.54, NNZs: 500, Bias: -58.987652, T: 89796, Avg. loss: 7.492200
Total training time: 0.12 seconds.
-- Epoch 4
Norm: 19.97, NNZs: 500, Bias: -54.395260, T: 119728, Avg. loss: 6.675335
Total training time: 0.16 seconds.
-- Epoch 5
Norm: 18.67, NNZs: 500, Bias: -50.925839, T: 149660, Avg. loss: 6.085015
Total training time: 0.20 seconds.
-- Epoch 6
Norm: 17.78, NNZs: 500, Bias: -48.119197, T: 179592, Avg. loss: 5.664982
Total training time: 0.24 seconds.
-- Epoch 7
Norm: 16.99, NNZs: 500, Bias: -45.778371, T: 209524, Avg. loss: 5.286619
Total training time: 0.28 seconds.
-- Epoch 8
Norm: 16.41, NNZs: 500, Bias: -43.715168, T: 239456, Avg. loss: 5.010172
Total training time: 0.32 seconds.
-- Epoch 9
Norm: 15.79, NNZs: 500, Bias: -41.986054, T: 269388, Avg. loss: 4.812837
Total training time: 0.35 seconds.
-- Epoch 10
Norm: 15.32, NNZs: 500, Bias: -40.420991, T: 299320, Avg. loss: 4.629296
Total training time: 0.39 seconds.
-- Epoch 11
Norm: 14.76, NNZs: 500, Bias: -39.071654, T: 329252, Avg. loss: 4.454330
Total training time: 0.43 seconds.
-- Epoch 12
Norm: 14.43, NNZs: 500, Bias: -37.781009, T: 359184, Avg. loss: 4.248956
Total training time: 0.47 seconds.
-- Epoch 13
Norm: 13.94, NNZs: 500, Bias: -36.679116, T: 389116, Avg. loss: 4.095904
Total training time: 0.50 seconds.
-- Epoch 14
Norm: 13.69, NNZs: 500, Bias: -35.590813, T: 419048, Avg. loss: 4.065953
Total training time: 0.54 seconds.
-- Epoch 15
Norm: 13.36, NNZs: 500, Bias: -34.618281, T: 448980, Avg. loss: 3.922090
Total training time: 0.58 seconds.
-- Epoch 16
Norm: 13.08, NNZs: 500, Bias: -33.707882, T: 478912, Avg. loss: 3.838481
Total training time: 0.62 seconds.
-- Epoch 17
Norm: 12.76, NNZs: 500, Bias: -32.883700, T: 508844, Avg. loss: 3.755687
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Total training time: 0.66 seconds.
-- Epoch 18
Norm: 12.50, NNZs: 500, Bias: -32.093732, T: 538776, Avg. loss: 3.669937
Total training time: 0.70 seconds.
-- Epoch 19
Norm: 12.24, NNZs: 500, Bias: -31.355498, T: 568708, Avg. loss: 3.555230
Total training time: 0.73 seconds.
-- Epoch 20
Norm: 12.01, NNZs: 500, Bias: -30.660305, T: 598640, Avg. loss: 3.517266
Total training time: 0.77 seconds.
-- Epoch 21
Norm: 11.80, NNZs: 500, Bias: -29.989728, T: 628572, Avg. loss: 3.427916
Total training time: 0.81 seconds.
-- Epoch 22
Norm: 11.62, NNZs: 500, Bias: -29.349675, T: 658504, Avg. loss: 3.342978
Total training time: 0.85 seconds.
-- Epoch 23
Norm: 11.40, NNZs: 500, Bias: -28.760803, T: 688436, Avg. loss: 3.303974
Total training time: 0.88 seconds.
-- Epoch 24
Norm: 11.22, NNZs: 500, Bias: -28.187561, T: 718368, Avg. loss: 3.240161
Total training time: 0.92 seconds.
-- Epoch 25
Norm: 11.00, NNZs: 500, Bias: -27.664450, T: 748300, Avg. loss: 3.168963
Total training time: 0.96 seconds.
-- Epoch 26
Norm: 10.88, NNZs: 500, Bias: -27.124467, T: 778232, Avg. loss: 3.113530
Total training time: 1.00 seconds.
-- Epoch 27
Norm: 10.64, NNZs: 500, Bias: -26.657778, T: 808164, Avg. loss: 3.063326
Total training time: 1.03 seconds.
-- Epoch 28
Norm: 10.48, NNZs: 500, Bias: -26.179293, T: 838096, Avg. loss: 3.022958
Total training time: 1.07 seconds.
-- Epoch 29
Norm: 10.31, NNZs: 500, Bias: -25.731420, T: 868028, Avg. loss: 2.959652
Total training time: 1.11 seconds.
-- Epoch 30
Norm: 10.20, NNZs: 500, Bias: -25.275147, T: 897960, Avg. loss: 2.915266
Total training time: 1.15 seconds.
-- Epoch 31
Norm: 10.04, NNZs: 500, Bias: -24.858143, T: 927892, Avg. loss: 2.892189
Total training time: 1.18 seconds.
-- Epoch 32
Norm: 9.90, NNZs: 500, Bias: -24.449867, T: 957824, Avg. loss: 2.839335
Total training time: 1.22 seconds.
-- Epoch 33
Norm: 9.75, NNZs: 500, Bias: -24.063156, T: 987756, Avg. loss: 2.785796
Total training time: 1.26 seconds.
-- Epoch 34
Norm: 9.61, NNZs: 500, Bias: -23.685679, T: 1017688, Avg. loss: 2.758601
Total training time: 1.30 seconds.
-- Epoch 35
Norm: 9.49, NNZs: 500, Bias: -23.317195, T: 1047620, Avg. loss: 2.741523
Total training time: 1.34 seconds.
-- Epoch 36
Norm: 9.35, NNZs: 500, Bias: -22.969091, T: 1077552, Avg. loss: 2.683781

Total training time: 1.37 seconds.
-- Epoch 37
Norm: 9.22, NNZs: 500, Bias: -22.629024, T: 1107484, Avg. loss: 2.664580
Total training time: 1.41 seconds.
-- Epoch 38
Norm: 9.11, NNZs: 500, Bias: -22.294150, T: 1137416, Avg. loss: 2.628710
Total training time: 1.45 seconds.
-- Epoch 39
Norm: 8.97, NNZs: 500, Bias: -21.984898, T: 1167348, Avg. loss: 2.590119
Total training time: 1.48 seconds.
-- Epoch 40
Norm: 8.91, NNZs: 500, Bias: -21.649612, T: 1197280, Avg. loss: 2.575328
Total training time: 1.52 seconds.
-- Epoch 41
Norm: 8.75, NNZs: 500, Bias: -21.364697, T: 1227212, Avg. loss: 2.519404
Total training time: 1.56 seconds.
-- Epoch 42
Norm: 8.68, NNZs: 500, Bias: -21.054968, T: 1257144, Avg. loss: 2.497656
Total training time: 1.60 seconds.
-- Epoch 43
Norm: 8.59, NNZs: 500, Bias: -20.761400, T: 1287076, Avg. loss: 2.469683
Total training time: 1.63 seconds.
-- Epoch 44
Norm: 8.46, NNZs: 500, Bias: -20.493305, T: 1317008, Avg. loss: 2.446131
Total training time: 1.67 seconds.
-- Epoch 45
Norm: 8.35, NNZs: 500, Bias: -20.224692, T: 1346940, Avg. loss: 2.413715
Total training time: 1.71 seconds.
-- Epoch 46
Norm: 8.27, NNZs: 500, Bias: -19.949429, T: 1376872, Avg. loss: 2.392794
Total training time: 1.75 seconds.
-- Epoch 47
Norm: 8.18, NNZs: 500, Bias: -19.691351, T: 1406804, Avg. loss: 2.376574
Total training time: 1.79 seconds.
-- Epoch 48
Norm: 8.07, NNZs: 500, Bias: -19.441910, T: 1436736, Avg. loss: 2.334491
Total training time: 1.82 seconds.
-- Epoch 49
Norm: 8.01, NNZs: 500, Bias: -19.181802, T: 1466668, Avg. loss: 2.323120
Total training time: 1.86 seconds.
-- Epoch 50
Norm: 7.87, NNZs: 500, Bias: -18.964772, T: 1496600, Avg. loss: 2.292546
Total training time: 1.90 seconds.
-- Epoch 51
Norm: 7.80, NNZs: 500, Bias: -18.724641, T: 1526532, Avg. loss: 2.283371
Total training time: 1.94 seconds.
-- Epoch 52
Norm: 7.72, NNZs: 500, Bias: -18.488940, T: 1556464, Avg. loss: 2.250776
Total training time: 1.97 seconds.
-- Epoch 53
Norm: 7.65, NNZs: 500, Bias: -18.259856, T: 1586396, Avg. loss: 2.218427
Total training time: 2.01 seconds.
-- Epoch 54
Norm: 7.61, NNZs: 500, Bias: -18.023303, T: 1616328, Avg. loss: 2.214322
Total training time: 2.05 seconds.
-- Epoch 55
Norm: 7.51, NNZs: 500, Bias: -17.813581, T: 1646260, Avg. loss: 2.191014

Total training time: 2.09 seconds.
-- Epoch 56
Norm: 7.41, NNZs: 500, Bias: -17.611715, T: 1676192, Avg. loss: 2.169670
Total training time: 2.12 seconds.
-- Epoch 57
Norm: 7.36, NNZs: 500, Bias: -17.396025, T: 1706124, Avg. loss: 2.155837
Total training time: 2.16 seconds.
-- Epoch 58
Norm: 7.27, NNZs: 500, Bias: -17.197508, T: 1736056, Avg. loss: 2.135638
Total training time: 2.20 seconds.
-- Epoch 59
Norm: 7.19, NNZs: 500, Bias: -17.001057, T: 1765988, Avg. loss: 2.109409
Total training time: 2.24 seconds.
-- Epoch 60
Norm: 7.16, NNZs: 500, Bias: -16.789073, T: 1795920, Avg. loss: 2.096305
Total training time: 2.28 seconds.
-- Epoch 61
Norm: 7.06, NNZs: 500, Bias: -16.609791, T: 1825852, Avg. loss: 2.079422
Total training time: 2.31 seconds.
-- Epoch 62
Norm: 6.97, NNZs: 500, Bias: -16.431298, T: 1855784, Avg. loss: 2.054921
Total training time: 2.35 seconds.
-- Epoch 63
Norm: 6.92, NNZs: 500, Bias: -16.242753, T: 1885716, Avg. loss: 2.055440
Total training time: 2.39 seconds.
-- Epoch 64
Norm: 6.81, NNZs: 500, Bias: -16.079579, T: 1915648, Avg. loss: 2.022596
Total training time: 2.42 seconds.
-- Epoch 65
Norm: 6.79, NNZs: 500, Bias: -15.882951, T: 1945580, Avg. loss: 2.012110
Total training time: 2.46 seconds.
-- Epoch 66
Norm: 6.70, NNZs: 500, Bias: -15.721217, T: 1975512, Avg. loss: 1.988292
Total training time: 2.50 seconds.
-- Epoch 67
Norm: 6.65, NNZs: 500, Bias: -15.546617, T: 2005444, Avg. loss: 1.979049
Total training time: 2.54 seconds.
-- Epoch 68
Norm: 6.59, NNZs: 500, Bias: -15.375683, T: 2035376, Avg. loss: 1.961629
Total training time: 2.57 seconds.
-- Epoch 69
Norm: 6.54, NNZs: 500, Bias: -15.208972, T: 2065308, Avg. loss: 1.953950
Total training time: 2.61 seconds.
-- Epoch 70
Norm: 6.49, NNZs: 500, Bias: -15.040662, T: 2095240, Avg. loss: 1.920480
Total training time: 2.65 seconds.
-- Epoch 71
Norm: 6.42, NNZs: 500, Bias: -14.884396, T: 2125172, Avg. loss: 1.907969
Total training time: 2.69 seconds.
-- Epoch 72
Norm: 6.34, NNZs: 500, Bias: -14.739461, T: 2155104, Avg. loss: 1.902361
Total training time: 2.72 seconds.
-- Epoch 73
Norm: 6.31, NNZs: 500, Bias: -14.573241, T: 2185036, Avg. loss: 1.890652
Total training time: 2.76 seconds.
-- Epoch 74
Norm: 6.26, NNZs: 500, Bias: -14.418824, T: 2214968, Avg. loss: 1.871832

Total training time: 2.80 seconds.
-- Epoch 75
Norm: 6.15, NNZs: 500, Bias: -14.293864, T: 2244900, Avg. loss: 1.843424
Total training time: 2.83 seconds.
-- Epoch 76
Norm: 6.13, NNZs: 500, Bias: -14.131207, T: 2274832, Avg. loss: 1.854699
Total training time: 2.87 seconds.
-- Epoch 77
Norm: 6.06, NNZs: 500, Bias: -13.991305, T: 2304764, Avg. loss: 1.827528
Total training time: 2.91 seconds.
-- Epoch 78
Norm: 6.02, NNZs: 500, Bias: -13.844569, T: 2334696, Avg. loss: 1.816520
Total training time: 2.95 seconds.
-- Epoch 79
Norm: 5.96, NNZs: 500, Bias: -13.707112, T: 2364628, Avg. loss: 1.797945
Total training time: 2.99 seconds.
-- Epoch 80
Norm: 5.91, NNZs: 500, Bias: -13.570508, T: 2394560, Avg. loss: 1.788016
Total training time: 3.02 seconds.
-- Epoch 81
Norm: 5.86, NNZs: 500, Bias: -13.431671, T: 2424492, Avg. loss: 1.779056
Total training time: 3.06 seconds.
-- Epoch 82
Norm: 5.82, NNZs: 500, Bias: -13.291950, T: 2454424, Avg. loss: 1.763574
Total training time: 3.10 seconds.
-- Epoch 83
Norm: 5.75, NNZs: 500, Bias: -13.168153, T: 2484356, Avg. loss: 1.753866
Total training time: 3.14 seconds.
-- Epoch 84
Norm: 5.70, NNZs: 500, Bias: -13.040756, T: 2514288, Avg. loss: 1.733568
Total training time: 3.18 seconds.
-- Epoch 85
Norm: 5.65, NNZs: 500, Bias: -12.912868, T: 2544220, Avg. loss: 1.723137
Total training time: 3.21 seconds.
-- Epoch 86
Norm: 5.60, NNZs: 500, Bias: -12.785758, T: 2574152, Avg. loss: 1.722621
Total training time: 3.25 seconds.
-- Epoch 87
Norm: 5.56, NNZs: 500, Bias: -12.658970, T: 2604084, Avg. loss: 1.708549
Total training time: 3.29 seconds.
-- Epoch 88
Norm: 5.52, NNZs: 500, Bias: -12.534897, T: 2634016, Avg. loss: 1.700300
Total training time: 3.33 seconds.
-- Epoch 89
Norm: 5.45, NNZs: 500, Bias: -12.423402, T: 2663948, Avg. loss: 1.682155
Total training time: 3.36 seconds.
-- Epoch 90
Norm: 5.42, NNZs: 500, Bias: -12.300260, T: 2693880, Avg. loss: 1.676566
Total training time: 3.40 seconds.
-- Epoch 91
Norm: 5.38, NNZs: 500, Bias: -12.176028, T: 2723812, Avg. loss: 1.661782
Total training time: 3.44 seconds.
-- Epoch 92
Norm: 5.34, NNZs: 500, Bias: -12.058720, T: 2753744, Avg. loss: 1.655009
Total training time: 3.48 seconds.
-- Epoch 93
Norm: 5.30, NNZs: 500, Bias: -11.941960, T: 2783676, Avg. loss: 1.644478

Total training time: 3.52 seconds.
-- Epoch 94
Norm: 5.27, NNZs: 500, Bias: -11.824719, T: 2813608, Avg. loss: 1.636408
Total training time: 3.56 seconds.
-- Epoch 95
Norm: 5.22, NNZs: 500, Bias: -11.713842, T: 2843540, Avg. loss: 1.620766
Total training time: 3.59 seconds.
-- Epoch 96
Norm: 5.17, NNZs: 500, Bias: -11.611020, T: 2873472, Avg. loss: 1.603967
Total training time: 3.63 seconds.
-- Epoch 97
Norm: 5.12, NNZs: 500, Bias: -11.506730, T: 2903404, Avg. loss: 1.602158
Total training time: 3.67 seconds.
-- Epoch 98
Norm: 5.08, NNZs: 500, Bias: -11.397118, T: 2933336, Avg. loss: 1.594131
Total training time: 3.71 seconds.
-- Epoch 99
Norm: 5.04, NNZs: 500, Bias: -11.292803, T: 2963268, Avg. loss: 1.587507
Total training time: 3.75 seconds.
-- Epoch 100
Norm: 5.00, NNZs: 500, Bias: -11.183524, T: 2993200, Avg. loss: 1.573391
Total training time: 3.79 seconds.
-- Epoch 101
Norm: 4.96, NNZs: 500, Bias: -11.082234, T: 3023132, Avg. loss: 1.564689
Total training time: 3.83 seconds.
-- Epoch 102
Norm: 4.93, NNZs: 500, Bias: -10.978281, T: 3053064, Avg. loss: 1.562542
Total training time: 3.86 seconds.
-- Epoch 103
Norm: 4.90, NNZs: 500, Bias: -10.871396, T: 3082996, Avg. loss: 1.550381
Total training time: 3.90 seconds.
-- Epoch 104
Norm: 4.84, NNZs: 500, Bias: -10.781509, T: 3112928, Avg. loss: 1.537377
Total training time: 3.94 seconds.
-- Epoch 105
Norm: 4.82, NNZs: 500, Bias: -10.674726, T: 3142860, Avg. loss: 1.530413
Total training time: 3.98 seconds.
-- Epoch 106
Norm: 4.78, NNZs: 500, Bias: -10.579873, T: 3172792, Avg. loss: 1.520621
Total training time: 4.01 seconds.
-- Epoch 107
Norm: 4.74, NNZs: 500, Bias: -10.484312, T: 3202724, Avg. loss: 1.505291
Total training time: 4.05 seconds.
-- Epoch 108
Norm: 4.71, NNZs: 500, Bias: -10.383890, T: 3232656, Avg. loss: 1.495401
Total training time: 4.09 seconds.
-- Epoch 109
Norm: 4.66, NNZs: 500, Bias: -10.297782, T: 3262588, Avg. loss: 1.485424
Total training time: 4.13 seconds.
-- Epoch 110
Norm: 4.63, NNZs: 500, Bias: -10.202593, T: 3292520, Avg. loss: 1.482917
Total training time: 4.17 seconds.
-- Epoch 111
Norm: 4.61, NNZs: 500, Bias: -10.102962, T: 3322452, Avg. loss: 1.482516
Total training time: 4.21 seconds.
-- Epoch 112
Norm: 4.56, NNZs: 500, Bias: -10.021685, T: 3352384, Avg. loss: 1.477695

Total training time: 4.25 seconds.
-- Epoch 113
Norm: 4.53, NNZs: 500, Bias: -9.930606, T: 3382316, Avg. loss: 1.466226
Total training time: 4.28 seconds.
-- Epoch 114
Norm: 4.51, NNZs: 500, Bias: -9.835556, T: 3412248, Avg. loss: 1.453746
Total training time: 4.32 seconds.
-- Epoch 115
Norm: 4.47, NNZs: 500, Bias: -9.749070, T: 3442180, Avg. loss: 1.441010
Total training time: 4.36 seconds.
-- Epoch 116
Norm: 4.43, NNZs: 500, Bias: -9.663149, T: 3472112, Avg. loss: 1.442469
Total training time: 4.40 seconds.
-- Epoch 117
Norm: 4.40, NNZs: 500, Bias: -9.576782, T: 3502044, Avg. loss: 1.432705
Total training time: 4.44 seconds.
-- Epoch 118
Norm: 4.37, NNZs: 500, Bias: -9.492438, T: 3531976, Avg. loss: 1.422472
Total training time: 4.48 seconds.
-- Epoch 119
Norm: 4.34, NNZs: 500, Bias: -9.406164, T: 3561908, Avg. loss: 1.420535
Total training time: 4.51 seconds.
-- Epoch 120
Norm: 4.31, NNZs: 500, Bias: -9.326120, T: 3591840, Avg. loss: 1.416334
Total training time: 4.55 seconds.
-- Epoch 121
Norm: 4.27, NNZs: 500, Bias: -9.246290, T: 3621772, Avg. loss: 1.398902
Total training time: 4.59 seconds.
-- Epoch 122
Norm: 4.24, NNZs: 500, Bias: -9.162677, T: 3651704, Avg. loss: 1.401418
Total training time: 4.63 seconds.
-- Epoch 123
Norm: 4.23, NNZs: 500, Bias: -9.075043, T: 3681636, Avg. loss: 1.386751
Total training time: 4.66 seconds.
-- Epoch 124
Norm: 4.18, NNZs: 500, Bias: -9.005427, T: 3711568, Avg. loss: 1.376947
Total training time: 4.70 seconds.
-- Epoch 125
Norm: 4.15, NNZs: 500, Bias: -8.924825, T: 3741500, Avg. loss: 1.372688
Total training time: 4.74 seconds.
-- Epoch 126
Norm: 4.11, NNZs: 500, Bias: -8.851109, T: 3771432, Avg. loss: 1.355825
Total training time: 4.78 seconds.
-- Epoch 127
Norm: 4.08, NNZs: 500, Bias: -8.774991, T: 3801364, Avg. loss: 1.359180
Total training time: 4.82 seconds.
-- Epoch 128
Norm: 4.07, NNZs: 500, Bias: -8.691405, T: 3831296, Avg. loss: 1.364727
Total training time: 4.85 seconds.
-- Epoch 129
Norm: 4.04, NNZs: 500, Bias: -8.615352, T: 3861228, Avg. loss: 1.351794
Total training time: 4.89 seconds.
-- Epoch 130
Norm: 4.01, NNZs: 500, Bias: -8.541204, T: 3891160, Avg. loss: 1.343463
Total training time: 4.93 seconds.
-- Epoch 131
Norm: 3.99, NNZs: 500, Bias: -8.464750, T: 3921092, Avg. loss: 1.346490

Total training time: 4.97 seconds.
-- Epoch 132
Norm: 3.95, NNZs: 500, Bias: -8.396645, T: 3951024, Avg. loss: 1.329922
Total training time: 5.01 seconds.
-- Epoch 133
Norm: 3.92, NNZs: 500, Bias: -8.325572, T: 3980956, Avg. loss: 1.322349
Total training time: 5.05 seconds.
-- Epoch 134
Norm: 3.89, NNZs: 500, Bias: -8.255938, T: 4010888, Avg. loss: 1.315847
Total training time: 5.09 seconds.
-- Epoch 135
Norm: 3.87, NNZs: 500, Bias: -8.179373, T: 4040820, Avg. loss: 1.310818
Total training time: 5.12 seconds.
-- Epoch 136
Norm: 3.85, NNZs: 500, Bias: -8.110348, T: 4070752, Avg. loss: 1.304569
Total training time: 5.16 seconds.
-- Epoch 137
Norm: 3.81, NNZs: 500, Bias: -8.047760, T: 4100684, Avg. loss: 1.297342
Total training time: 5.20 seconds.
-- Epoch 138
Norm: 3.78, NNZs: 500, Bias: -7.978450, T: 4130616, Avg. loss: 1.300131
Total training time: 5.24 seconds.
-- Epoch 139
Norm: 3.77, NNZs: 500, Bias: -7.901948, T: 4160548, Avg. loss: 1.289487
Total training time: 5.28 seconds.
-- Epoch 140
Norm: 3.73, NNZs: 500, Bias: -7.842749, T: 4190480, Avg. loss: 1.278002
Total training time: 5.32 seconds.
-- Epoch 141
Norm: 3.71, NNZs: 500, Bias: -7.773150, T: 4220412, Avg. loss: 1.276261
Total training time: 5.35 seconds.
-- Epoch 142
Norm: 3.69, NNZs: 500, Bias: -7.704167, T: 4250344, Avg. loss: 1.268553
Total training time: 5.39 seconds.
-- Epoch 143
Norm: 3.66, NNZs: 500, Bias: -7.642949, T: 4280276, Avg. loss: 1.262900
Total training time: 5.43 seconds.
-- Epoch 144
Norm: 3.64, NNZs: 500, Bias: -7.575229, T: 4310208, Avg. loss: 1.259876
Total training time: 5.47 seconds.
-- Epoch 145
Norm: 3.61, NNZs: 500, Bias: -7.512658, T: 4340140, Avg. loss: 1.253942
Total training time: 5.51 seconds.
-- Epoch 146
Norm: 3.59, NNZs: 500, Bias: -7.448368, T: 4370072, Avg. loss: 1.251293
Total training time: 5.55 seconds.
-- Epoch 147
Norm: 3.57, NNZs: 500, Bias: -7.382985, T: 4400004, Avg. loss: 1.245379
Total training time: 5.59 seconds.
-- Epoch 148
Norm: 3.55, NNZs: 500, Bias: -7.322524, T: 4429936, Avg. loss: 1.238033
Total training time: 5.63 seconds.
-- Epoch 149
Norm: 3.51, NNZs: 500, Bias: -7.266136, T: 4459868, Avg. loss: 1.228485
Total training time: 5.67 seconds.
-- Epoch 150
Norm: 3.50, NNZs: 500, Bias: -7.200495, T: 4489800, Avg. loss: 1.230335

Total training time: 5.71 seconds.
-- Epoch 151
Norm: 3.48, NNZs: 500, Bias: -7.140562, T: 4519732, Avg. loss: 1.223808
Total training time: 5.75 seconds.
-- Epoch 152
Norm: 3.45, NNZs: 500, Bias: -7.081131, T: 4549664, Avg. loss: 1.219280
Total training time: 5.78 seconds.
-- Epoch 153
Norm: 3.43, NNZs: 500, Bias: -7.024675, T: 4579596, Avg. loss: 1.211393
Total training time: 5.82 seconds.
-- Epoch 154
Norm: 3.41, NNZs: 500, Bias: -6.963558, T: 4609528, Avg. loss: 1.204536
Total training time: 5.86 seconds.
-- Epoch 155
Norm: 3.39, NNZs: 500, Bias: -6.905097, T: 4639460, Avg. loss: 1.197184
Total training time: 5.90 seconds.
-- Epoch 156
Norm: 3.37, NNZs: 500, Bias: -6.846110, T: 4669392, Avg. loss: 1.199072
Total training time: 5.94 seconds.
-- Epoch 157
Norm: 3.34, NNZs: 500, Bias: -6.789185, T: 4699324, Avg. loss: 1.193213
Total training time: 5.98 seconds.
-- Epoch 158
Norm: 3.32, NNZs: 500, Bias: -6.734540, T: 4729256, Avg. loss: 1.195160
Total training time: 6.02 seconds.
-- Epoch 159
Norm: 3.30, NNZs: 500, Bias: -6.676639, T: 4759188, Avg. loss: 1.190125
Total training time: 6.05 seconds.
-- Epoch 160
Norm: 3.28, NNZs: 500, Bias: -6.622849, T: 4789120, Avg. loss: 1.184019
Total training time: 6.09 seconds.
-- Epoch 161
Norm: 3.26, NNZs: 500, Bias: -6.565567, T: 4819052, Avg. loss: 1.174222
Total training time: 6.13 seconds.
-- Epoch 162
Norm: 3.24, NNZs: 500, Bias: -6.510116, T: 4848984, Avg. loss: 1.179684
Total training time: 6.17 seconds.
-- Epoch 163
Norm: 3.22, NNZs: 500, Bias: -6.458571, T: 4878916, Avg. loss: 1.167849
Total training time: 6.21 seconds.
-- Epoch 164
Norm: 3.20, NNZs: 500, Bias: -6.405332, T: 4908848, Avg. loss: 1.165833
Total training time: 6.25 seconds.
-- Epoch 165
Norm: 3.18, NNZs: 500, Bias: -6.354587, T: 4938780, Avg. loss: 1.162783
Total training time: 6.28 seconds.
-- Epoch 166
Norm: 3.16, NNZs: 500, Bias: -6.301293, T: 4968712, Avg. loss: 1.155383
Total training time: 6.32 seconds.
-- Epoch 167
Norm: 3.14, NNZs: 500, Bias: -6.250231, T: 4998644, Avg. loss: 1.149749
Total training time: 6.36 seconds.
-- Epoch 168
Norm: 3.11, NNZs: 500, Bias: -6.203972, T: 5028576, Avg. loss: 1.144314
Total training time: 6.40 seconds.
-- Epoch 169
Norm: 3.11, NNZs: 500, Bias: -6.145138, T: 5058508, Avg. loss: 1.143789

Total training time: 6.44 seconds.
-- Epoch 170
Norm: 3.08, NNZs: 500, Bias: -6.096366, T: 5088440, Avg. loss: 1.134599
Total training time: 6.48 seconds.
-- Epoch 171
Norm: 3.07, NNZs: 500, Bias: -6.041088, T: 5118372, Avg. loss: 1.139254
Total training time: 6.52 seconds.
-- Epoch 172
Norm: 3.04, NNZs: 500, Bias: -5.998217, T: 5148304, Avg. loss: 1.127805
Total training time: 6.56 seconds.
-- Epoch 173
Norm: 3.03, NNZs: 500, Bias: -5.946440, T: 5178236, Avg. loss: 1.127677
Total training time: 6.60 seconds.
-- Epoch 174
Norm: 3.01, NNZs: 500, Bias: -5.897209, T: 5208168, Avg. loss: 1.124055
Total training time: 6.63 seconds.
-- Epoch 175
Norm: 2.99, NNZs: 500, Bias: -5.852743, T: 5238100, Avg. loss: 1.121918
Total training time: 6.67 seconds.
-- Epoch 176
Norm: 2.96, NNZs: 500, Bias: -5.810175, T: 5268032, Avg. loss: 1.110026
Total training time: 6.71 seconds.
-- Epoch 177
Norm: 2.95, NNZs: 500, Bias: -5.762946, T: 5297964, Avg. loss: 1.113071
Total training time: 6.75 seconds.
-- Epoch 178
Norm: 2.93, NNZs: 500, Bias: -5.716912, T: 5327896, Avg. loss: 1.103829
Total training time: 6.79 seconds.
-- Epoch 179
Norm: 2.92, NNZs: 500, Bias: -5.665925, T: 5357828, Avg. loss: 1.108895
Total training time: 6.83 seconds.
-- Epoch 180
Norm: 2.90, NNZs: 500, Bias: -5.622689, T: 5387760, Avg. loss: 1.093284
Total training time: 6.87 seconds.
-- Epoch 181
Norm: 2.88, NNZs: 500, Bias: -5.580537, T: 5417692, Avg. loss: 1.100305
Total training time: 6.91 seconds.
-- Epoch 182
Norm: 2.87, NNZs: 500, Bias: -5.530434, T: 5447624, Avg. loss: 1.099380
Total training time: 6.95 seconds.
-- Epoch 183
Norm: 2.85, NNZs: 500, Bias: -5.488136, T: 5477556, Avg. loss: 1.094366
Total training time: 6.98 seconds.
-- Epoch 184
Norm: 2.84, NNZs: 500, Bias: -5.440462, T: 5507488, Avg. loss: 1.091157
Total training time: 7.02 seconds.
-- Epoch 185
Norm: 2.82, NNZs: 500, Bias: -5.396485, T: 5537420, Avg. loss: 1.089426
Total training time: 7.06 seconds.
-- Epoch 186
Norm: 2.80, NNZs: 500, Bias: -5.358993, T: 5567352, Avg. loss: 1.080875
Total training time: 7.10 seconds.
-- Epoch 187
Norm: 2.79, NNZs: 500, Bias: -5.313619, T: 5597284, Avg. loss: 1.081759
Total training time: 7.14 seconds.
-- Epoch 188
Norm: 2.77, NNZs: 500, Bias: -5.270069, T: 5627216, Avg. loss: 1.077684

Total training time: 7.18 seconds.
-- Epoch 189
Norm: 2.75, NNZs: 500, Bias: -5.229335, T: 5657148, Avg. loss: 1.066667
Total training time: 7.22 seconds.
-- Epoch 190
Norm: 2.73, NNZs: 500, Bias: -5.190312, T: 5687080, Avg. loss: 1.067754
Total training time: 7.26 seconds.
-- Epoch 191
Norm: 2.73, NNZs: 500, Bias: -5.144453, T: 5717012, Avg. loss: 1.064372
Total training time: 7.30 seconds.
-- Epoch 192
Norm: 2.70, NNZs: 500, Bias: -5.108230, T: 5746944, Avg. loss: 1.059477
Total training time: 7.34 seconds.
-- Epoch 193
Norm: 2.69, NNZs: 500, Bias: -5.065036, T: 5776876, Avg. loss: 1.058975
Total training time: 7.37 seconds.
-- Epoch 194
Norm: 2.68, NNZs: 500, Bias: -5.026420, T: 5806808, Avg. loss: 1.055690
Total training time: 7.41 seconds.
-- Epoch 195
Norm: 2.66, NNZs: 500, Bias: -4.990588, T: 5836740, Avg. loss: 1.050804
Total training time: 7.45 seconds.
-- Epoch 196
Norm: 2.65, NNZs: 500, Bias: -4.948220, T: 5866672, Avg. loss: 1.053761
Total training time: 7.49 seconds.
-- Epoch 197
Norm: 2.63, NNZs: 500, Bias: -4.909633, T: 5896604, Avg. loss: 1.053836
Total training time: 7.53 seconds.
-- Epoch 198
Norm: 2.62, NNZs: 500, Bias: -4.868707, T: 5926536, Avg. loss: 1.046626
Total training time: 7.57 seconds.
-- Epoch 199
Norm: 2.60, NNZs: 500, Bias: -4.832482, T: 5956468, Avg. loss: 1.047342
Total training time: 7.61 seconds.
-- Epoch 200
Norm: 2.59, NNZs: 500, Bias: -4.794761, T: 5986400, Avg. loss: 1.041804
Total training time: 7.65 seconds.
-- Epoch 201
Norm: 2.58, NNZs: 500, Bias: -4.758215, T: 6016332, Avg. loss: 1.039881
Total training time: 7.69 seconds.
-- Epoch 202
Norm: 2.56, NNZs: 500, Bias: -4.725261, T: 6046264, Avg. loss: 1.031630
Total training time: 7.73 seconds.
-- Epoch 203
Norm: 2.55, NNZs: 500, Bias: -4.688321, T: 6076196, Avg. loss: 1.037387
Total training time: 7.76 seconds.
-- Epoch 204
Norm: 2.53, NNZs: 500, Bias: -4.653125, T: 6106128, Avg. loss: 1.030424
Total training time: 7.80 seconds.
-- Epoch 205
Norm: 2.51, NNZs: 500, Bias: -4.619938, T: 6136060, Avg. loss: 1.028106
Total training time: 7.84 seconds.
-- Epoch 206
Norm: 2.51, NNZs: 500, Bias: -4.580458, T: 6165992, Avg. loss: 1.029467
Total training time: 7.88 seconds.
-- Epoch 207
Norm: 2.49, NNZs: 500, Bias: -4.545984, T: 6195924, Avg. loss: 1.031816

Total training time: 7.92 seconds.
-- Epoch 208
Norm: 2.48, NNZs: 500, Bias: -4.511390, T: 6225856, Avg. loss: 1.025617
Total training time: 7.96 seconds.
-- Epoch 209
Norm: 2.47, NNZs: 500, Bias: -4.476591, T: 6255788, Avg. loss: 1.022724
Total training time: 8.00 seconds.
-- Epoch 210
Norm: 2.45, NNZs: 500, Bias: -4.445803, T: 6285720, Avg. loss: 1.017896
Total training time: 8.04 seconds.
-- Epoch 211
Norm: 2.44, NNZs: 500, Bias: -4.413882, T: 6315652, Avg. loss: 1.016525
Total training time: 8.08 seconds.
-- Epoch 212
Norm: 2.43, NNZs: 500, Bias: -4.377615, T: 6345584, Avg. loss: 1.015492
Total training time: 8.12 seconds.
-- Epoch 213
Norm: 2.42, NNZs: 500, Bias: -4.343292, T: 6375516, Avg. loss: 1.014597
Total training time: 8.16 seconds.
-- Epoch 214
Norm: 2.41, NNZs: 500, Bias: -4.314776, T: 6405448, Avg. loss: 1.008595
Total training time: 8.20 seconds.
-- Epoch 215
Norm: 2.39, NNZs: 500, Bias: -4.285844, T: 6435380, Avg. loss: 1.009097
Total training time: 8.24 seconds.
-- Epoch 216
Norm: 2.39, NNZs: 500, Bias: -4.249101, T: 6465312, Avg. loss: 1.005565
Total training time: 8.28 seconds.
-- Epoch 217
Norm: 2.37, NNZs: 500, Bias: -4.219573, T: 6495244, Avg. loss: 0.999761
Total training time: 8.32 seconds.
-- Epoch 218
Norm: 2.36, NNZs: 500, Bias: -4.189064, T: 6525176, Avg. loss: 1.000293
Total training time: 8.36 seconds.
-- Epoch 219
Norm: 2.35, NNZs: 500, Bias: -4.159948, T: 6555108, Avg. loss: 0.997741
Total training time: 8.40 seconds.
-- Epoch 220
Norm: 2.34, NNZs: 500, Bias: -4.128553, T: 6585040, Avg. loss: 0.996651
Total training time: 8.44 seconds.
-- Epoch 221
Norm: 2.33, NNZs: 500, Bias: -4.099592, T: 6614972, Avg. loss: 0.993686
Total training time: 8.48 seconds.
-- Epoch 222
Norm: 2.32, NNZs: 500, Bias: -4.069090, T: 6644904, Avg. loss: 0.995040
Total training time: 8.52 seconds.
-- Epoch 223
Norm: 2.30, NNZs: 500, Bias: -4.044125, T: 6674836, Avg. loss: 0.994830
Total training time: 8.56 seconds.
-- Epoch 224
Norm: 2.29, NNZs: 500, Bias: -4.011718, T: 6704768, Avg. loss: 0.991673
Total training time: 8.60 seconds.
-- Epoch 225
Norm: 2.28, NNZs: 500, Bias: -3.982176, T: 6734700, Avg. loss: 0.986294
Total training time: 8.63 seconds.
-- Epoch 226
Norm: 2.27, NNZs: 500, Bias: -3.955233, T: 6764632, Avg. loss: 0.987660

```

Total training time: 8.67 seconds.
-- Epoch 227
Norm: 2.26, NNZs: 500, Bias: -3.928281, T: 6794564, Avg. loss: 0.981588
Total training time: 8.71 seconds.
-- Epoch 228
Norm: 2.25, NNZs: 500, Bias: -3.900822, T: 6824496, Avg. loss: 0.979860
Total training time: 8.75 seconds.
-- Epoch 229
Norm: 2.24, NNZs: 500, Bias: -3.871661, T: 6854428, Avg. loss: 0.983117
Total training time: 8.79 seconds.
-- Epoch 230
Norm: 2.23, NNZs: 500, Bias: -3.848107, T: 6884360, Avg. loss: 0.975180
Total training time: 8.83 seconds.
-- Epoch 231
Norm: 2.22, NNZs: 500, Bias: -3.821868, T: 6914292, Avg. loss: 0.978399
Total training time: 8.87 seconds.
-- Epoch 232
Norm: 2.21, NNZs: 500, Bias: -3.794605, T: 6944224, Avg. loss: 0.979009
Total training time: 8.91 seconds.
-- Epoch 233
Norm: 2.20, NNZs: 500, Bias: -3.764537, T: 6974156, Avg. loss: 0.976387
Total training time: 8.95 seconds.
-- Epoch 234
Norm: 2.19, NNZs: 500, Bias: -3.741217, T: 7004088, Avg. loss: 0.966721
Total training time: 9.00 seconds.
-- Epoch 235
Norm: 2.18, NNZs: 500, Bias: -3.715303, T: 7034020, Avg. loss: 0.969930
Total training time: 9.03 seconds.
-- Epoch 236
Norm: 2.17, NNZs: 500, Bias: -3.689990, T: 7063952, Avg. loss: 0.970772
Total training time: 9.08 seconds.
-- Epoch 237
Norm: 2.16, NNZs: 500, Bias: -3.665013, T: 7093884, Avg. loss: 0.966534
Total training time: 9.12 seconds.
-- Epoch 238
Norm: 2.15, NNZs: 500, Bias: -3.642217, T: 7123816, Avg. loss: 0.969436
Total training time: 9.16 seconds.
-- Epoch 239
Norm: 2.15, NNZs: 500, Bias: -3.616653, T: 7153748, Avg. loss: 0.965926
Total training time: 9.20 seconds.
Convergence after 239 epochs took 9.20 seconds
[1 1 0 ... 1 0 1]

```

	precision	recall	f1-score	support
0	0.45	0.82	0.58	1218
1	0.96	0.81	0.88	6265
micro avg	0.81	0.81	0.81	7483
macro avg	0.71	0.81	0.73	7483
weighted avg	0.88	0.81	0.83	7483

```

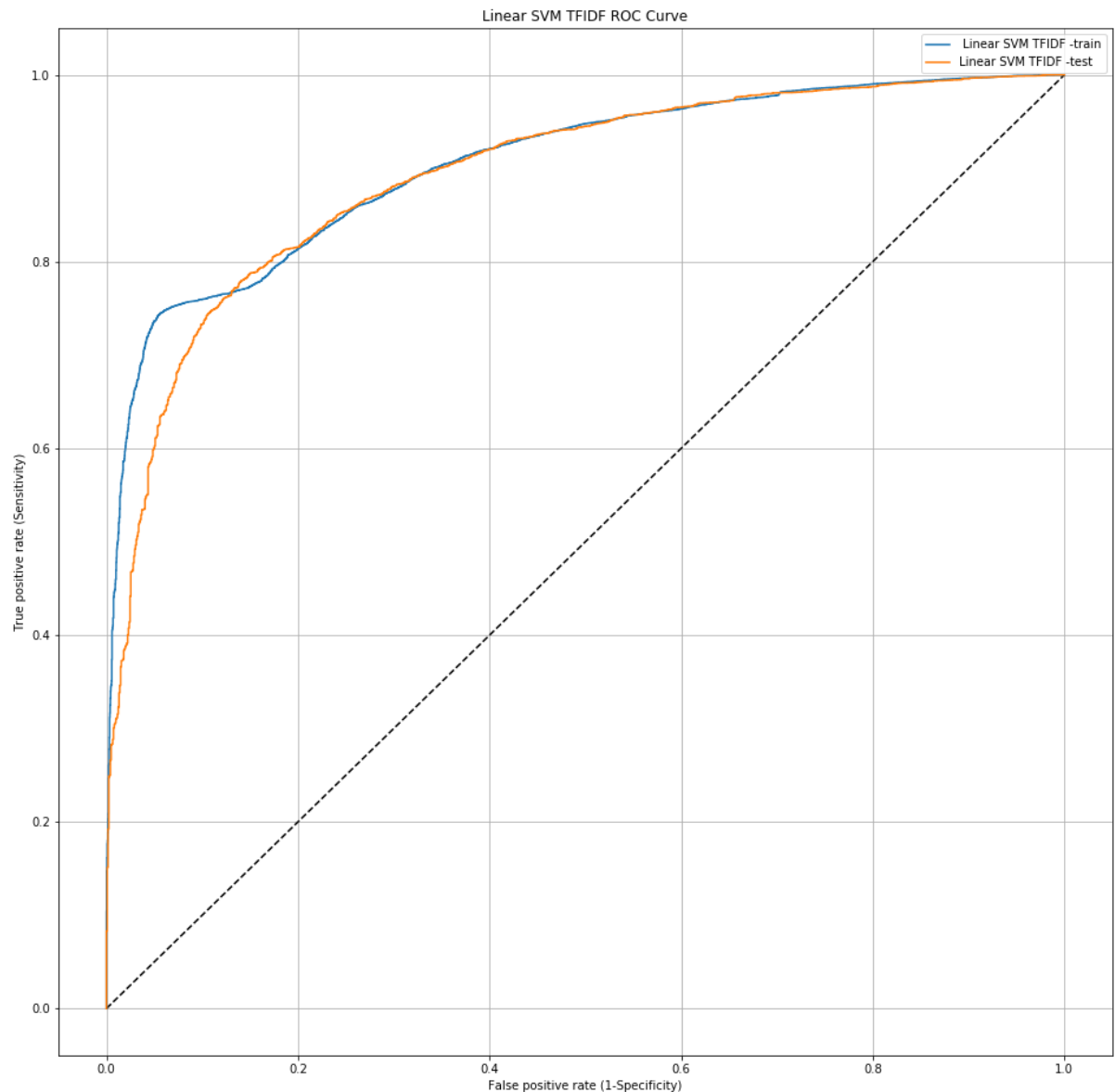
[0.87797604 0.60519903 0.43931695 ... 0.98512525 0.46340477 0.67251197]

```

```

In [60]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='Linear SVM TFIDF ROC Curve'
displaygraph.legnd_1 = ' Linear SVM TFIDF -train'
displaygraph.legnd_2 = 'Linear SVM TFIDF -test'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='False positive rate (1-Specificity)'
displaygraph.label_y='True positive rate (Sensitivity)'
displaygraph.constructgraph(lnrsvm_tidf.roc_curve_test['fpr_trn'],lnrsvm_tidf.roc_curve_test['tpr_trn'],\
                             lnrsvm_tidf.roc_curve_test['fpr'],lnrsvm_tidf.roc_curve_test['tpr'])

```



```
In [61]: data = [[lnrsvm_tidf.confsnmtxytstpred['tn'] ,lnrsvm_tidf.confsnmtxytstpred
['fn']], [lnrsvm_tidf.confsnmtxytstpred['fp'],lnrsvm_tidf.confsnmtxytstpred[
'tp']]]
displaygraph.draw_table(data)
```

	Predicted: NO	Predicted: YES
Actual: NO	997	1199
Actual: YES	221	5066

```
In [62]: data1= [[lnrsvm_tidf.accuracy_score_val,lnrsvm_tidf.accuracy_score_test]]
displaygraph.draw_accscore(data1)
```

	Validation	Test
Accuracy Score	0.7928845832637381	0.8102365361486035

Precision, Recall, f-1 Score

```
In [63]: import tabulate
res_tab = [['Label', 'Precision', 'Recall', 'f-1 Score'],
           [0, 0.45, 0.82, 0.58],
           [1, 0.96, 0.81, 0.88]]
print(tabulate.tabulate(res_tab, tablefmt='fancy_grid'))
```

Label	Precision	Recall	f-1 Score
0	0.45	0.82	0.58
1	0.96	0.81	0.88

Feature Importance for Linear SVM

```
In [64]: lnrsm_tidfc1f = lnrsvm_tidf.getSGDClassifier()
feature_names = lnrsvm_tidf.feats_names
top10_negve = sorted(zip(lnrsm_tidfc1f.coef_[0], feature_names))[-10:]
top10_posve = sorted(zip(lnrsm_tidfc1f.coef_[0], feature_names))[0:10]
feat_pos=[]
feat_neg=[]
features=[]
for coef,feat in (top10_negve):
    feat_pos.append(feat)

for cef,feat in (top10_posve):
    feat_neg.append(feat)

i=0
while i< int(len(feat_pos)):
    feat_item=[]
    feat_item.append(feat_pos[i])
    feat_item.append(feat_neg[i])
    features.append(feat_item)
    i +=1

displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.draw_posnegwords(features)
```

	Postive	Negative
1	fast	noodles
2	work	honey
3	yummy	diet
4	love	bad
5	decaf	mix
6	per	review
7	go	away
8	best	would not
9	looks	three
10	going	cooking

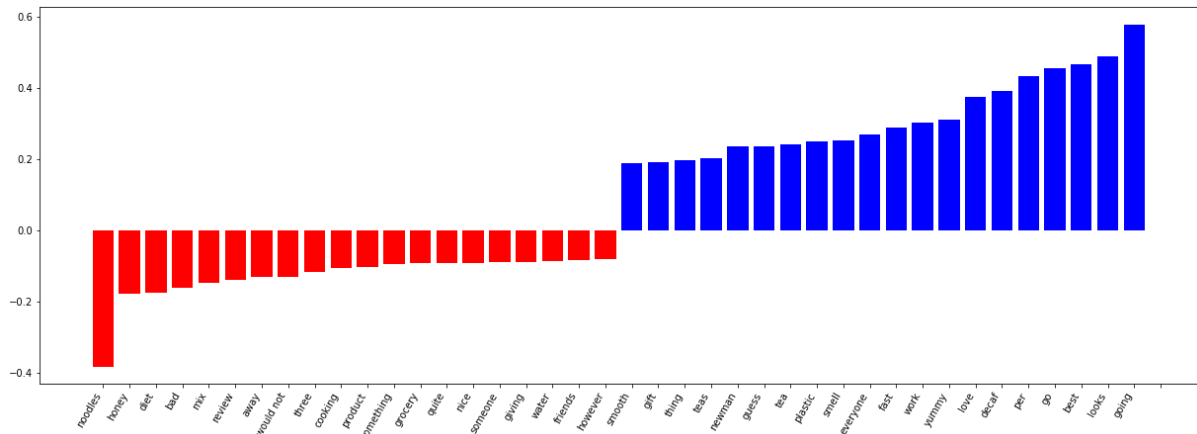
FeatureNames - a different prespective

```
In [65]: no_feat = 20
coef = lnrm_tidfc1f.coef_.ravel()

top_posve_coef = np.argsort(coef)[-no_feat:]
top_negve_coef = np.argsort(coef)[:no_feat]

top_coefs = np.hstack([top_negve_coef, top_posve_coef])
feature_names = lnrm_tidf.feat_names

dspgraph = drawgraphs()
dspgraph.setdefaultparm()
dspgraph.visual_featname(feature_names,coef,top_coefs,no_feat)
```



[5.1.3] Applying Linear SVM on AVG W2V, SET 3

```
In [3]: # Please write all the code with proper documentation
```

GridsearchCV output for AVGW2V

```
0.8909825893272035 {'alpha': 0.01, 'penalty': 'l2'} GridSearchCV(cv=10, error_score='raise-deprecating',
estimator=SGDClassifier(alpha=0.0001, average=False, class_weight=None, early_stopping=False,
epsilon=0.1, eta0=0.0, fit_intercept=True, l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2', power_t=0.5, random_state=42, shuffle=True,
tol=0.001, validation_fraction=0.1, verbose=100, warm_start=False), fit_params=None, iid='warn',
n_jobs=None, param_grid={'penalty': ['l2', 'l1'], 'alpha': [0.0001, 0.001, 0.01, 0.1, 1, 10, 100, 1000]},
pre_dispatch='2*n_jobs', refit=True, return_train_score='warn', scoring='roc_auc', verbose=100)
```



```
In [24]: lnrsvmavgw2v = assign7SVM()  
lnrsm_sgdc1f = lnrsvmavgw2v.SGDClassifier()  
lnrsvmavgw2v.load_data('AVGW2V')  
lnrsvmavgw2v.setpenaltyparm('l2')  
  
Out[24]: SGDClassifier(alpha=0.0001, average=False, class_weight={0: 5.14, 1: 1},  
    early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,  
    l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,  
    n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',  
    power_t=0.5, random_state=42, shuffle=True, tol=0.001,  
    validation_fraction=0.1, verbose=100, warm_start=False)
```

In [25]: `lnrsvmavgw2v.SVM_calcrocaucscore(1000000)`

```
SGDClassifier(alpha=1e-07, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 7481.64, NNZs: 50, Bias: 2717.694835, T: 23945, Avg. loss: 1062.06129
0
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 6679.53, NNZs: 50, Bias: 2656.980311, T: 47890, Avg. loss: 965.812661
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 6137.71, NNZs: 50, Bias: 2443.776994, T: 71835, Avg. loss: 854.901634
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 5676.97, NNZs: 50, Bias: 2157.489994, T: 95780, Avg. loss: 774.718450
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 5573.67, NNZs: 50, Bias: 2800.608283, T: 119725, Avg. loss: 725.58481
6
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 5234.40, NNZs: 50, Bias: 1876.608197, T: 143670, Avg. loss: 678.73030
2
Total training time: 0.07 seconds.
-- Epoch 7
Norm: 5157.62, NNZs: 50, Bias: 1876.247093, T: 167615, Avg. loss: 612.87583
4
Total training time: 0.08 seconds.
-- Epoch 8
Norm: 4294.30, NNZs: 50, Bias: 1745.832774, T: 191560, Avg. loss: 562.09834
4
Total training time: 0.09 seconds.
-- Epoch 9
Norm: 4465.47, NNZs: 50, Bias: 1464.442567, T: 215505, Avg. loss: 530.43008
1
Total training time: 0.10 seconds.
-- Epoch 10
Norm: 3852.46, NNZs: 50, Bias: 1534.926125, T: 239450, Avg. loss: 507.39674
6
Total training time: 0.12 seconds.
-- Epoch 11
Norm: 3746.37, NNZs: 50, Bias: 1894.289487, T: 263395, Avg. loss: 476.32313
8
Total training time: 0.13 seconds.
-- Epoch 12
Norm: 3387.75, NNZs: 50, Bias: 1265.795129, T: 287340, Avg. loss: 441.37184
4
Total training time: 0.14 seconds.
-- Epoch 13
Norm: 3297.96, NNZs: 50, Bias: 1155.401747, T: 311285, Avg. loss: 426.60055
7
Total training time: 0.15 seconds.
-- Epoch 14
Norm: 3762.84, NNZs: 50, Bias: 469.222386, T: 335230, Avg. loss: 427.484667
```

```
Total training time: 0.17 seconds.
-- Epoch 15
Norm: 3469.76, NNZs: 50, Bias: 894.344537, T: 359175, Avg. loss: 395.504347
Total training time: 0.18 seconds.
-- Epoch 16
Norm: 3187.66, NNZs: 50, Bias: 845.860317, T: 383120, Avg. loss: 377.524667
Total training time: 0.19 seconds.
-- Epoch 17
Norm: 2714.64, NNZs: 50, Bias: 1336.390258, T: 407065, Avg. loss: 360.85356
3
Total training time: 0.21 seconds.
-- Epoch 18
Norm: 2992.36, NNZs: 50, Bias: 998.353305, T: 431010, Avg. loss: 330.554488
Total training time: 0.22 seconds.
-- Epoch 19
Norm: 2551.17, NNZs: 50, Bias: 1226.559914, T: 454955, Avg. loss: 336.59652
5
Total training time: 0.23 seconds.
-- Epoch 20
Norm: 2430.28, NNZs: 50, Bias: 762.417158, T: 478900, Avg. loss: 317.231518
Total training time: 0.25 seconds.
-- Epoch 21
Norm: 2185.78, NNZs: 50, Bias: 757.421671, T: 502845, Avg. loss: 300.595399
Total training time: 0.26 seconds.
-- Epoch 22
Norm: 2252.50, NNZs: 50, Bias: 953.701418, T: 526790, Avg. loss: 302.724019
Total training time: 0.27 seconds.
-- Epoch 23
Norm: 2161.68, NNZs: 50, Bias: 749.147432, T: 550735, Avg. loss: 291.557600
Total training time: 0.28 seconds.
-- Epoch 24
Norm: 2241.24, NNZs: 50, Bias: 650.842691, T: 574680, Avg. loss: 266.094244
Total training time: 0.30 seconds.
-- Epoch 25
Norm: 2363.04, NNZs: 50, Bias: 814.394464, T: 598625, Avg. loss: 267.793427
Total training time: 0.31 seconds.
-- Epoch 26
Norm: 1849.03, NNZs: 50, Bias: 1023.682505, T: 622570, Avg. loss: 257.43232
3
Total training time: 0.33 seconds.
-- Epoch 27
Norm: 1910.20, NNZs: 50, Bias: 672.934825, T: 646515, Avg. loss: 263.364455
Total training time: 0.34 seconds.
-- Epoch 28
Norm: 2007.83, NNZs: 50, Bias: 528.700392, T: 670460, Avg. loss: 246.721906
Total training time: 0.35 seconds.
-- Epoch 29
Norm: 1812.18, NNZs: 50, Bias: 693.706424, T: 694405, Avg. loss: 240.464439
Total training time: 0.36 seconds.
-- Epoch 30
Norm: 1723.67, NNZs: 50, Bias: 650.727490, T: 718350, Avg. loss: 230.345700
Total training time: 0.38 seconds.
-- Epoch 31
Norm: 1819.84, NNZs: 50, Bias: 418.981239, T: 742295, Avg. loss: 223.028912
Total training time: 0.39 seconds.
-- Epoch 32
Norm: 1731.78, NNZs: 50, Bias: 686.341390, T: 766240, Avg. loss: 222.136125
```

```
Total training time: 0.40 seconds.
-- Epoch 33
Norm: 1599.09, NNZs: 50, Bias: 701.324796, T: 790185, Avg. loss: 214.061331
Total training time: 0.41 seconds.
-- Epoch 34
Norm: 1644.57, NNZs: 50, Bias: 586.562681, T: 814130, Avg. loss: 208.578822
Total training time: 0.42 seconds.
-- Epoch 35
Norm: 1601.78, NNZs: 50, Bias: 657.299801, T: 838075, Avg. loss: 199.942948
Total training time: 0.44 seconds.
-- Epoch 36
Norm: 1559.09, NNZs: 50, Bias: 698.771160, T: 862020, Avg. loss: 197.650542
Total training time: 0.45 seconds.
-- Epoch 37
Norm: 1313.85, NNZs: 50, Bias: 731.299909, T: 885965, Avg. loss: 194.585565
Total training time: 0.46 seconds.
-- Epoch 38
Norm: 1636.39, NNZs: 50, Bias: 727.203376, T: 909910, Avg. loss: 187.722834
Total training time: 0.47 seconds.
-- Epoch 39
Norm: 1523.61, NNZs: 50, Bias: 498.670101, T: 933855, Avg. loss: 188.373863
Total training time: 0.49 seconds.
-- Epoch 40
Norm: 1604.72, NNZs: 50, Bias: 694.694583, T: 957800, Avg. loss: 181.407076
Total training time: 0.50 seconds.
-- Epoch 41
Norm: 1580.09, NNZs: 50, Bias: 465.045013, T: 981745, Avg. loss: 182.879345
Total training time: 0.52 seconds.
-- Epoch 42
Norm: 1514.82, NNZs: 50, Bias: 476.210979, T: 1005690, Avg. loss: 170.63025
7
Total training time: 0.53 seconds.
-- Epoch 43
Norm: 1412.54, NNZs: 50, Bias: 453.706978, T: 1029635, Avg. loss: 172.17600
3
Total training time: 0.54 seconds.
-- Epoch 44
Norm: 1344.30, NNZs: 50, Bias: 602.200809, T: 1053580, Avg. loss: 167.86126
8
Total training time: 0.55 seconds.
-- Epoch 45
Norm: 1397.83, NNZs: 50, Bias: 386.783978, T: 1077525, Avg. loss: 164.31358
7
Total training time: 0.57 seconds.
-- Epoch 46
Norm: 1178.81, NNZs: 50, Bias: 560.498844, T: 1101470, Avg. loss: 157.35782
8
Total training time: 0.58 seconds.
-- Epoch 47
Norm: 1198.31, NNZs: 50, Bias: 396.168870, T: 1125415, Avg. loss: 160.31630
9
Total training time: 0.59 seconds.
-- Epoch 48
Norm: 1085.88, NNZs: 50, Bias: 473.926952, T: 1149360, Avg. loss: 151.27116
1
Total training time: 0.60 seconds.
-- Epoch 49
```

Norm: 1137.48, NNZs: 50, Bias: 440.386435, T: 1173305, Avg. loss: 155.87683
6
Total training time: 0.62 seconds.
-- Epoch 50
Norm: 1071.74, NNZs: 50, Bias: 376.085774, T: 1197250, Avg. loss: 145.88107
2
Total training time: 0.63 seconds.
-- Epoch 51
Norm: 1068.28, NNZs: 50, Bias: 546.724283, T: 1221195, Avg. loss: 148.91198
0
Total training time: 0.64 seconds.
-- Epoch 52
Norm: 1131.14, NNZs: 50, Bias: 432.640459, T: 1245140, Avg. loss: 144.94300
8
Total training time: 0.65 seconds.
-- Epoch 53
Norm: 1107.25, NNZs: 50, Bias: 345.741334, T: 1269085, Avg. loss: 146.58011
9
Total training time: 0.67 seconds.
-- Epoch 54
Norm: 1029.31, NNZs: 50, Bias: 471.336146, T: 1293030, Avg. loss: 138.36535
2
Total training time: 0.68 seconds.
-- Epoch 55
Norm: 1028.81, NNZs: 50, Bias: 566.037902, T: 1316975, Avg. loss: 136.87730
3
Total training time: 0.70 seconds.
-- Epoch 56
Norm: 915.72, NNZs: 50, Bias: 434.727645, T: 1340920, Avg. loss: 133.252474
Total training time: 0.71 seconds.
-- Epoch 57
Norm: 1026.44, NNZs: 50, Bias: 435.373874, T: 1364865, Avg. loss: 137.22168
0
Total training time: 0.73 seconds.
-- Epoch 58
Norm: 1050.33, NNZs: 50, Bias: 382.365749, T: 1388810, Avg. loss: 134.36550
8
Total training time: 0.74 seconds.
-- Epoch 59
Norm: 1096.65, NNZs: 50, Bias: 458.964211, T: 1412755, Avg. loss: 134.66557
9
Total training time: 0.75 seconds.
-- Epoch 60
Norm: 889.48, NNZs: 50, Bias: 447.628211, T: 1436700, Avg. loss: 126.897443
Total training time: 0.76 seconds.
-- Epoch 61
Norm: 1026.31, NNZs: 50, Bias: 594.782520, T: 1460645, Avg. loss: 124.91816
3
Total training time: 0.78 seconds.
-- Epoch 62
Norm: 1113.80, NNZs: 50, Bias: 381.382764, T: 1484590, Avg. loss: 126.22216
4
Total training time: 0.79 seconds.
-- Epoch 63
Norm: 955.86, NNZs: 50, Bias: 449.595399, T: 1508535, Avg. loss: 121.730747
Total training time: 0.80 seconds.
-- Epoch 64

Norm: 937.89, NNZs: 50, Bias: 452.024398, T: 1532480, Avg. loss: 120.626143
Total training time: 0.81 seconds.
-- Epoch 65
Norm: 909.59, NNZs: 50, Bias: 458.154255, T: 1556425, Avg. loss: 123.003330
Total training time: 0.82 seconds.
-- Epoch 66
Norm: 869.48, NNZs: 50, Bias: 350.537640, T: 1580370, Avg. loss: 115.853324
Total training time: 0.84 seconds.
-- Epoch 67
Norm: 800.65, NNZs: 50, Bias: 460.820065, T: 1604315, Avg. loss: 111.667603
Total training time: 0.85 seconds.
-- Epoch 68
Norm: 847.11, NNZs: 50, Bias: 381.893489, T: 1628260, Avg. loss: 111.950104
Total training time: 0.86 seconds.
-- Epoch 69
Norm: 920.15, NNZs: 50, Bias: 394.508556, T: 1652205, Avg. loss: 111.466052
Total training time: 0.87 seconds.
-- Epoch 70
Norm: 822.84, NNZs: 50, Bias: 397.738585, T: 1676150, Avg. loss: 109.718344
Total training time: 0.88 seconds.
-- Epoch 71
Norm: 739.76, NNZs: 50, Bias: 254.039122, T: 1700095, Avg. loss: 106.813428
Total training time: 0.90 seconds.
-- Epoch 72
Norm: 883.96, NNZs: 50, Bias: 326.290326, T: 1724040, Avg. loss: 106.852975
Total training time: 0.91 seconds.
-- Epoch 73
Norm: 1209.45, NNZs: 50, Bias: 163.011068, T: 1747985, Avg. loss: 104.63403
8
Total training time: 0.92 seconds.
-- Epoch 74
Norm: 918.65, NNZs: 50, Bias: 220.718852, T: 1771930, Avg. loss: 107.980144
Total training time: 0.94 seconds.
-- Epoch 75
Norm: 877.19, NNZs: 50, Bias: 211.827123, T: 1795875, Avg. loss: 102.981462
Total training time: 0.95 seconds.
-- Epoch 76
Norm: 796.77, NNZs: 50, Bias: 241.763356, T: 1819820, Avg. loss: 100.366882
Total training time: 0.96 seconds.
-- Epoch 77
Norm: 702.12, NNZs: 50, Bias: 336.424167, T: 1843765, Avg. loss: 100.567499
Total training time: 0.98 seconds.
-- Epoch 78
Norm: 875.27, NNZs: 50, Bias: 252.100502, T: 1867710, Avg. loss: 102.046841
Total training time: 0.99 seconds.
-- Epoch 79
Norm: 871.63, NNZs: 50, Bias: 293.458469, T: 1891655, Avg. loss: 98.528609
Total training time: 1.00 seconds.
-- Epoch 80
Norm: 753.29, NNZs: 50, Bias: 269.070962, T: 1915600, Avg. loss: 100.755881
Total training time: 1.01 seconds.
-- Epoch 81
Norm: 809.04, NNZs: 50, Bias: 261.302995, T: 1939545, Avg. loss: 96.497942
Total training time: 1.03 seconds.
-- Epoch 82
Norm: 804.29, NNZs: 50, Bias: 327.181609, T: 1963490, Avg. loss: 98.923439
Total training time: 1.04 seconds.

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-- Epoch 83
Norm: 762.67, NNZs: 50, Bias: 325.423977, T: 1987435, Avg. loss: 94.307725
Total training time: 1.05 seconds.
-- Epoch 84
Norm: 820.30, NNZs: 50, Bias: 280.709263, T: 2011380, Avg. loss: 92.331828
Total training time: 1.06 seconds.
-- Epoch 85
Norm: 770.84, NNZs: 50, Bias: 365.157191, T: 2035325, Avg. loss: 89.312991
Total training time: 1.07 seconds.
-- Epoch 86
Norm: 708.53, NNZs: 50, Bias: 299.077200, T: 2059270, Avg. loss: 89.585226
Total training time: 1.09 seconds.
-- Epoch 87
Norm: 771.60, NNZs: 50, Bias: 226.307430, T: 2083215, Avg. loss: 91.584397
Total training time: 1.10 seconds.
-- Epoch 88
Norm: 789.78, NNZs: 50, Bias: 274.352064, T: 2107160, Avg. loss: 93.463867
Total training time: 1.11 seconds.
-- Epoch 89
Norm: 708.68, NNZs: 50, Bias: 341.864131, T: 2131105, Avg. loss: 90.602173
Total training time: 1.12 seconds.
-- Epoch 90
Norm: 708.59, NNZs: 50, Bias: 250.110958, T: 2155050, Avg. loss: 87.073461
Total training time: 1.14 seconds.
-- Epoch 91
Norm: 701.29, NNZs: 50, Bias: 296.897602, T: 2178995, Avg. loss: 85.262799
Total training time: 1.15 seconds.
-- Epoch 92
Norm: 712.13, NNZs: 50, Bias: 350.803170, T: 2202940, Avg. loss: 87.990245
Total training time: 1.16 seconds.
-- Epoch 93
Norm: 722.74, NNZs: 50, Bias: 230.056677, T: 2226885, Avg. loss: 83.271358
Total training time: 1.17 seconds.
-- Epoch 94
Norm: 707.99, NNZs: 50, Bias: 283.424363, T: 2250830, Avg. loss: 86.855843
Total training time: 1.18 seconds.
-- Epoch 95
Norm: 748.75, NNZs: 50, Bias: 283.152473, T: 2274775, Avg. loss: 85.016639
Total training time: 1.20 seconds.
-- Epoch 96
Norm: 736.68, NNZs: 50, Bias: 253.987580, T: 2298720, Avg. loss: 83.597584
Total training time: 1.21 seconds.
-- Epoch 97
Norm: 745.79, NNZs: 50, Bias: 250.948041, T: 2322665, Avg. loss: 78.798373
Total training time: 1.22 seconds.
-- Epoch 98
Norm: 799.04, NNZs: 50, Bias: 351.756102, T: 2346610, Avg. loss: 84.979932
Total training time: 1.23 seconds.
-- Epoch 99
Norm: 665.13, NNZs: 50, Bias: 218.067410, T: 2370555, Avg. loss: 81.262191
Total training time: 1.25 seconds.
-- Epoch 100
Norm: 700.26, NNZs: 50, Bias: 272.917144, T: 2394500, Avg. loss: 81.824752
Total training time: 1.26 seconds.
-- Epoch 101
Norm: 691.42, NNZs: 50, Bias: 269.084582, T: 2418445, Avg. loss: 84.169965
Total training time: 1.27 seconds.
```



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-- Epoch 102
Norm: 634.56, NNZs: 50, Bias: 270.984106, T: 2442390, Avg. loss: 77.424084
Total training time: 1.29 seconds.
-- Epoch 103
Norm: 587.07, NNZs: 50, Bias: 253.965390, T: 2466335, Avg. loss: 78.437499
Total training time: 1.30 seconds.
-- Epoch 104
Norm: 725.12, NNZs: 50, Bias: 249.524936, T: 2490280, Avg. loss: 77.104095
Total training time: 1.31 seconds.
-- Epoch 105
Norm: 638.78, NNZs: 50, Bias: 221.243719, T: 2514225, Avg. loss: 74.523026
Total training time: 1.32 seconds.
-- Epoch 106
Norm: 621.71, NNZs: 50, Bias: 179.446520, T: 2538170, Avg. loss: 77.104007
Total training time: 1.33 seconds.
-- Epoch 107
Norm: 634.66, NNZs: 50, Bias: 169.304299, T: 2562115, Avg. loss: 72.463767
Total training time: 1.34 seconds.
-- Epoch 108
Norm: 621.00, NNZs: 50, Bias: 264.809367, T: 2586060, Avg. loss: 75.128419
Total training time: 1.35 seconds.
-- Epoch 109
Norm: 583.07, NNZs: 50, Bias: 233.665928, T: 2610005, Avg. loss: 74.869720
Total training time: 1.37 seconds.
-- Epoch 110
Norm: 574.37, NNZs: 50, Bias: 239.929632, T: 2633950, Avg. loss: 74.846624
Total training time: 1.38 seconds.
-- Epoch 111
Norm: 611.53, NNZs: 50, Bias: 155.592868, T: 2657895, Avg. loss: 72.184005
Total training time: 1.39 seconds.
-- Epoch 112
Norm: 555.54, NNZs: 50, Bias: 273.967249, T: 2681840, Avg. loss: 70.052838
Total training time: 1.40 seconds.
-- Epoch 113
Norm: 625.97, NNZs: 50, Bias: 214.586095, T: 2705785, Avg. loss: 70.381423
Total training time: 1.41 seconds.
-- Epoch 114
Norm: 622.59, NNZs: 50, Bias: 197.772357, T: 2729730, Avg. loss: 69.336671
Total training time: 1.43 seconds.
-- Epoch 115
Norm: 552.63, NNZs: 50, Bias: 188.754145, T: 2753675, Avg. loss: 70.950398
Total training time: 1.44 seconds.
-- Epoch 116
Norm: 579.04, NNZs: 50, Bias: 192.853771, T: 2777620, Avg. loss: 70.002963
Total training time: 1.45 seconds.
-- Epoch 117
Norm: 528.42, NNZs: 50, Bias: 195.720019, T: 2801565, Avg. loss: 67.914379
Total training time: 1.46 seconds.
-- Epoch 118
Norm: 569.98, NNZs: 50, Bias: 161.099722, T: 2825510, Avg. loss: 67.280124
Total training time: 1.47 seconds.
-- Epoch 119
Norm: 568.87, NNZs: 50, Bias: 262.034044, T: 2849455, Avg. loss: 67.098999
Total training time: 1.48 seconds.
-- Epoch 120
Norm: 505.34, NNZs: 50, Bias: 218.107258, T: 2873400, Avg. loss: 68.524079
Total training time: 1.49 seconds.
```

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-- Epoch 121
Norm: 553.25, NNZs: 50, Bias: 195.733549, T: 2897345, Avg. loss: 66.599221
Total training time: 1.50 seconds.
-- Epoch 122
Norm: 556.61, NNZs: 50, Bias: 144.619843, T: 2921290, Avg. loss: 65.544622
Total training time: 1.52 seconds.
-- Epoch 123
Norm: 509.15, NNZs: 50, Bias: 183.885065, T: 2945235, Avg. loss: 66.778626
Total training time: 1.53 seconds.
-- Epoch 124
Norm: 509.09, NNZs: 50, Bias: 197.294461, T: 2969180, Avg. loss: 66.004810
Total training time: 1.54 seconds.
-- Epoch 125
Norm: 448.48, NNZs: 50, Bias: 170.234724, T: 2993125, Avg. loss: 65.708722
Total training time: 1.55 seconds.
-- Epoch 126
Norm: 520.02, NNZs: 50, Bias: 217.046545, T: 3017070, Avg. loss: 66.852643
Total training time: 1.56 seconds.
-- Epoch 127
Norm: 512.54, NNZs: 50, Bias: 175.645152, T: 3041015, Avg. loss: 63.070052
Total training time: 1.58 seconds.
-- Epoch 128
Norm: 488.03, NNZs: 50, Bias: 156.939184, T: 3064960, Avg. loss: 64.330988
Total training time: 1.59 seconds.
-- Epoch 129
Norm: 481.52, NNZs: 50, Bias: 219.796442, T: 3088905, Avg. loss: 64.881016
Total training time: 1.60 seconds.
-- Epoch 130
Norm: 532.92, NNZs: 50, Bias: 223.088882, T: 3112850, Avg. loss: 64.576712
Total training time: 1.61 seconds.
-- Epoch 131
Norm: 444.97, NNZs: 50, Bias: 287.647536, T: 3136795, Avg. loss: 63.646652
Total training time: 1.62 seconds.
-- Epoch 132
Norm: 485.53, NNZs: 50, Bias: 189.833163, T: 3160740, Avg. loss: 60.236714
Total training time: 1.63 seconds.
-- Epoch 133
Norm: 485.99, NNZs: 50, Bias: 229.306563, T: 3184685, Avg. loss: 59.146965
Total training time: 1.64 seconds.
-- Epoch 134
Norm: 459.69, NNZs: 50, Bias: 169.159667, T: 3208630, Avg. loss: 61.557192
Total training time: 1.65 seconds.
-- Epoch 135
Norm: 434.70, NNZs: 50, Bias: 199.876181, T: 3232575, Avg. loss: 59.932704
Total training time: 1.67 seconds.
-- Epoch 136
Norm: 520.53, NNZs: 50, Bias: 170.793233, T: 3256520, Avg. loss: 61.138931
Total training time: 1.68 seconds.
-- Epoch 137
Norm: 487.28, NNZs: 50, Bias: 179.111576, T: 3280465, Avg. loss: 59.302606
Total training time: 1.69 seconds.
-- Epoch 138
Norm: 509.67, NNZs: 50, Bias: 220.259731, T: 3304410, Avg. loss: 58.940289
Total training time: 1.70 seconds.
-- Epoch 139
Norm: 476.15, NNZs: 50, Bias: 164.287378, T: 3328355, Avg. loss: 59.206376
Total training time: 1.72 seconds.
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-- Epoch 140
Norm: 499.95, NNZs: 50, Bias: 109.873154, T: 3352300, Avg. loss: 59.520223
Total training time: 1.73 seconds.
-- Epoch 141
Norm: 433.87, NNZs: 50, Bias: 164.840753, T: 3376245, Avg. loss: 56.294010
Total training time: 1.74 seconds.
-- Epoch 142
Norm: 451.30, NNZs: 50, Bias: 267.450555, T: 3400190, Avg. loss: 56.061408
Total training time: 1.75 seconds.
-- Epoch 143
Norm: 428.85, NNZs: 50, Bias: 130.564351, T: 3424135, Avg. loss: 58.052125
Total training time: 1.76 seconds.
-- Epoch 144
Norm: 449.39, NNZs: 50, Bias: 140.394976, T: 3448080, Avg. loss: 56.448815
Total training time: 1.77 seconds.
-- Epoch 145
Norm: 450.32, NNZs: 50, Bias: 216.820945, T: 3472025, Avg. loss: 56.369231
Total training time: 1.79 seconds.
-- Epoch 146
Norm: 440.28, NNZs: 50, Bias: 153.890110, T: 3495970, Avg. loss: 54.810474
Total training time: 1.80 seconds.
-- Epoch 147
Norm: 402.72, NNZs: 50, Bias: 191.945221, T: 3519915, Avg. loss: 55.061521
Total training time: 1.81 seconds.
-- Epoch 148
Norm: 407.74, NNZs: 50, Bias: 128.064279, T: 3543860, Avg. loss: 54.400805
Total training time: 1.82 seconds.
-- Epoch 149
Norm: 390.42, NNZs: 50, Bias: 119.822295, T: 3567805, Avg. loss: 54.042426
Total training time: 1.83 seconds.
-- Epoch 150
Norm: 408.87, NNZs: 50, Bias: 174.323548, T: 3591750, Avg. loss: 54.096428
Total training time: 1.84 seconds.
-- Epoch 151
Norm: 359.89, NNZs: 50, Bias: 201.715776, T: 3615695, Avg. loss: 53.958146
Total training time: 1.85 seconds.
-- Epoch 152
Norm: 451.27, NNZs: 50, Bias: 175.018781, T: 3639640, Avg. loss: 54.089472
Total training time: 1.86 seconds.
-- Epoch 153
Norm: 473.24, NNZs: 50, Bias: 151.198702, T: 3663585, Avg. loss: 53.080069
Total training time: 1.88 seconds.
-- Epoch 154
Norm: 434.77, NNZs: 50, Bias: 138.766252, T: 3687530, Avg. loss: 54.359172
Total training time: 1.89 seconds.
-- Epoch 155
Norm: 414.60, NNZs: 50, Bias: 169.430505, T: 3711475, Avg. loss: 52.841198
Total training time: 1.90 seconds.
-- Epoch 156
Norm: 451.67, NNZs: 50, Bias: 82.284617, T: 3735420, Avg. loss: 52.805789
Total training time: 1.91 seconds.
-- Epoch 157
Norm: 464.01, NNZs: 50, Bias: 157.907765, T: 3759365, Avg. loss: 53.752870
Total training time: 1.92 seconds.
-- Epoch 158
Norm: 394.34, NNZs: 50, Bias: 144.585981, T: 3783310, Avg. loss: 52.834316
Total training time: 1.93 seconds.
```

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-- Epoch 159
Norm: 468.81, NNZs: 50, Bias: 147.920269, T: 3807255, Avg. loss: 52.845091
Total training time: 1.94 seconds.
-- Epoch 160
Norm: 451.19, NNZs: 50, Bias: 126.273634, T: 3831200, Avg. loss: 51.632300
Total training time: 1.95 seconds.
-- Epoch 161
Norm: 409.37, NNZs: 50, Bias: 124.194824, T: 3855145, Avg. loss: 54.372290
Total training time: 1.97 seconds.
-- Epoch 162
Norm: 395.13, NNZs: 50, Bias: 142.743094, T: 3879090, Avg. loss: 52.983840
Total training time: 1.98 seconds.
-- Epoch 163
Norm: 431.08, NNZs: 50, Bias: 211.729752, T: 3903035, Avg. loss: 50.179803
Total training time: 1.99 seconds.
-- Epoch 164
Norm: 390.63, NNZs: 50, Bias: 158.276833, T: 3926980, Avg. loss: 50.738811
Total training time: 2.00 seconds.
-- Epoch 165
Norm: 429.73, NNZs: 50, Bias: 190.156225, T: 3950925, Avg. loss: 50.706228
Total training time: 2.01 seconds.
-- Epoch 166
Norm: 459.47, NNZs: 50, Bias: 167.972283, T: 3974870, Avg. loss: 48.471069
Total training time: 2.02 seconds.
-- Epoch 167
Norm: 400.39, NNZs: 50, Bias: 85.386740, T: 3998815, Avg. loss: 49.251610
Total training time: 2.03 seconds.
-- Epoch 168
Norm: 406.95, NNZs: 50, Bias: 103.074922, T: 4022760, Avg. loss: 50.468315
Total training time: 2.04 seconds.
-- Epoch 169
Norm: 374.91, NNZs: 50, Bias: 138.668425, T: 4046705, Avg. loss: 51.654059
Total training time: 2.05 seconds.
-- Epoch 170
Norm: 366.12, NNZs: 50, Bias: 194.265851, T: 4070650, Avg. loss: 47.679524
Total training time: 2.07 seconds.
-- Epoch 171
Norm: 372.92, NNZs: 50, Bias: 100.976018, T: 4094595, Avg. loss: 50.559061
Total training time: 2.08 seconds.
-- Epoch 172
Norm: 388.56, NNZs: 50, Bias: 115.940011, T: 4118540, Avg. loss: 46.060231
Total training time: 2.09 seconds.
-- Epoch 173
Norm: 430.24, NNZs: 50, Bias: 131.669719, T: 4142485, Avg. loss: 47.638013
Total training time: 2.10 seconds.
-- Epoch 174
Norm: 414.17, NNZs: 50, Bias: 155.911722, T: 4166430, Avg. loss: 48.737819
Total training time: 2.11 seconds.
-- Epoch 175
Norm: 366.63, NNZs: 50, Bias: 171.286618, T: 4190375, Avg. loss: 46.190055
Total training time: 2.13 seconds.
-- Epoch 176
Norm: 389.59, NNZs: 50, Bias: 144.894750, T: 4214320, Avg. loss: 48.199040
Total training time: 2.14 seconds.
-- Epoch 177
Norm: 388.43, NNZs: 50, Bias: 166.893180, T: 4238265, Avg. loss: 47.534824
Total training time: 2.15 seconds.
```

```
Convergence after 177 epochs took 2.15 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=1e-06, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 2909.52, NNZs: 50, Bias: 1088.541346, T: 23945, Avg. loss: 488.803953
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 1950.03, NNZs: 50, Bias: 830.357237, T: 47890, Avg. loss: 311.864499
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 1585.96, NNZs: 50, Bias: 556.090395, T: 71835, Avg. loss: 223.077314
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 1247.00, NNZs: 50, Bias: 467.511961, T: 95780, Avg. loss: 174.155932
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 1142.09, NNZs: 50, Bias: 532.900858, T: 119725, Avg. loss: 151.144485
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 1031.54, NNZs: 50, Bias: 405.558320, T: 143670, Avg. loss: 128.609917
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 887.56, NNZs: 50, Bias: 351.997548, T: 167615, Avg. loss: 111.530666
Total training time: 0.09 seconds.
-- Epoch 8
Norm: 810.36, NNZs: 50, Bias: 309.298500, T: 191560, Avg. loss: 97.649490
Total training time: 0.10 seconds.
-- Epoch 9
Norm: 797.45, NNZs: 50, Bias: 270.911849, T: 215505, Avg. loss: 87.651272
Total training time: 0.11 seconds.
-- Epoch 10
Norm: 621.66, NNZs: 50, Bias: 243.825511, T: 239450, Avg. loss: 78.861254
Total training time: 0.13 seconds.
-- Epoch 11
Norm: 588.44, NNZs: 50, Bias: 281.392450, T: 263395, Avg. loss: 71.866465
Total training time: 0.14 seconds.
-- Epoch 12
Norm: 527.69, NNZs: 50, Bias: 156.464843, T: 287340, Avg. loss: 65.470203
Total training time: 0.15 seconds.
-- Epoch 13
Norm: 479.14, NNZs: 50, Bias: 184.570785, T: 311285, Avg. loss: 61.656206
Total training time: 0.17 seconds.
-- Epoch 14
Norm: 469.29, NNZs: 50, Bias: 120.488723, T: 335230, Avg. loss: 57.986453
Total training time: 0.18 seconds.
-- Epoch 15
Norm: 429.55, NNZs: 50, Bias: 159.615678, T: 359175, Avg. loss: 53.921117
Total training time: 0.20 seconds.
-- Epoch 16
```

Norm: 418.45, NNZs: 50, Bias: 113.036594, T: 383120, Avg. loss: 51.846773
Total training time: 0.21 seconds.
-- Epoch 17
Norm: 372.75, NNZs: 50, Bias: 179.489752, T: 407065, Avg. loss: 49.281365
Total training time: 0.22 seconds.
-- Epoch 18
Norm: 382.61, NNZs: 50, Bias: 130.636856, T: 431010, Avg. loss: 45.079710
Total training time: 0.24 seconds.
-- Epoch 19
Norm: 343.54, NNZs: 50, Bias: 143.230736, T: 454955, Avg. loss: 43.136504
Total training time: 0.25 seconds.
-- Epoch 20
Norm: 311.50, NNZs: 50, Bias: 110.757296, T: 478900, Avg. loss: 40.620562
Total training time: 0.26 seconds.
-- Epoch 21
Norm: 270.07, NNZs: 50, Bias: 107.186766, T: 502845, Avg. loss: 38.561322
Total training time: 0.27 seconds.
-- Epoch 22
Norm: 288.27, NNZs: 50, Bias: 107.890142, T: 526790, Avg. loss: 39.471186
Total training time: 0.28 seconds.
-- Epoch 23
Norm: 304.37, NNZs: 50, Bias: 99.435365, T: 550735, Avg. loss: 36.006861
Total training time: 0.29 seconds.
-- Epoch 24
Norm: 277.14, NNZs: 50, Bias: 89.431025, T: 574680, Avg. loss: 33.734314
Total training time: 0.30 seconds.
-- Epoch 25
Norm: 294.01, NNZs: 50, Bias: 104.264949, T: 598625, Avg. loss: 33.727078
Total training time: 0.31 seconds.
-- Epoch 26
Norm: 237.72, NNZs: 50, Bias: 117.826029, T: 622570, Avg. loss: 31.914622
Total training time: 0.32 seconds.
-- Epoch 27
Norm: 228.64, NNZs: 50, Bias: 72.568156, T: 646515, Avg. loss: 31.710392
Total training time: 0.34 seconds.
-- Epoch 28
Norm: 229.85, NNZs: 50, Bias: 69.437673, T: 670460, Avg. loss: 31.171678
Total training time: 0.35 seconds.
-- Epoch 29
Norm: 231.13, NNZs: 50, Bias: 90.217998, T: 694405, Avg. loss: 29.615467
Total training time: 0.36 seconds.
-- Epoch 30
Norm: 214.82, NNZs: 50, Bias: 88.508460, T: 718350, Avg. loss: 29.194388
Total training time: 0.37 seconds.
-- Epoch 31
Norm: 224.95, NNZs: 50, Bias: 78.082031, T: 742295, Avg. loss: 27.523776
Total training time: 0.38 seconds.
-- Epoch 32
Norm: 198.45, NNZs: 50, Bias: 68.879229, T: 766240, Avg. loss: 26.883567
Total training time: 0.39 seconds.
-- Epoch 33
Norm: 195.30, NNZs: 50, Bias: 74.716604, T: 790185, Avg. loss: 25.416502
Total training time: 0.41 seconds.
-- Epoch 34
Norm: 186.62, NNZs: 50, Bias: 74.097936, T: 814130, Avg. loss: 24.342617
Total training time: 0.42 seconds.
-- Epoch 35

Norm: 185.21, NNZs: 50, Bias: 82.770822, T: 838075, Avg. loss: 23.299105
Total training time: 0.43 seconds.
-- Epoch 36
Norm: 180.23, NNZs: 50, Bias: 70.453645, T: 862020, Avg. loss: 23.229818
Total training time: 0.44 seconds.
-- Epoch 37
Norm: 166.51, NNZs: 50, Bias: 77.066063, T: 885965, Avg. loss: 23.885967
Total training time: 0.45 seconds.
-- Epoch 38
Norm: 184.16, NNZs: 50, Bias: 79.309304, T: 909910, Avg. loss: 22.437839
Total training time: 0.47 seconds.
-- Epoch 39
Norm: 181.69, NNZs: 50, Bias: 46.756717, T: 933855, Avg. loss: 22.957984
Total training time: 0.48 seconds.
-- Epoch 40
Norm: 177.80, NNZs: 50, Bias: 87.554616, T: 957800, Avg. loss: 21.035693
Total training time: 0.50 seconds.
-- Epoch 41
Norm: 172.07, NNZs: 50, Bias: 41.593739, T: 981745, Avg. loss: 20.636477
Total training time: 0.51 seconds.
-- Epoch 42
Norm: 145.93, NNZs: 50, Bias: 55.269528, T: 1005690, Avg. loss: 19.349186
Total training time: 0.52 seconds.
-- Epoch 43
Norm: 155.80, NNZs: 50, Bias: 60.309764, T: 1029635, Avg. loss: 19.761240
Total training time: 0.53 seconds.
-- Epoch 44
Norm: 146.35, NNZs: 50, Bias: 61.326532, T: 1053580, Avg. loss: 19.248233
Total training time: 0.55 seconds.
-- Epoch 45
Norm: 151.14, NNZs: 50, Bias: 52.254500, T: 1077525, Avg. loss: 18.858537
Total training time: 0.57 seconds.
-- Epoch 46
Norm: 141.49, NNZs: 50, Bias: 54.010877, T: 1101470, Avg. loss: 18.679150
Total training time: 0.58 seconds.
-- Epoch 47
Norm: 143.64, NNZs: 50, Bias: 53.827808, T: 1125415, Avg. loss: 18.129118
Total training time: 0.59 seconds.
-- Epoch 48
Norm: 129.01, NNZs: 50, Bias: 50.427685, T: 1149360, Avg. loss: 17.245450
Total training time: 0.60 seconds.
-- Epoch 49
Norm: 135.62, NNZs: 50, Bias: 47.199739, T: 1173305, Avg. loss: 17.652247
Total training time: 0.61 seconds.
-- Epoch 50
Norm: 119.47, NNZs: 50, Bias: 36.991008, T: 1197250, Avg. loss: 17.208091
Total training time: 0.63 seconds.
-- Epoch 51
Norm: 111.44, NNZs: 50, Bias: 65.343175, T: 1221195, Avg. loss: 17.510362
Total training time: 0.64 seconds.
-- Epoch 52
Norm: 134.42, NNZs: 50, Bias: 48.856381, T: 1245140, Avg. loss: 16.516054
Total training time: 0.65 seconds.
-- Epoch 53
Norm: 129.33, NNZs: 50, Bias: 47.140366, T: 1269085, Avg. loss: 16.345463
Total training time: 0.66 seconds.
-- Epoch 54

Norm: 117.63, NNZs: 50, Bias: 46.773518, T: 1293030, Avg. loss: 16.079197
Total training time: 0.67 seconds.
-- Epoch 55
Norm: 116.12, NNZs: 50, Bias: 60.242090, T: 1316975, Avg. loss: 15.265484
Total training time: 0.68 seconds.
-- Epoch 56
Norm: 113.26, NNZs: 50, Bias: 52.560371, T: 1340920, Avg. loss: 15.099797
Total training time: 0.69 seconds.
-- Epoch 57
Norm: 109.58, NNZs: 50, Bias: 49.722679, T: 1364865, Avg. loss: 15.509098
Total training time: 0.70 seconds.
-- Epoch 58
Norm: 128.76, NNZs: 50, Bias: 46.276415, T: 1388810, Avg. loss: 15.214764
Total training time: 0.71 seconds.
-- Epoch 59
Norm: 112.86, NNZs: 50, Bias: 56.458630, T: 1412755, Avg. loss: 15.103767
Total training time: 0.72 seconds.
-- Epoch 60
Norm: 106.46, NNZs: 50, Bias: 51.537095, T: 1436700, Avg. loss: 14.501814
Total training time: 0.74 seconds.
-- Epoch 61
Norm: 116.38, NNZs: 50, Bias: 50.615047, T: 1460645, Avg. loss: 14.067066
Total training time: 0.75 seconds.
-- Epoch 62
Norm: 120.48, NNZs: 50, Bias: 45.178871, T: 1484590, Avg. loss: 14.565972
Total training time: 0.76 seconds.
-- Epoch 63
Norm: 108.69, NNZs: 50, Bias: 48.948508, T: 1508535, Avg. loss: 14.190489
Total training time: 0.77 seconds.
-- Epoch 64
Norm: 114.87, NNZs: 50, Bias: 55.620062, T: 1532480, Avg. loss: 14.066061
Total training time: 0.78 seconds.
-- Epoch 65
Norm: 110.89, NNZs: 50, Bias: 56.773559, T: 1556425, Avg. loss: 13.698705
Total training time: 0.79 seconds.
-- Epoch 66
Norm: 100.24, NNZs: 50, Bias: 45.539405, T: 1580370, Avg. loss: 12.764038
Total training time: 0.80 seconds.
-- Epoch 67
Norm: 91.97, NNZs: 50, Bias: 47.970929, T: 1604315, Avg. loss: 12.809074
Total training time: 0.81 seconds.
-- Epoch 68
Norm: 99.14, NNZs: 50, Bias: 41.694231, T: 1628260, Avg. loss: 12.613062
Total training time: 0.82 seconds.
-- Epoch 69
Norm: 106.40, NNZs: 50, Bias: 37.475364, T: 1652205, Avg. loss: 12.137350
Total training time: 0.84 seconds.
-- Epoch 70
Norm: 99.42, NNZs: 50, Bias: 45.022110, T: 1676150, Avg. loss: 12.513591
Total training time: 0.85 seconds.
-- Epoch 71
Norm: 91.29, NNZs: 50, Bias: 33.790050, T: 1700095, Avg. loss: 12.016942
Total training time: 0.86 seconds.
-- Epoch 72
Norm: 98.79, NNZs: 50, Bias: 33.454283, T: 1724040, Avg. loss: 12.107763
Total training time: 0.87 seconds.
-- Epoch 73

Norm: 134.36, NNZs: 50, Bias: 16.743698, T: 1747985, Avg. loss: 11.974535
Total training time: 0.88 seconds.
-- Epoch 74
Norm: 101.10, NNZs: 50, Bias: 28.842971, T: 1771930, Avg. loss: 11.958745
Total training time: 0.89 seconds.
-- Epoch 75
Norm: 96.61, NNZs: 50, Bias: 35.835859, T: 1795875, Avg. loss: 11.666354
Total training time: 0.90 seconds.
-- Epoch 76
Norm: 89.26, NNZs: 50, Bias: 29.827476, T: 1819820, Avg. loss: 11.099037
Total training time: 0.92 seconds.
-- Epoch 77
Norm: 77.55, NNZs: 50, Bias: 33.617115, T: 1843765, Avg. loss: 10.836702
Total training time: 0.93 seconds.
-- Epoch 78
Norm: 94.99, NNZs: 50, Bias: 33.236578, T: 1867710, Avg. loss: 10.904841
Total training time: 0.94 seconds.
-- Epoch 79
Norm: 96.57, NNZs: 50, Bias: 32.830233, T: 1891655, Avg. loss: 10.941152
Total training time: 0.95 seconds.
-- Epoch 80
Norm: 76.49, NNZs: 50, Bias: 29.846335, T: 1915600, Avg. loss: 11.141185
Total training time: 0.96 seconds.
-- Epoch 81
Norm: 89.30, NNZs: 50, Bias: 31.346174, T: 1939545, Avg. loss: 10.774849
Total training time: 0.97 seconds.
-- Epoch 82
Norm: 78.27, NNZs: 50, Bias: 35.114061, T: 1963490, Avg. loss: 10.888337
Total training time: 0.99 seconds.
-- Epoch 83
Norm: 83.79, NNZs: 50, Bias: 39.556843, T: 1987435, Avg. loss: 10.766966
Total training time: 1.00 seconds.
-- Epoch 84
Norm: 88.75, NNZs: 50, Bias: 25.907910, T: 2011380, Avg. loss: 10.044014
Total training time: 1.01 seconds.
-- Epoch 85
Norm: 90.15, NNZs: 50, Bias: 41.325733, T: 2035325, Avg. loss: 10.033877
Total training time: 1.02 seconds.
-- Epoch 86
Norm: 79.42, NNZs: 50, Bias: 34.051217, T: 2059270, Avg. loss: 9.910320
Total training time: 1.03 seconds.
-- Epoch 87
Norm: 87.84, NNZs: 50, Bias: 25.190076, T: 2083215, Avg. loss: 10.162240
Total training time: 1.04 seconds.
-- Epoch 88
Norm: 83.17, NNZs: 50, Bias: 22.664141, T: 2107160, Avg. loss: 9.944817
Total training time: 1.05 seconds.
-- Epoch 89
Norm: 78.32, NNZs: 50, Bias: 35.503999, T: 2131105, Avg. loss: 9.912454
Total training time: 1.06 seconds.
-- Epoch 90
Norm: 77.86, NNZs: 50, Bias: 31.788130, T: 2155050, Avg. loss: 9.431506
Total training time: 1.07 seconds.
-- Epoch 91
Norm: 71.55, NNZs: 50, Bias: 32.159787, T: 2178995, Avg. loss: 9.499428
Total training time: 1.09 seconds.
-- Epoch 92

Norm: 79.92, NNZs: 50, Bias: 36.189812, T: 2202940, Avg. loss: 9.518881
Total training time: 1.10 seconds.
-- Epoch 93
Norm: 81.30, NNZs: 50, Bias: 27.972172, T: 2226885, Avg. loss: 9.197510
Total training time: 1.11 seconds.
-- Epoch 94
Norm: 67.52, NNZs: 50, Bias: 31.641993, T: 2250830, Avg. loss: 9.601803
Total training time: 1.12 seconds.
-- Epoch 95
Norm: 78.28, NNZs: 50, Bias: 32.500975, T: 2274775, Avg. loss: 9.388039
Total training time: 1.13 seconds.
-- Epoch 96
Norm: 71.76, NNZs: 50, Bias: 25.129234, T: 2298720, Avg. loss: 9.293379
Total training time: 1.14 seconds.
-- Epoch 97
Norm: 81.58, NNZs: 50, Bias: 30.994258, T: 2322665, Avg. loss: 9.079043
Total training time: 1.15 seconds.
-- Epoch 98
Norm: 78.29, NNZs: 50, Bias: 33.083564, T: 2346610, Avg. loss: 9.036052
Total training time: 1.16 seconds.
-- Epoch 99
Norm: 73.95, NNZs: 50, Bias: 23.130371, T: 2370555, Avg. loss: 9.009473
Total training time: 1.17 seconds.
-- Epoch 100
Norm: 77.47, NNZs: 50, Bias: 28.192817, T: 2394500, Avg. loss: 8.793857
Total training time: 1.19 seconds.
-- Epoch 101
Norm: 78.23, NNZs: 50, Bias: 31.241406, T: 2418445, Avg. loss: 9.130005
Total training time: 1.20 seconds.
-- Epoch 102
Norm: 66.69, NNZs: 50, Bias: 29.364547, T: 2442390, Avg. loss: 8.513899
Total training time: 1.21 seconds.
-- Epoch 103
Norm: 64.55, NNZs: 50, Bias: 24.197944, T: 2466335, Avg. loss: 8.366599
Total training time: 1.22 seconds.
-- Epoch 104
Norm: 76.42, NNZs: 50, Bias: 22.473712, T: 2490280, Avg. loss: 8.428462
Total training time: 1.23 seconds.
-- Epoch 105
Norm: 70.87, NNZs: 50, Bias: 22.819358, T: 2514225, Avg. loss: 8.404964
Total training time: 1.24 seconds.
-- Epoch 106
Norm: 67.04, NNZs: 50, Bias: 22.710958, T: 2538170, Avg. loss: 8.562922
Total training time: 1.25 seconds.
-- Epoch 107
Norm: 71.92, NNZs: 50, Bias: 17.685615, T: 2562115, Avg. loss: 8.064247
Total training time: 1.26 seconds.
-- Epoch 108
Norm: 66.23, NNZs: 50, Bias: 25.092168, T: 2586060, Avg. loss: 8.257318
Total training time: 1.27 seconds.
-- Epoch 109
Norm: 68.55, NNZs: 50, Bias: 23.640946, T: 2610005, Avg. loss: 8.075391
Total training time: 1.29 seconds.
-- Epoch 110
Norm: 64.98, NNZs: 50, Bias: 20.517649, T: 2633950, Avg. loss: 8.020294
Total training time: 1.30 seconds.
-- Epoch 111

Norm: 63.77, NNZs: 50, Bias: 19.403204, T: 2657895, Avg. loss: 8.050929
Total training time: 1.31 seconds.
-- Epoch 112
Norm: 58.46, NNZs: 50, Bias: 24.776655, T: 2681840, Avg. loss: 7.695789
Total training time: 1.32 seconds.
-- Epoch 113
Norm: 67.65, NNZs: 50, Bias: 25.411224, T: 2705785, Avg. loss: 7.723097
Total training time: 1.33 seconds.
-- Epoch 114
Norm: 73.26, NNZs: 50, Bias: 19.111218, T: 2729730, Avg. loss: 7.704535
Total training time: 1.34 seconds.
-- Epoch 115
Norm: 59.90, NNZs: 50, Bias: 21.315815, T: 2753675, Avg. loss: 7.619432
Total training time: 1.35 seconds.
-- Epoch 116
Norm: 56.70, NNZs: 50, Bias: 18.317987, T: 2777620, Avg. loss: 7.967216
Total training time: 1.37 seconds.
-- Epoch 117
Norm: 50.76, NNZs: 50, Bias: 21.406848, T: 2801565, Avg. loss: 7.536261
Total training time: 1.38 seconds.
-- Epoch 118
Norm: 61.28, NNZs: 50, Bias: 19.598508, T: 2825510, Avg. loss: 7.566721
Total training time: 1.39 seconds.
-- Epoch 119
Norm: 59.54, NNZs: 50, Bias: 23.216333, T: 2849455, Avg. loss: 7.305438
Total training time: 1.40 seconds.
-- Epoch 120
Norm: 57.24, NNZs: 50, Bias: 25.930039, T: 2873400, Avg. loss: 7.479416
Total training time: 1.41 seconds.
-- Epoch 121
Norm: 55.86, NNZs: 50, Bias: 22.167504, T: 2897345, Avg. loss: 7.344899
Total training time: 1.42 seconds.
-- Epoch 122
Norm: 53.46, NNZs: 50, Bias: 14.168324, T: 2921290, Avg. loss: 7.176255
Total training time: 1.43 seconds.
-- Epoch 123
Norm: 58.14, NNZs: 50, Bias: 21.209831, T: 2945235, Avg. loss: 7.314604
Total training time: 1.44 seconds.
-- Epoch 124
Norm: 57.85, NNZs: 50, Bias: 23.632979, T: 2969180, Avg. loss: 7.260836
Total training time: 1.45 seconds.
-- Epoch 125
Norm: 48.92, NNZs: 50, Bias: 18.734015, T: 2993125, Avg. loss: 7.329443
Total training time: 1.46 seconds.
-- Epoch 126
Norm: 52.83, NNZs: 50, Bias: 22.800546, T: 3017070, Avg. loss: 7.082732
Total training time: 1.48 seconds.
-- Epoch 127
Norm: 52.03, NNZs: 50, Bias: 19.796157, T: 3041015, Avg. loss: 7.045081
Total training time: 1.49 seconds.
-- Epoch 128
Norm: 53.63, NNZs: 50, Bias: 12.679771, T: 3064960, Avg. loss: 7.138826
Total training time: 1.50 seconds.
-- Epoch 129
Norm: 55.12, NNZs: 50, Bias: 22.290322, T: 3088905, Avg. loss: 6.970347
Total training time: 1.51 seconds.
-- Epoch 130

Norm: 58.44, NNZs: 50, Bias: 27.895644, T: 3112850, Avg. loss: 7.118553
Total training time: 1.52 seconds.
-- Epoch 131
Norm: 45.41, NNZs: 50, Bias: 34.189055, T: 3136795, Avg. loss: 7.025803
Total training time: 1.54 seconds.
-- Epoch 132
Norm: 54.78, NNZs: 50, Bias: 18.189405, T: 3160740, Avg. loss: 6.685720
Total training time: 1.55 seconds.
-- Epoch 133
Norm: 50.74, NNZs: 50, Bias: 25.210916, T: 3184685, Avg. loss: 6.802256
Total training time: 1.56 seconds.
-- Epoch 134
Norm: 53.84, NNZs: 50, Bias: 14.792606, T: 3208630, Avg. loss: 6.740865
Total training time: 1.57 seconds.
-- Epoch 135
Norm: 51.08, NNZs: 50, Bias: 18.354574, T: 3232575, Avg. loss: 6.662516
Total training time: 1.58 seconds.
-- Epoch 136
Norm: 50.46, NNZs: 50, Bias: 17.226068, T: 3256520, Avg. loss: 6.762562
Total training time: 1.59 seconds.
-- Epoch 137
Norm: 55.54, NNZs: 50, Bias: 18.810851, T: 3280465, Avg. loss: 6.355282
Total training time: 1.61 seconds.
-- Epoch 138
Norm: 54.07, NNZs: 50, Bias: 22.946979, T: 3304410, Avg. loss: 6.452532
Total training time: 1.62 seconds.
-- Epoch 139
Norm: 52.78, NNZs: 50, Bias: 17.556889, T: 3328355, Avg. loss: 6.557678
Total training time: 1.63 seconds.
-- Epoch 140
Norm: 48.19, NNZs: 50, Bias: 16.537215, T: 3352300, Avg. loss: 6.398973
Total training time: 1.64 seconds.
-- Epoch 141
Norm: 46.09, NNZs: 50, Bias: 15.524116, T: 3376245, Avg. loss: 6.414863
Total training time: 1.65 seconds.
-- Epoch 142
Norm: 49.26, NNZs: 50, Bias: 28.263762, T: 3400190, Avg. loss: 6.169071
Total training time: 1.66 seconds.
-- Epoch 143
Norm: 46.48, NNZs: 50, Bias: 13.772841, T: 3424135, Avg. loss: 6.412220
Total training time: 1.67 seconds.
-- Epoch 144
Norm: 53.19, NNZs: 50, Bias: 13.594206, T: 3448080, Avg. loss: 6.317811
Total training time: 1.68 seconds.
-- Epoch 145
Norm: 46.40, NNZs: 50, Bias: 25.428268, T: 3472025, Avg. loss: 6.233079
Total training time: 1.69 seconds.
-- Epoch 146
Norm: 44.04, NNZs: 50, Bias: 18.396395, T: 3495970, Avg. loss: 6.052214
Total training time: 1.71 seconds.
-- Epoch 147
Norm: 43.19, NNZs: 50, Bias: 19.590508, T: 3519915, Avg. loss: 6.287069
Total training time: 1.72 seconds.
-- Epoch 148
Norm: 45.60, NNZs: 50, Bias: 15.840838, T: 3543860, Avg. loss: 5.914526
Total training time: 1.73 seconds.
-- Epoch 149

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Norm: 46.72, NNZs: 50, Bias: 13.253118, T: 3567805, Avg. loss: 6.155521
Total training time: 1.74 seconds.
-- Epoch 150
Norm: 41.81, NNZs: 50, Bias: 23.209458, T: 3591750, Avg. loss: 5.999780
Total training time: 1.75 seconds.
-- Epoch 151
Norm: 42.87, NNZs: 50, Bias: 22.064465, T: 3615695, Avg. loss: 6.083738
Total training time: 1.76 seconds.
-- Epoch 152
Norm: 47.13, NNZs: 50, Bias: 20.400620, T: 3639640, Avg. loss: 6.051005
Total training time: 1.77 seconds.
-- Epoch 153
Norm: 49.52, NNZs: 50, Bias: 15.573737, T: 3663585, Avg. loss: 5.780032
Total training time: 1.78 seconds.
-- Epoch 154
Norm: 47.39, NNZs: 50, Bias: 14.356420, T: 3687530, Avg. loss: 6.270674
Total training time: 1.79 seconds.
-- Epoch 155
Norm: 44.38, NNZs: 50, Bias: 21.154322, T: 3711475, Avg. loss: 5.955721
Total training time: 1.80 seconds.
-- Epoch 156
Norm: 46.82, NNZs: 50, Bias: 10.480618, T: 3735420, Avg. loss: 6.013244
Total training time: 1.82 seconds.
-- Epoch 157
Norm: 49.77, NNZs: 50, Bias: 18.016218, T: 3759365, Avg. loss: 5.948129
Total training time: 1.83 seconds.
-- Epoch 158
Norm: 42.00, NNZs: 50, Bias: 15.488834, T: 3783310, Avg. loss: 5.786246
Total training time: 1.84 seconds.
Convergence after 158 epochs took 1.84 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=9.999999999999999e-06, average=False,
              class_weight={0: 5.14, 1: 1}, early_stopping=False, epsilon=0.1,
              eta0=0.0, fit_intercept=True, l1_ratio=0.15,
              learning_rate='optimal', loss='hinge', max_iter=1000, n_iter=None,
              n_iter_no_change=5, n_jobs=None, penalty='l2', power_t=0.5,
              random_state=42, shuffle=True, tol=0.001, validation_fraction=0.1,
              verbose=100, warm_start=False)
-- Epoch 1
Norm: 515.59, NNZs: 50, Bias: 211.629633, T: 23945, Avg. loss: 139.196868
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 288.88, NNZs: 50, Bias: 132.456844, T: 47890, Avg. loss: 50.253077
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 220.94, NNZs: 50, Bias: 79.643014, T: 71835, Avg. loss: 31.228638
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 163.33, NNZs: 50, Bias: 53.634579, T: 95780, Avg. loss: 23.783821
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 144.77, NNZs: 50, Bias: 71.039061, T: 119725, Avg. loss: 19.480858
Total training time: 0.07 seconds.
-- Epoch 6
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Norm: 122.11, NNZs: 50, Bias: 44.559606, T: 143670, Avg. loss: 15.439448
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 94.93, NNZs: 50, Bias: 42.591020, T: 167615, Avg. loss: 12.981986
Total training time: 0.09 seconds.
-- Epoch 8
Norm: 88.61, NNZs: 50, Bias: 37.275302, T: 191560, Avg. loss: 11.707595
Total training time: 0.10 seconds.
-- Epoch 9
Norm: 81.55, NNZs: 50, Bias: 28.286136, T: 215505, Avg. loss: 9.980582
Total training time: 0.12 seconds.
-- Epoch 10
Norm: 68.21, NNZs: 50, Bias: 26.861645, T: 239450, Avg. loss: 9.219271
Total training time: 0.13 seconds.
-- Epoch 11
Norm: 62.96, NNZs: 50, Bias: 32.824413, T: 263395, Avg. loss: 8.249745
Total training time: 0.14 seconds.
-- Epoch 12
Norm: 60.58, NNZs: 50, Bias: 18.056699, T: 287340, Avg. loss: 7.921229
Total training time: 0.15 seconds.
-- Epoch 13
Norm: 56.59, NNZs: 50, Bias: 17.533140, T: 311285, Avg. loss: 6.984788
Total training time: 0.17 seconds.
-- Epoch 14
Norm: 55.98, NNZs: 50, Bias: 11.398974, T: 335230, Avg. loss: 6.744245
Total training time: 0.18 seconds.
-- Epoch 15
Norm: 47.57, NNZs: 50, Bias: 13.192590, T: 359175, Avg. loss: 6.197043
Total training time: 0.19 seconds.
-- Epoch 16
Norm: 44.79, NNZs: 50, Bias: 11.189306, T: 383120, Avg. loss: 5.958763
Total training time: 0.20 seconds.
-- Epoch 17
Norm: 40.10, NNZs: 50, Bias: 20.774164, T: 407065, Avg. loss: 5.603342
Total training time: 0.21 seconds.
-- Epoch 18
Norm: 41.59, NNZs: 50, Bias: 13.971163, T: 431010, Avg. loss: 5.214753
Total training time: 0.22 seconds.
-- Epoch 19
Norm: 40.44, NNZs: 50, Bias: 15.186353, T: 454955, Avg. loss: 5.029449
Total training time: 0.24 seconds.
-- Epoch 20
Norm: 38.67, NNZs: 50, Bias: 12.751526, T: 478900, Avg. loss: 4.585846
Total training time: 0.25 seconds.
-- Epoch 21
Norm: 35.06, NNZs: 50, Bias: 11.238720, T: 502845, Avg. loss: 4.438109
Total training time: 0.26 seconds.
-- Epoch 22
Norm: 33.05, NNZs: 50, Bias: 14.993827, T: 526790, Avg. loss: 4.448494
Total training time: 0.27 seconds.
-- Epoch 23
Norm: 33.53, NNZs: 50, Bias: 11.336301, T: 550735, Avg. loss: 4.157716
Total training time: 0.28 seconds.
-- Epoch 24
Norm: 30.70, NNZs: 50, Bias: 7.724421, T: 574680, Avg. loss: 3.912123
Total training time: 0.29 seconds.
-- Epoch 25

Norm: 32.35, NNZs: 50, Bias: 13.516561, T: 598625, Avg. loss: 3.864798
Total training time: 0.30 seconds.
-- Epoch 26
Norm: 25.42, NNZs: 50, Bias: 13.582958, T: 622570, Avg. loss: 3.794391
Total training time: 0.31 seconds.
-- Epoch 27
Norm: 26.60, NNZs: 50, Bias: 9.925600, T: 646515, Avg. loss: 3.699619
Total training time: 0.33 seconds.
-- Epoch 28
Norm: 26.87, NNZs: 50, Bias: 8.119301, T: 670460, Avg. loss: 3.565728
Total training time: 0.34 seconds.
-- Epoch 29
Norm: 23.95, NNZs: 50, Bias: 10.620668, T: 694405, Avg. loss: 3.442084
Total training time: 0.35 seconds.
-- Epoch 30
Norm: 25.69, NNZs: 50, Bias: 9.126319, T: 718350, Avg. loss: 3.245762
Total training time: 0.36 seconds.
-- Epoch 31
Norm: 22.60, NNZs: 50, Bias: 7.382679, T: 742295, Avg. loss: 3.261336
Total training time: 0.37 seconds.
-- Epoch 32
Norm: 21.54, NNZs: 50, Bias: 8.919633, T: 766240, Avg. loss: 2.994582
Total training time: 0.38 seconds.
-- Epoch 33
Norm: 21.77, NNZs: 50, Bias: 8.684168, T: 790185, Avg. loss: 2.961701
Total training time: 0.39 seconds.
-- Epoch 34
Norm: 22.46, NNZs: 50, Bias: 7.909370, T: 814130, Avg. loss: 2.937450
Total training time: 0.40 seconds.
-- Epoch 35
Norm: 20.97, NNZs: 50, Bias: 7.978600, T: 838075, Avg. loss: 2.824265
Total training time: 0.41 seconds.
-- Epoch 36
Norm: 20.73, NNZs: 50, Bias: 9.292639, T: 862020, Avg. loss: 2.849197
Total training time: 0.43 seconds.
-- Epoch 37
Norm: 18.13, NNZs: 50, Bias: 9.829543, T: 885965, Avg. loss: 2.778731
Total training time: 0.44 seconds.
-- Epoch 38
Norm: 20.87, NNZs: 50, Bias: 9.160250, T: 909910, Avg. loss: 2.614360
Total training time: 0.45 seconds.
-- Epoch 39
Norm: 19.14, NNZs: 50, Bias: 6.112648, T: 933855, Avg. loss: 2.572476
Total training time: 0.46 seconds.
-- Epoch 40
Norm: 20.03, NNZs: 50, Bias: 9.334827, T: 957800, Avg. loss: 2.580100
Total training time: 0.47 seconds.
-- Epoch 41
Norm: 19.59, NNZs: 50, Bias: 5.779061, T: 981745, Avg. loss: 2.459136
Total training time: 0.48 seconds.
-- Epoch 42
Norm: 17.95, NNZs: 50, Bias: 7.118962, T: 1005690, Avg. loss: 2.401326
Total training time: 0.50 seconds.
-- Epoch 43
Norm: 17.74, NNZs: 50, Bias: 6.601781, T: 1029635, Avg. loss: 2.368222
Total training time: 0.51 seconds.
-- Epoch 44

Norm: 19.08, NNZs: 50, Bias: 7.439285, T: 1053580, Avg. loss: 2.359647
Total training time: 0.53 seconds.
-- Epoch 45
Norm: 18.36, NNZs: 50, Bias: 6.137898, T: 1077525, Avg. loss: 2.309484
Total training time: 0.54 seconds.
-- Epoch 46
Norm: 17.29, NNZs: 50, Bias: 6.296302, T: 1101470, Avg. loss: 2.257738
Total training time: 0.56 seconds.
-- Epoch 47
Norm: 16.01, NNZs: 50, Bias: 6.736784, T: 1125415, Avg. loss: 2.182806
Total training time: 0.57 seconds.
-- Epoch 48
Norm: 15.68, NNZs: 50, Bias: 7.051431, T: 1149360, Avg. loss: 2.222058
Total training time: 0.58 seconds.
-- Epoch 49
Norm: 15.27, NNZs: 50, Bias: 6.100788, T: 1173305, Avg. loss: 2.120127
Total training time: 0.60 seconds.
-- Epoch 50
Norm: 13.57, NNZs: 50, Bias: 5.055592, T: 1197250, Avg. loss: 2.102948
Total training time: 0.61 seconds.
-- Epoch 51
Norm: 13.45, NNZs: 50, Bias: 7.411959, T: 1221195, Avg. loss: 2.154301
Total training time: 0.62 seconds.
-- Epoch 52
Norm: 13.75, NNZs: 50, Bias: 6.159850, T: 1245140, Avg. loss: 2.078582
Total training time: 0.64 seconds.
-- Epoch 53
Norm: 14.59, NNZs: 50, Bias: 4.687751, T: 1269085, Avg. loss: 2.065785
Total training time: 0.66 seconds.
-- Epoch 54
Norm: 13.81, NNZs: 50, Bias: 5.916971, T: 1293030, Avg. loss: 1.989212
Total training time: 0.67 seconds.
-- Epoch 55
Norm: 12.99, NNZs: 50, Bias: 8.156552, T: 1316975, Avg. loss: 1.955840
Total training time: 0.69 seconds.
-- Epoch 56
Norm: 12.65, NNZs: 50, Bias: 6.523660, T: 1340920, Avg. loss: 1.943140
Total training time: 0.70 seconds.
-- Epoch 57
Norm: 12.98, NNZs: 50, Bias: 6.298658, T: 1364865, Avg. loss: 1.957632
Total training time: 0.72 seconds.
-- Epoch 58
Norm: 14.51, NNZs: 50, Bias: 5.398023, T: 1388810, Avg. loss: 1.955066
Total training time: 0.73 seconds.
-- Epoch 59
Norm: 14.22, NNZs: 50, Bias: 6.556500, T: 1412755, Avg. loss: 1.930997
Total training time: 0.74 seconds.
-- Epoch 60
Norm: 11.38, NNZs: 50, Bias: 6.439749, T: 1436700, Avg. loss: 1.859595
Total training time: 0.75 seconds.
-- Epoch 61
Norm: 14.11, NNZs: 50, Bias: 6.636253, T: 1460645, Avg. loss: 1.848903
Total training time: 0.77 seconds.
-- Epoch 62
Norm: 13.84, NNZs: 50, Bias: 5.194281, T: 1484590, Avg. loss: 1.768412
Total training time: 0.78 seconds.
-- Epoch 63

Norm: 12.40, NNZs: 50, Bias: 5.946917, T: 1508535, Avg. loss: 1.758960
Total training time: 0.80 seconds.
-- Epoch 64
Norm: 13.42, NNZs: 50, Bias: 6.762765, T: 1532480, Avg. loss: 1.776700
Total training time: 0.81 seconds.
-- Epoch 65
Norm: 11.57, NNZs: 50, Bias: 6.536006, T: 1556425, Avg. loss: 1.750477
Total training time: 0.82 seconds.
-- Epoch 66
Norm: 12.15, NNZs: 50, Bias: 5.154876, T: 1580370, Avg. loss: 1.683368
Total training time: 0.84 seconds.
-- Epoch 67
Norm: 10.55, NNZs: 50, Bias: 5.869328, T: 1604315, Avg. loss: 1.658115
Total training time: 0.85 seconds.
-- Epoch 68
Norm: 11.76, NNZs: 50, Bias: 4.923078, T: 1628260, Avg. loss: 1.662159
Total training time: 0.87 seconds.
-- Epoch 69
Norm: 11.92, NNZs: 50, Bias: 5.817194, T: 1652205, Avg. loss: 1.652913
Total training time: 0.88 seconds.
-- Epoch 70
Norm: 12.26, NNZs: 50, Bias: 5.008042, T: 1676150, Avg. loss: 1.636428
Total training time: 0.89 seconds.
-- Epoch 71
Norm: 10.45, NNZs: 50, Bias: 4.571231, T: 1700095, Avg. loss: 1.654807
Total training time: 0.90 seconds.
-- Epoch 72
Norm: 12.03, NNZs: 50, Bias: 4.464624, T: 1724040, Avg. loss: 1.598612
Total training time: 0.92 seconds.
-- Epoch 73
Norm: 14.84, NNZs: 50, Bias: 2.261589, T: 1747985, Avg. loss: 1.560695
Total training time: 0.93 seconds.
-- Epoch 74
Norm: 11.37, NNZs: 50, Bias: 3.975032, T: 1771930, Avg. loss: 1.596023
Total training time: 0.94 seconds.
-- Epoch 75
Norm: 12.09, NNZs: 50, Bias: 3.280646, T: 1795875, Avg. loss: 1.549890
Total training time: 0.96 seconds.
-- Epoch 76
Norm: 11.04, NNZs: 50, Bias: 3.708409, T: 1819820, Avg. loss: 1.556253
Total training time: 0.97 seconds.
-- Epoch 77
Norm: 10.09, NNZs: 50, Bias: 5.040874, T: 1843765, Avg. loss: 1.495630
Total training time: 0.98 seconds.
-- Epoch 78
Norm: 11.25, NNZs: 50, Bias: 3.820952, T: 1867710, Avg. loss: 1.470018
Total training time: 0.99 seconds.
-- Epoch 79
Norm: 12.32, NNZs: 50, Bias: 3.652295, T: 1891655, Avg. loss: 1.489453
Total training time: 1.01 seconds.
-- Epoch 80
Norm: 10.57, NNZs: 50, Bias: 4.043586, T: 1915600, Avg. loss: 1.522076
Total training time: 1.02 seconds.
-- Epoch 81
Norm: 11.27, NNZs: 50, Bias: 3.683605, T: 1939545, Avg. loss: 1.476917
Total training time: 1.04 seconds.
-- Epoch 82

Norm: 10.65, NNZs: 50, Bias: 4.641093, T: 1963490, Avg. loss: 1.489139
Total training time: 1.05 seconds.
-- Epoch 83
Norm: 10.61, NNZs: 50, Bias: 4.296578, T: 1987435, Avg. loss: 1.433505
Total training time: 1.06 seconds.
-- Epoch 84
Norm: 11.38, NNZs: 50, Bias: 3.859560, T: 2011380, Avg. loss: 1.431405
Total training time: 1.08 seconds.
-- Epoch 85
Norm: 10.66, NNZs: 50, Bias: 4.727476, T: 2035325, Avg. loss: 1.413339
Total training time: 1.09 seconds.
-- Epoch 86
Norm: 10.12, NNZs: 50, Bias: 4.651392, T: 2059270, Avg. loss: 1.432401
Total training time: 1.11 seconds.
-- Epoch 87
Norm: 9.63, NNZs: 50, Bias: 3.605439, T: 2083215, Avg. loss: 1.405394
Total training time: 1.12 seconds.
-- Epoch 88
Norm: 9.54, NNZs: 50, Bias: 3.492613, T: 2107160, Avg. loss: 1.381373
Total training time: 1.13 seconds.
-- Epoch 89
Norm: 9.64, NNZs: 50, Bias: 4.211686, T: 2131105, Avg. loss: 1.386749
Total training time: 1.15 seconds.
-- Epoch 90
Norm: 9.63, NNZs: 50, Bias: 3.594145, T: 2155050, Avg. loss: 1.356197
Total training time: 1.16 seconds.
-- Epoch 91
Norm: 9.62, NNZs: 50, Bias: 3.407976, T: 2178995, Avg. loss: 1.356246
Total training time: 1.17 seconds.
-- Epoch 92
Norm: 9.41, NNZs: 50, Bias: 4.474634, T: 2202940, Avg. loss: 1.370429
Total training time: 1.19 seconds.
-- Epoch 93
Norm: 10.07, NNZs: 50, Bias: 3.719454, T: 2226885, Avg. loss: 1.350584
Total training time: 1.20 seconds.
-- Epoch 94
Norm: 9.29, NNZs: 50, Bias: 4.359897, T: 2250830, Avg. loss: 1.336146
Total training time: 1.21 seconds.
-- Epoch 95
Norm: 9.49, NNZs: 50, Bias: 4.210446, T: 2274775, Avg. loss: 1.294727
Total training time: 1.23 seconds.
-- Epoch 96
Norm: 9.12, NNZs: 50, Bias: 3.618725, T: 2298720, Avg. loss: 1.331077
Total training time: 1.24 seconds.
-- Epoch 97
Norm: 9.45, NNZs: 50, Bias: 3.889033, T: 2322665, Avg. loss: 1.303809
Total training time: 1.25 seconds.
-- Epoch 98
Norm: 9.48, NNZs: 50, Bias: 4.147491, T: 2346610, Avg. loss: 1.284492
Total training time: 1.27 seconds.
-- Epoch 99
Norm: 9.17, NNZs: 50, Bias: 3.027226, T: 2370555, Avg. loss: 1.289885
Total training time: 1.28 seconds.
-- Epoch 100
Norm: 10.05, NNZs: 50, Bias: 3.558546, T: 2394500, Avg. loss: 1.280852
Total training time: 1.30 seconds.
-- Epoch 101

Norm: 9.20, NNZs: 50, Bias: 4.139505, T: 2418445, Avg. loss: 1.308319
Total training time: 1.31 seconds.
-- Epoch 102
Norm: 9.00, NNZs: 50, Bias: 3.469131, T: 2442390, Avg. loss: 1.244752
Total training time: 1.32 seconds.
-- Epoch 103
Norm: 8.81, NNZs: 50, Bias: 3.863033, T: 2466335, Avg. loss: 1.257994
Total training time: 1.34 seconds.
-- Epoch 104
Norm: 9.19, NNZs: 50, Bias: 3.176294, T: 2490280, Avg. loss: 1.251546
Total training time: 1.35 seconds.
-- Epoch 105
Norm: 8.89, NNZs: 50, Bias: 3.680971, T: 2514225, Avg. loss: 1.238895
Total training time: 1.36 seconds.
-- Epoch 106
Norm: 9.06, NNZs: 50, Bias: 2.923500, T: 2538170, Avg. loss: 1.237873
Total training time: 1.38 seconds.
-- Epoch 107
Norm: 8.82, NNZs: 50, Bias: 2.446360, T: 2562115, Avg. loss: 1.207733
Total training time: 1.40 seconds.
-- Epoch 108
Norm: 8.87, NNZs: 50, Bias: 3.415363, T: 2586060, Avg. loss: 1.223323
Total training time: 1.41 seconds.
-- Epoch 109
Norm: 8.35, NNZs: 50, Bias: 3.264824, T: 2610005, Avg. loss: 1.208371
Total training time: 1.43 seconds.
-- Epoch 110
Norm: 7.81, NNZs: 50, Bias: 2.598369, T: 2633950, Avg. loss: 1.218195
Total training time: 1.44 seconds.
-- Epoch 111
Norm: 7.92, NNZs: 50, Bias: 3.057776, T: 2657895, Avg. loss: 1.175950
Total training time: 1.45 seconds.
-- Epoch 112
Norm: 7.48, NNZs: 50, Bias: 3.981949, T: 2681840, Avg. loss: 1.173986
Total training time: 1.47 seconds.
-- Epoch 113
Norm: 8.22, NNZs: 50, Bias: 3.220973, T: 2705785, Avg. loss: 1.173817
Total training time: 1.48 seconds.
-- Epoch 114
Norm: 9.06, NNZs: 50, Bias: 3.271589, T: 2729730, Avg. loss: 1.153239
Total training time: 1.49 seconds.
-- Epoch 115
Norm: 7.83, NNZs: 50, Bias: 2.654039, T: 2753675, Avg. loss: 1.173462
Total training time: 1.51 seconds.
-- Epoch 116
Norm: 7.72, NNZs: 50, Bias: 2.800363, T: 2777620, Avg. loss: 1.163929
Total training time: 1.52 seconds.
-- Epoch 117
Norm: 6.81, NNZs: 50, Bias: 3.224320, T: 2801565, Avg. loss: 1.155196
Total training time: 1.54 seconds.
-- Epoch 118
Norm: 7.25, NNZs: 50, Bias: 3.307859, T: 2825510, Avg. loss: 1.120457
Total training time: 1.55 seconds.
-- Epoch 119
Norm: 7.61, NNZs: 50, Bias: 3.526647, T: 2849455, Avg. loss: 1.157376
Total training time: 1.57 seconds.
-- Epoch 120

Norm: 7.53, NNZs: 50, Bias: 2.992154, T: 2873400, Avg. loss: 1.155359
Total training time: 1.58 seconds.
-- Epoch 121
Norm: 7.78, NNZs: 50, Bias: 3.475340, T: 2897345, Avg. loss: 1.138658
Total training time: 1.60 seconds.
-- Epoch 122
Norm: 7.71, NNZs: 50, Bias: 2.510761, T: 2921290, Avg. loss: 1.115266
Total training time: 1.61 seconds.
-- Epoch 123
Norm: 7.78, NNZs: 50, Bias: 2.824692, T: 2945235, Avg. loss: 1.113829
Total training time: 1.62 seconds.
-- Epoch 124
Norm: 7.84, NNZs: 50, Bias: 2.753932, T: 2969180, Avg. loss: 1.110573
Total training time: 1.63 seconds.
-- Epoch 125
Norm: 7.01, NNZs: 50, Bias: 3.037861, T: 2993125, Avg. loss: 1.127728
Total training time: 1.64 seconds.
-- Epoch 126
Norm: 7.47, NNZs: 50, Bias: 2.650398, T: 3017070, Avg. loss: 1.115446
Total training time: 1.65 seconds.
-- Epoch 127
Norm: 7.21, NNZs: 50, Bias: 2.830708, T: 3041015, Avg. loss: 1.081119
Total training time: 1.67 seconds.
-- Epoch 128
Norm: 7.23, NNZs: 50, Bias: 1.901035, T: 3064960, Avg. loss: 1.093696
Total training time: 1.68 seconds.
-- Epoch 129
Norm: 7.45, NNZs: 50, Bias: 2.993767, T: 3088905, Avg. loss: 1.099438
Total training time: 1.69 seconds.
-- Epoch 130
Norm: 8.16, NNZs: 50, Bias: 3.446765, T: 3112850, Avg. loss: 1.099238
Total training time: 1.70 seconds.
-- Epoch 131
Norm: 7.08, NNZs: 50, Bias: 4.649985, T: 3136795, Avg. loss: 1.113882
Total training time: 1.71 seconds.
-- Epoch 132
Norm: 7.47, NNZs: 50, Bias: 3.136381, T: 3160740, Avg. loss: 1.072306
Total training time: 1.72 seconds.
-- Epoch 133
Norm: 7.31, NNZs: 50, Bias: 3.763602, T: 3184685, Avg. loss: 1.066922
Total training time: 1.73 seconds.
-- Epoch 134
Norm: 7.33, NNZs: 50, Bias: 2.527445, T: 3208630, Avg. loss: 1.058345
Total training time: 1.74 seconds.
-- Epoch 135
Norm: 7.29, NNZs: 50, Bias: 2.804114, T: 3232575, Avg. loss: 1.056070
Total training time: 1.76 seconds.
-- Epoch 136
Norm: 7.25, NNZs: 50, Bias: 2.784578, T: 3256520, Avg. loss: 1.084906
Total training time: 1.77 seconds.
-- Epoch 137
Norm: 7.48, NNZs: 50, Bias: 2.542799, T: 3280465, Avg. loss: 1.040227
Total training time: 1.78 seconds.
-- Epoch 138
Norm: 7.76, NNZs: 50, Bias: 3.220310, T: 3304410, Avg. loss: 1.055845
Total training time: 1.79 seconds.
-- Epoch 139

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Norm: 7.42, NNZs: 50, Bias: 2.525149, T: 3328355, Avg. loss: 1.046816
Total training time: 1.80 seconds.
-- Epoch 140
Norm: 7.36, NNZs: 50, Bias: 1.903631, T: 3352300, Avg. loss: 1.028649
Total training time: 1.81 seconds.
-- Epoch 141
Norm: 6.81, NNZs: 50, Bias: 2.249180, T: 3376245, Avg. loss: 1.042561
Total training time: 1.83 seconds.
-- Epoch 142
Norm: 7.26, NNZs: 50, Bias: 3.746542, T: 3400190, Avg. loss: 0.996565
Total training time: 1.84 seconds.
-- Epoch 143
Norm: 6.30, NNZs: 50, Bias: 2.385371, T: 3424135, Avg. loss: 1.037999
Total training time: 1.85 seconds.
-- Epoch 144
Norm: 7.00, NNZs: 50, Bias: 2.030986, T: 3448080, Avg. loss: 1.027332
Total training time: 1.86 seconds.
-- Epoch 145
Norm: 6.67, NNZs: 50, Bias: 3.376065, T: 3472025, Avg. loss: 1.013924
Total training time: 1.87 seconds.
-- Epoch 146
Norm: 6.43, NNZs: 50, Bias: 2.805814, T: 3495970, Avg. loss: 0.990395
Total training time: 1.88 seconds.
-- Epoch 147
Norm: 6.39, NNZs: 50, Bias: 3.164494, T: 3519915, Avg. loss: 1.033542
Total training time: 1.89 seconds.
-- Epoch 148
Norm: 6.44, NNZs: 50, Bias: 2.495227, T: 3543860, Avg. loss: 0.994235
Total training time: 1.90 seconds.
-- Epoch 149
Norm: 6.48, NNZs: 50, Bias: 1.950484, T: 3567805, Avg. loss: 1.010148
Total training time: 1.91 seconds.
-- Epoch 150
Norm: 6.40, NNZs: 50, Bias: 2.923741, T: 3591750, Avg. loss: 1.004209
Total training time: 1.92 seconds.
-- Epoch 151
Norm: 6.34, NNZs: 50, Bias: 3.370051, T: 3615695, Avg. loss: 1.002017
Total training time: 1.94 seconds.
Convergence after 151 epochs took 1.94 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=9.999999999999999e-05, average=False,
               class_weight={0: 5.14, 1: 1}, early_stopping=False, epsilon=0.1,
               eta0=0.0, fit_intercept=True, l1_ratio=0.15,
               learning_rate='optimal', loss='hinge', max_iter=1000, n_iter=None,
               n_iter_no_change=5, n_jobs=None, penalty='l2', power_t=0.5,
               random_state=42, shuffle=True, tol=0.001, validation_fraction=0.1,
               verbose=100, warm_start=False)
-- Epoch 1
Norm: 61.81, NNZs: 50, Bias: 20.930683, T: 23945, Avg. loss: 28.408707
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 32.29, NNZs: 50, Bias: 13.813438, T: 47890, Avg. loss: 6.178385
Total training time: 0.03 seconds.
-- Epoch 3
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Norm: 23.02, NNZs: 50, Bias: 9.116186, T: 71835, Avg. loss: 3.711626
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 18.48, NNZs: 50, Bias: 5.678352, T: 95780, Avg. loss: 2.849650
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 15.66, NNZs: 50, Bias: 8.051227, T: 119725, Avg. loss: 2.338886
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 13.51, NNZs: 50, Bias: 5.149899, T: 143670, Avg. loss: 2.000664
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 11.65, NNZs: 50, Bias: 5.019453, T: 167615, Avg. loss: 1.742667
Total training time: 0.09 seconds.
-- Epoch 8
Norm: 10.22, NNZs: 50, Bias: 4.393546, T: 191560, Avg. loss: 1.543649
Total training time: 0.10 seconds.
-- Epoch 9
Norm: 9.54, NNZs: 50, Bias: 3.725971, T: 215505, Avg. loss: 1.418749
Total training time: 0.11 seconds.
-- Epoch 10
Norm: 8.82, NNZs: 50, Bias: 3.475933, T: 239450, Avg. loss: 1.308523
Total training time: 0.13 seconds.
-- Epoch 11
Norm: 8.62, NNZs: 50, Bias: 3.909767, T: 263395, Avg. loss: 1.217176
Total training time: 0.14 seconds.
-- Epoch 12
Norm: 7.77, NNZs: 50, Bias: 2.515495, T: 287340, Avg. loss: 1.164451
Total training time: 0.15 seconds.
-- Epoch 13
Norm: 8.04, NNZs: 50, Bias: 2.333487, T: 311285, Avg. loss: 1.123298
Total training time: 0.16 seconds.
-- Epoch 14
Norm: 7.14, NNZs: 50, Bias: 2.287378, T: 335230, Avg. loss: 1.076409
Total training time: 0.18 seconds.
-- Epoch 15
Norm: 6.47, NNZs: 50, Bias: 2.430874, T: 359175, Avg. loss: 1.011987
Total training time: 0.19 seconds.
-- Epoch 16
Norm: 6.49, NNZs: 50, Bias: 1.676021, T: 383120, Avg. loss: 0.990868
Total training time: 0.20 seconds.
-- Epoch 17
Norm: 6.28, NNZs: 50, Bias: 2.539130, T: 407065, Avg. loss: 0.949406
Total training time: 0.22 seconds.
-- Epoch 18
Norm: 6.39, NNZs: 50, Bias: 2.145559, T: 431010, Avg. loss: 0.926113
Total training time: 0.23 seconds.
-- Epoch 19
Norm: 5.76, NNZs: 50, Bias: 2.790600, T: 454955, Avg. loss: 0.895085
Total training time: 0.24 seconds.
-- Epoch 20
Norm: 5.44, NNZs: 50, Bias: 2.046689, T: 478900, Avg. loss: 0.850040
Total training time: 0.25 seconds.
-- Epoch 21
Norm: 5.32, NNZs: 50, Bias: 1.957340, T: 502845, Avg. loss: 0.843931
Total training time: 0.26 seconds.
-- Epoch 22

Norm: 5.02, NNZs: 50, Bias: 2.310970, T: 526790, Avg. loss: 0.853586
Total training time: 0.27 seconds.
-- Epoch 23
Norm: 5.38, NNZs: 50, Bias: 1.901148, T: 550735, Avg. loss: 0.822539
Total training time: 0.28 seconds.
-- Epoch 24
Norm: 5.15, NNZs: 50, Bias: 1.890562, T: 574680, Avg. loss: 0.807030
Total training time: 0.30 seconds.
-- Epoch 25
Norm: 5.08, NNZs: 50, Bias: 2.157194, T: 598625, Avg. loss: 0.784069
Total training time: 0.31 seconds.
-- Epoch 26
Norm: 4.82, NNZs: 50, Bias: 2.158060, T: 622570, Avg. loss: 0.776730
Total training time: 0.32 seconds.
-- Epoch 27
Norm: 4.52, NNZs: 50, Bias: 1.804250, T: 646515, Avg. loss: 0.760498
Total training time: 0.33 seconds.
-- Epoch 28
Norm: 4.56, NNZs: 50, Bias: 1.670118, T: 670460, Avg. loss: 0.766155
Total training time: 0.34 seconds.
-- Epoch 29
Norm: 4.28, NNZs: 50, Bias: 1.791919, T: 694405, Avg. loss: 0.748585
Total training time: 0.35 seconds.
-- Epoch 30
Norm: 3.99, NNZs: 50, Bias: 1.694041, T: 718350, Avg. loss: 0.740895
Total training time: 0.36 seconds.
-- Epoch 31
Norm: 4.15, NNZs: 50, Bias: 1.587969, T: 742295, Avg. loss: 0.734212
Total training time: 0.37 seconds.
-- Epoch 32
Norm: 3.99, NNZs: 50, Bias: 1.779687, T: 766240, Avg. loss: 0.723742
Total training time: 0.38 seconds.
-- Epoch 33
Norm: 4.04, NNZs: 50, Bias: 1.784094, T: 790185, Avg. loss: 0.711829
Total training time: 0.40 seconds.
-- Epoch 34
Norm: 4.11, NNZs: 50, Bias: 1.784663, T: 814130, Avg. loss: 0.700792
Total training time: 0.41 seconds.
-- Epoch 35
Norm: 4.22, NNZs: 50, Bias: 1.823907, T: 838075, Avg. loss: 0.693597
Total training time: 0.42 seconds.
-- Epoch 36
Norm: 4.23, NNZs: 50, Bias: 1.675694, T: 862020, Avg. loss: 0.697735
Total training time: 0.43 seconds.
-- Epoch 37
Norm: 3.66, NNZs: 50, Bias: 1.811903, T: 885965, Avg. loss: 0.686086
Total training time: 0.44 seconds.
-- Epoch 38
Norm: 3.89, NNZs: 50, Bias: 1.647765, T: 909910, Avg. loss: 0.668597
Total training time: 0.45 seconds.
-- Epoch 39
Norm: 3.84, NNZs: 50, Bias: 1.347364, T: 933855, Avg. loss: 0.684962
Total training time: 0.46 seconds.
-- Epoch 40
Norm: 3.78, NNZs: 50, Bias: 1.818505, T: 957800, Avg. loss: 0.672191
Total training time: 0.47 seconds.
-- Epoch 41

Norm: 3.94, NNZs: 50, Bias: 1.398279, T: 981745, Avg. loss: 0.667341
Total training time: 0.49 seconds.
-- Epoch 42
Norm: 3.65, NNZs: 50, Bias: 1.744330, T: 1005690, Avg. loss: 0.654538
Total training time: 0.50 seconds.
-- Epoch 43
Norm: 3.67, NNZs: 50, Bias: 1.459958, T: 1029635, Avg. loss: 0.659436
Total training time: 0.51 seconds.
-- Epoch 44
Norm: 3.52, NNZs: 50, Bias: 1.527687, T: 1053580, Avg. loss: 0.647871
Total training time: 0.52 seconds.
-- Epoch 45
Norm: 3.70, NNZs: 50, Bias: 1.511633, T: 1077525, Avg. loss: 0.658361
Total training time: 0.53 seconds.
-- Epoch 46
Norm: 3.59, NNZs: 50, Bias: 1.571177, T: 1101470, Avg. loss: 0.638764
Total training time: 0.54 seconds.
-- Epoch 47
Norm: 3.62, NNZs: 50, Bias: 1.305241, T: 1125415, Avg. loss: 0.646933
Total training time: 0.55 seconds.
-- Epoch 48
Norm: 3.47, NNZs: 50, Bias: 1.531685, T: 1149360, Avg. loss: 0.641303
Total training time: 0.56 seconds.
-- Epoch 49
Norm: 3.41, NNZs: 50, Bias: 1.463054, T: 1173305, Avg. loss: 0.631663
Total training time: 0.57 seconds.
-- Epoch 50
Norm: 3.25, NNZs: 50, Bias: 1.355187, T: 1197250, Avg. loss: 0.623757
Total training time: 0.58 seconds.
-- Epoch 51
Norm: 3.30, NNZs: 50, Bias: 1.724446, T: 1221195, Avg. loss: 0.625132
Total training time: 0.59 seconds.
-- Epoch 52
Norm: 3.26, NNZs: 50, Bias: 1.497882, T: 1245140, Avg. loss: 0.623852
Total training time: 0.61 seconds.
-- Epoch 53
Norm: 3.32, NNZs: 50, Bias: 1.226001, T: 1269085, Avg. loss: 0.622788
Total training time: 0.62 seconds.
-- Epoch 54
Norm: 3.34, NNZs: 50, Bias: 1.403374, T: 1293030, Avg. loss: 0.618707
Total training time: 0.63 seconds.
-- Epoch 55
Norm: 3.22, NNZs: 50, Bias: 1.746497, T: 1316975, Avg. loss: 0.625313
Total training time: 0.64 seconds.
-- Epoch 56
Norm: 3.18, NNZs: 50, Bias: 1.421444, T: 1340920, Avg. loss: 0.603089
Total training time: 0.65 seconds.
-- Epoch 57
Norm: 3.16, NNZs: 50, Bias: 1.712715, T: 1364865, Avg. loss: 0.609395
Total training time: 0.66 seconds.
-- Epoch 58
Norm: 3.08, NNZs: 50, Bias: 1.581072, T: 1388810, Avg. loss: 0.614683
Total training time: 0.67 seconds.
-- Epoch 59
Norm: 3.19, NNZs: 50, Bias: 1.412542, T: 1412755, Avg. loss: 0.610292
Total training time: 0.68 seconds.
-- Epoch 60


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Norm: 3.20, NNZs: 50, Bias: 1.491860, T: 1436700, Avg. loss: 0.608992
Total training time: 0.70 seconds.
-- Epoch 61
Norm: 3.38, NNZs: 50, Bias: 1.671867, T: 1460645, Avg. loss: 0.605017
Total training time: 0.71 seconds.
Convergence after 61 epochs took 0.71 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=0.001, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 7.30, NNZs: 50, Bias: 3.281329, T: 23945, Avg. loss: 4.625160
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 4.48, NNZs: 50, Bias: 2.314383, T: 47890, Avg. loss: 1.018538
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 3.63, NNZs: 50, Bias: 1.881740, T: 71835, Avg. loss: 0.777136
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 3.15, NNZs: 50, Bias: 1.419731, T: 95780, Avg. loss: 0.685475
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 3.09, NNZs: 50, Bias: 1.592590, T: 119725, Avg. loss: 0.651101
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 3.02, NNZs: 50, Bias: 1.328718, T: 143670, Avg. loss: 0.617307
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 2.72, NNZs: 50, Bias: 1.330200, T: 167615, Avg. loss: 0.594181
Total training time: 0.10 seconds.
-- Epoch 8
Norm: 2.68, NNZs: 50, Bias: 1.178618, T: 191560, Avg. loss: 0.576542
Total training time: 0.11 seconds.
-- Epoch 9
Norm: 2.71, NNZs: 50, Bias: 1.299398, T: 215505, Avg. loss: 0.573441
Total training time: 0.12 seconds.
-- Epoch 10
Norm: 2.51, NNZs: 50, Bias: 1.272624, T: 239450, Avg. loss: 0.562916
Total training time: 0.14 seconds.
-- Epoch 11
Norm: 2.48, NNZs: 50, Bias: 1.336562, T: 263395, Avg. loss: 0.548734
Total training time: 0.15 seconds.
-- Epoch 12
Norm: 2.48, NNZs: 50, Bias: 1.049529, T: 287340, Avg. loss: 0.543881
Total training time: 0.16 seconds.
-- Epoch 13
Norm: 2.35, NNZs: 50, Bias: 1.031414, T: 311285, Avg. loss: 0.540975
Total training time: 0.18 seconds.
-- Epoch 14
Norm: 2.35, NNZs: 50, Bias: 1.139940, T: 335230, Avg. loss: 0.538952
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Total training time: 0.19 seconds.
-- Epoch 15
Norm: 2.34, NNZs: 50, Bias: 1.107909, T: 359175, Avg. loss: 0.535493
Total training time: 0.20 seconds.
-- Epoch 16
Norm: 2.34, NNZs: 50, Bias: 1.004768, T: 383120, Avg. loss: 0.532081
Total training time: 0.21 seconds.
-- Epoch 17
Norm: 2.35, NNZs: 50, Bias: 1.084755, T: 407065, Avg. loss: 0.529541
Total training time: 0.23 seconds.
-- Epoch 18
Norm: 2.31, NNZs: 50, Bias: 1.100257, T: 431010, Avg. loss: 0.530273
Total training time: 0.24 seconds.
-- Epoch 19
Norm: 2.30, NNZs: 50, Bias: 1.130248, T: 454955, Avg. loss: 0.523788
Total training time: 0.25 seconds.
-- Epoch 20
Norm: 2.26, NNZs: 50, Bias: 0.993338, T: 478900, Avg. loss: 0.519365
Total training time: 0.26 seconds.
-- Epoch 21
Norm: 2.26, NNZs: 50, Bias: 1.023195, T: 502845, Avg. loss: 0.521971
Total training time: 0.27 seconds.
-- Epoch 22
Norm: 2.24, NNZs: 50, Bias: 1.133718, T: 526790, Avg. loss: 0.525192
Total training time: 0.29 seconds.
-- Epoch 23
Norm: 2.21, NNZs: 50, Bias: 1.030514, T: 550735, Avg. loss: 0.513611
Total training time: 0.30 seconds.
-- Epoch 24
Norm: 2.23, NNZs: 50, Bias: 1.067033, T: 574680, Avg. loss: 0.523350
Total training time: 0.31 seconds.
-- Epoch 25
Norm: 2.19, NNZs: 50, Bias: 1.044918, T: 598625, Avg. loss: 0.516692
Total training time: 0.32 seconds.
-- Epoch 26
Norm: 2.20, NNZs: 50, Bias: 1.119905, T: 622570, Avg. loss: 0.517382
Total training time: 0.33 seconds.
-- Epoch 27
Norm: 2.19, NNZs: 50, Bias: 1.124122, T: 646515, Avg. loss: 0.513512
Total training time: 0.34 seconds.
-- Epoch 28
Norm: 2.15, NNZs: 50, Bias: 1.007084, T: 670460, Avg. loss: 0.516486
Total training time: 0.35 seconds.
Convergence after 28 epochs took 0.35 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=0.01, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 1.82, NNZs: 50, Bias: 1.135284, T: 23945, Avg. loss: 1.085416
Total training time: 0.01 seconds.
```

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-- Epoch 2
Norm: 1.63, NNZs: 50, Bias: 1.014229, T: 47890, Avg. loss: 0.533682
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 1.52, NNZs: 50, Bias: 1.047157, T: 71835, Avg. loss: 0.522290
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 1.59, NNZs: 50, Bias: 0.982642, T: 95780, Avg. loss: 0.513126
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 1.62, NNZs: 50, Bias: 0.965846, T: 119725, Avg. loss: 0.507065
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 1.57, NNZs: 50, Bias: 0.945347, T: 143670, Avg. loss: 0.507103
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 1.56, NNZs: 50, Bias: 0.953659, T: 167615, Avg. loss: 0.505457
Total training time: 0.10 seconds.
-- Epoch 8
Norm: 1.57, NNZs: 50, Bias: 0.905161, T: 191560, Avg. loss: 0.500731
Total training time: 0.11 seconds.
-- Epoch 9
Norm: 1.54, NNZs: 50, Bias: 0.932451, T: 215505, Avg. loss: 0.504488
Total training time: 0.12 seconds.
-- Epoch 10
Norm: 1.52, NNZs: 50, Bias: 0.939040, T: 239450, Avg. loss: 0.502185
Total training time: 0.14 seconds.
-- Epoch 11
Norm: 1.53, NNZs: 50, Bias: 0.956966, T: 263395, Avg. loss: 0.504132
Total training time: 0.15 seconds.
-- Epoch 12
Norm: 1.55, NNZs: 50, Bias: 0.939995, T: 287340, Avg. loss: 0.501666
Total training time: 0.16 seconds.
-- Epoch 13
Norm: 1.54, NNZs: 50, Bias: 0.931293, T: 311285, Avg. loss: 0.499060
Total training time: 0.18 seconds.
-- Epoch 14
Norm: 1.51, NNZs: 50, Bias: 0.957989, T: 335230, Avg. loss: 0.501741
Total training time: 0.19 seconds.
-- Epoch 15
Norm: 1.54, NNZs: 50, Bias: 0.930407, T: 359175, Avg. loss: 0.498745
Total training time: 0.20 seconds.
-- Epoch 16
Norm: 1.52, NNZs: 50, Bias: 0.936679, T: 383120, Avg. loss: 0.498895
Total training time: 0.21 seconds.
-- Epoch 17
Norm: 1.53, NNZs: 50, Bias: 0.927994, T: 407065, Avg. loss: 0.498729
Total training time: 0.22 seconds.
-- Epoch 18
Norm: 1.52, NNZs: 50, Bias: 0.943623, T: 431010, Avg. loss: 0.499022
Total training time: 0.23 seconds.
Convergence after 18 epochs took 0.24 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=0.1, average=False, class_weight={0: 5.14, 1: 1},
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        early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
        l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
        n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
        power_t=0.5, random_state=42, shuffle=True, tol=0.001,
        validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 1.06, NNZs: 50, Bias: 0.767835, T: 23945, Avg. loss: 0.597155
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 1.03, NNZs: 50, Bias: 0.737613, T: 47890, Avg. loss: 0.517715
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 1.03, NNZs: 50, Bias: 0.726961, T: 71835, Avg. loss: 0.519810
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 1.02, NNZs: 50, Bias: 0.731159, T: 95780, Avg. loss: 0.521988
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 1.04, NNZs: 50, Bias: 0.714409, T: 119725, Avg. loss: 0.517106
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 1.04, NNZs: 50, Bias: 0.717189, T: 143670, Avg. loss: 0.519717
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 1.03, NNZs: 50, Bias: 0.720561, T: 167615, Avg. loss: 0.519146
Total training time: 0.09 seconds.
Convergence after 7 epochs took 0.10 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=1.0, average=False, class_weight={0: 5.14, 1: 1},
        early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
        l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
        n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
        power_t=0.5, random_state=42, shuffle=True, tol=0.001,
        validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.55, NNZs: 50, Bias: 0.291198, T: 23945, Avg. loss: 0.679344
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.56, NNZs: 50, Bias: 0.303188, T: 47890, Avg. loss: 0.632576
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 0.56, NNZs: 50, Bias: 0.308392, T: 71835, Avg. loss: 0.627951
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.56, NNZs: 50, Bias: 0.311720, T: 95780, Avg. loss: 0.626274
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 0.56, NNZs: 50, Bias: 0.314095, T: 119725, Avg. loss: 0.624573
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 0.56, NNZs: 50, Bias: 0.315540, T: 143670, Avg. loss: 0.623169
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 0.56, NNZs: 50, Bias: 0.316722, T: 167615, Avg. loss: 0.622960

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Total training time: 0.09 seconds.
-- Epoch 8
Norm: 0.56, NNZs: 50, Bias: 0.317634, T: 191560, Avg. loss: 0.622243
Total training time: 0.10 seconds.
-- Epoch 9
Norm: 0.56, NNZs: 50, Bias: 0.318557, T: 215505, Avg. loss: 0.621315
Total training time: 0.12 seconds.
-- Epoch 10
Norm: 0.56, NNZs: 50, Bias: 0.319166, T: 239450, Avg. loss: 0.621769
Total training time: 0.13 seconds.
-- Epoch 11
Norm: 0.56, NNZs: 50, Bias: 0.319646, T: 263395, Avg. loss: 0.621211
Total training time: 0.14 seconds.
Convergence after 11 epochs took 0.14 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=10.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.17, NNZs: 50, Bias: 0.057620, T: 23945, Avg. loss: 0.862191
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.17, NNZs: 50, Bias: 0.057502, T: 47890, Avg. loss: 0.861711
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.17, NNZs: 50, Bias: 0.057279, T: 71835, Avg. loss: 0.861592
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.17, NNZs: 50, Bias: 0.057130, T: 95780, Avg. loss: 0.861813
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 0.17, NNZs: 50, Bias: 0.057045, T: 119725, Avg. loss: 0.861655
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.17, NNZs: 50, Bias: 0.057003, T: 143670, Avg. loss: 0.861876
Total training time: 0.08 seconds.
Convergence after 6 epochs took 0.08 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=100.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.02, NNZs: 50, Bias: 0.269374, T: 23945, Avg. loss: 0.808215
Total training time: 0.01 seconds.
-- Epoch 2
```

```

Norm: 0.02, NNZs: 50, Bias: 0.269381, T: 47890, Avg. loss: 0.808184
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.02, NNZs: 50, Bias: 0.269371, T: 71835, Avg. loss: 0.808181
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.02, NNZs: 50, Bias: 0.269364, T: 95780, Avg. loss: 0.808200
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 0.02, NNZs: 50, Bias: 0.269361, T: 119725, Avg. loss: 0.808178
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.02, NNZs: 50, Bias: 0.269362, T: 143670, Avg. loss: 0.808197
Total training time: 0.09 seconds.
Convergence after 6 epochs took 0.09 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=1000.0, average=False, class_weight={0: 5.14, 1: 1},
               early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
               l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
               n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
               power_t=0.5, random_state=42, shuffle=True, tol=0.001,
               validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 50, Bias: 0.173106, T: 23945, Avg. loss: 0.882266
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 50, Bias: 0.173106, T: 47890, Avg. loss: 0.882288
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 50, Bias: 0.173105, T: 71835, Avg. loss: 0.882288
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 50, Bias: 0.173105, T: 95780, Avg. loss: 0.882290
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 50, Bias: 0.173104, T: 119725, Avg. loss: 0.882288
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 50, Bias: 0.173104, T: 143670, Avg. loss: 0.882290
Total training time: 0.08 seconds.
Convergence after 6 epochs took 0.08 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=10000.0, average=False, class_weight={0: 5.14, 1: 1},
               early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
               l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
               n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
               power_t=0.5, random_state=42, shuffle=True, tol=0.001,
               validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 50, Bias: 0.099527, T: 23945, Avg. loss: 0.932775
Total training time: 0.01 seconds.

```

```

-- Epoch 2
Norm: 0.00, NNZs: 50, Bias: 0.099527, T: 47890, Avg. loss: 0.932808
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 50, Bias: 0.099527, T: 71835, Avg. loss: 0.932808
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 50, Bias: 0.099527, T: 95780, Avg. loss: 0.932808
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 50, Bias: 0.099527, T: 119725, Avg. loss: 0.932808
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 50, Bias: 0.099527, T: 143670, Avg. loss: 0.932808
Total training time: 0.09 seconds.
Convergence after 6 epochs took 0.09 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=100000.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 50, Bias: 0.056197, T: 23945, Avg. loss: 0.962075
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 50, Bias: 0.056197, T: 47890, Avg. loss: 0.962108
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 50, Bias: 0.056197, T: 71835, Avg. loss: 0.962108
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 50, Bias: 0.056197, T: 95780, Avg. loss: 0.962108
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 50, Bias: 0.056197, T: 119725, Avg. loss: 0.962108
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 50, Bias: 0.056197, T: 143670, Avg. loss: 0.962108
Total training time: 0.08 seconds.
Convergence after 6 epochs took 0.08 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=100000.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 50, Bias: 0.031619, T: 23945, Avg. loss: 0.978666

```

```

Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 50, Bias: 0.031619, T: 47890, Avg. loss: 0.978685
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 50, Bias: 0.031619, T: 71835, Avg. loss: 0.978685
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 50, Bias: 0.031619, T: 95780, Avg. loss: 0.978685
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 50, Bias: 0.031619, T: 119725, Avg. loss: 0.978685
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 50, Bias: 0.031619, T: 143670, Avg. loss: 0.978685
Total training time: 0.08 seconds.
Convergence after 6 epochs took 0.08 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
Function exiting...

```

```

In [26]: print(lnrsvmavgw2v.rocaucscoretrn)
         print(lnrsvmavgw2v.rocaucscoreval)
         print(lnrsvmavgw2v.SVM_alpha)

```

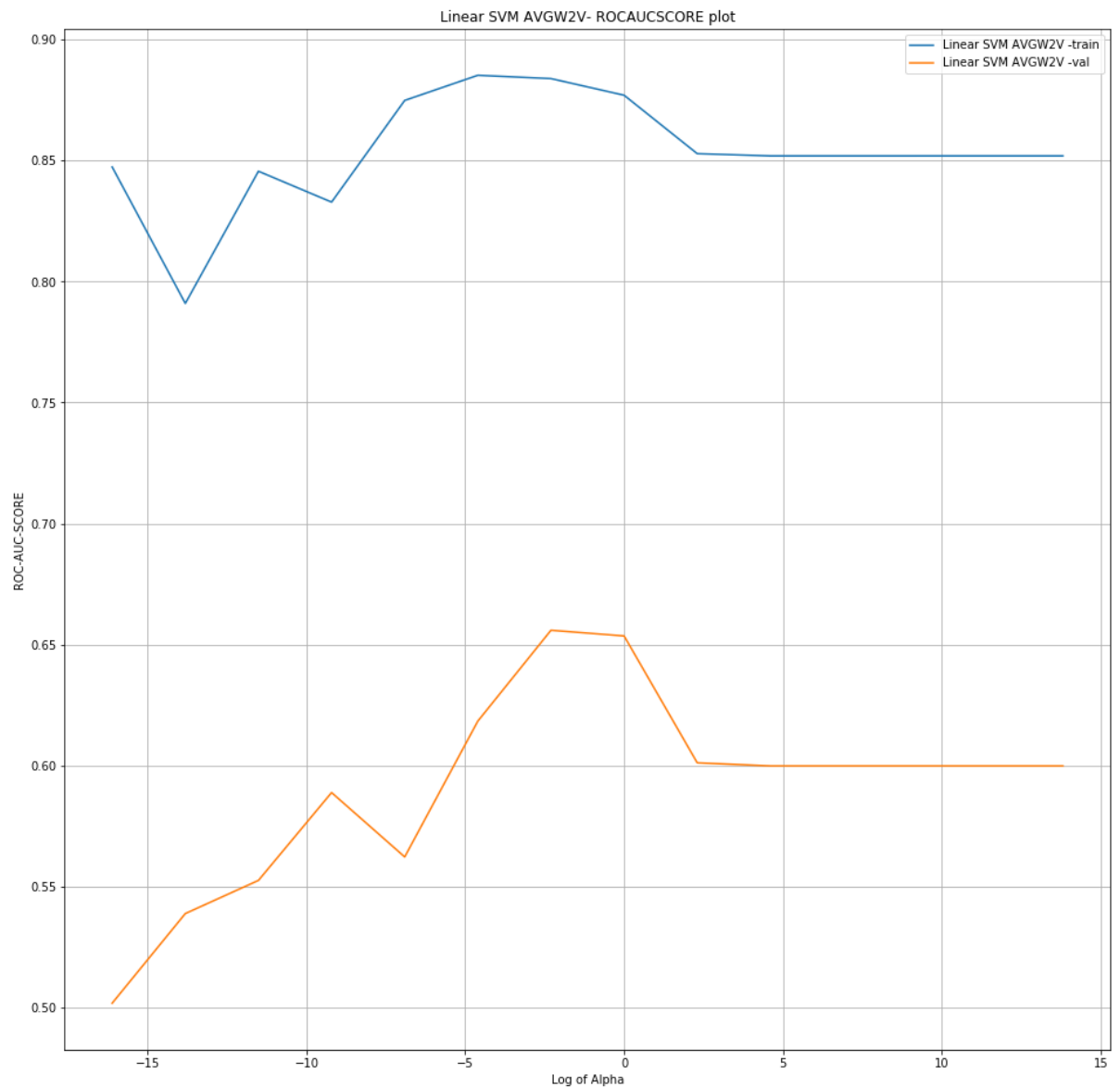
```

[0.8473404041894244, 0.7909553787905464, 0.8455799528706771, 0.8328250591315806, 0.8748388683448985, 0.8852253917531945, 0.883861934155763, 0.8769844987045152, 0.8528486025675245, 0.8519250628064066, 0.8519250628064066, 0.8519250628064066, 0.8519271981436733, 0.8519271981436733]
[0.5018410704694515, 0.5388723130267387, 0.5525720372460032, 0.5888622935956125, 0.5622746654577647, 0.6183888179863571, 0.6559267809538827, 0.6535833017146367, 0.6011568336626606, 0.5998777136643688, 0.5998777136643688, 0.5998777136643688, 0.5998775083481571, 0.5998775083481571]
[1e-07, 1e-06, 9.999999999999999e-06, 9.999999999999999e-05, 0.001, 0.01, 0.1, 1.0, 10.0, 100.0, 1000.0, 10000.0, 100000.0, 1000000.0]

```



```
In [29]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='Linear SVM AVG2V- ROCAUCSCORE plot'
displaygraph.legnd_1 = 'Linear SVM AVG2V -train'
displaygraph.legnd_2 = 'Linear SVM AVG2V -val'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='Log of Alpha'
displaygraph.label_y='ROC-AUC-SCORE'
displaygraph.Xdata = lnrsvmavgw2v.SVM_alpha
displaygraph.ydatatrn = lnrsvmavgw2v.rocaucscoretrn
displaygraph.ydataval = lnrsvmavgw2v.rocaucscoreval
displaygraph.rocacscoregraph()
```



```
In [71]: #Using alpha returned by gridsearchCV  
lnrsvmavgw2v.SVM_actualClasifier(0.01)
```

```
-- Epoch 1
Norm: 3.54, NNZs: 50, Bias: -0.516245, T: 23945, Avg. loss: 10.569002
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 2.16, NNZs: 50, Bias: -0.268519, T: 47890, Avg. loss: 1.525838
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 1.99, NNZs: 50, Bias: -0.469591, T: 71835, Avg. loss: 1.299442
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 1.77, NNZs: 50, Bias: -0.551488, T: 95780, Avg. loss: 1.224990
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 1.67, NNZs: 50, Bias: -0.330999, T: 119725, Avg. loss: 1.182563
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 1.62, NNZs: 50, Bias: -0.404016, T: 143670, Avg. loss: 1.130369
Total training time: 0.07 seconds.
-- Epoch 7
Norm: 1.62, NNZs: 50, Bias: -0.411684, T: 167615, Avg. loss: 1.139007
Total training time: 0.08 seconds.
-- Epoch 8
Norm: 1.55, NNZs: 50, Bias: -0.380394, T: 191560, Avg. loss: 1.120914
Total training time: 0.10 seconds.
-- Epoch 9
Norm: 1.52, NNZs: 50, Bias: -0.334772, T: 215505, Avg. loss: 1.105025
Total training time: 0.11 seconds.
-- Epoch 10
Norm: 1.43, NNZs: 50, Bias: -0.428249, T: 239450, Avg. loss: 1.096257
Total training time: 0.13 seconds.
-- Epoch 11
Norm: 1.42, NNZs: 50, Bias: -0.354600, T: 263395, Avg. loss: 1.096517
Total training time: 0.14 seconds.
-- Epoch 12
Norm: 1.41, NNZs: 50, Bias: -0.361173, T: 287340, Avg. loss: 1.083160
Total training time: 0.16 seconds.
-- Epoch 13
Norm: 1.41, NNZs: 50, Bias: -0.426889, T: 311285, Avg. loss: 1.076018
Total training time: 0.17 seconds.
-- Epoch 14
Norm: 1.43, NNZs: 50, Bias: -0.393417, T: 335230, Avg. loss: 1.089815
Total training time: 0.19 seconds.
-- Epoch 15
Norm: 1.39, NNZs: 50, Bias: -0.386223, T: 359175, Avg. loss: 1.087590
Total training time: 0.20 seconds.
-- Epoch 16
Norm: 1.39, NNZs: 50, Bias: -0.432427, T: 383120, Avg. loss: 1.079824
Total training time: 0.22 seconds.
-- Epoch 17
Norm: 1.40, NNZs: 50, Bias: -0.359401, T: 407065, Avg. loss: 1.087720
Total training time: 0.23 seconds.
-- Epoch 18
Norm: 1.37, NNZs: 50, Bias: -0.361557, T: 431010, Avg. loss: 1.069047
Total training time: 0.25 seconds.
-- Epoch 19
Norm: 1.35, NNZs: 50, Bias: -0.376203, T: 454955, Avg. loss: 1.073744
Total training time: 0.27 seconds.
```

```
-- Epoch 20
Norm: 1.35, NNZs: 50, Bias: -0.385133, T: 478900, Avg. loss: 1.059171
Total training time: 0.28 seconds.
-- Epoch 21
Norm: 1.35, NNZs: 50, Bias: -0.367042, T: 502845, Avg. loss: 1.071158
Total training time: 0.29 seconds.
-- Epoch 22
Norm: 1.34, NNZs: 50, Bias: -0.321769, T: 526790, Avg. loss: 1.072507
Total training time: 0.31 seconds.
-- Epoch 23
Norm: 1.34, NNZs: 50, Bias: -0.383139, T: 550735, Avg. loss: 1.055097
Total training time: 0.32 seconds.
-- Epoch 24
Norm: 1.34, NNZs: 50, Bias: -0.366962, T: 574680, Avg. loss: 1.062869
Total training time: 0.34 seconds.
-- Epoch 25
Norm: 1.31, NNZs: 50, Bias: -0.380226, T: 598625, Avg. loss: 1.064504
Total training time: 0.35 seconds.
-- Epoch 26
Norm: 1.31, NNZs: 50, Bias: -0.335095, T: 622570, Avg. loss: 1.076504
Total training time: 0.37 seconds.
-- Epoch 27
Norm: 1.32, NNZs: 50, Bias: -0.343555, T: 646515, Avg. loss: 1.063000
Total training time: 0.38 seconds.
-- Epoch 28
Norm: 1.30, NNZs: 50, Bias: -0.360983, T: 670460, Avg. loss: 1.052952
Total training time: 0.39 seconds.
-- Epoch 29
Norm: 1.30, NNZs: 50, Bias: -0.379573, T: 694405, Avg. loss: 1.057641
Total training time: 0.40 seconds.
-- Epoch 30
Norm: 1.30, NNZs: 50, Bias: -0.377836, T: 718350, Avg. loss: 1.062542
Total training time: 0.42 seconds.
-- Epoch 31
Norm: 1.31, NNZs: 50, Bias: -0.373427, T: 742295, Avg. loss: 1.058219
Total training time: 0.43 seconds.
-- Epoch 32
Norm: 1.30, NNZs: 50, Bias: -0.369547, T: 766240, Avg. loss: 1.057060
Total training time: 0.45 seconds.
-- Epoch 33
Norm: 1.29, NNZs: 50, Bias: -0.316041, T: 790185, Avg. loss: 1.074855
Total training time: 0.47 seconds.
Convergence after 33 epochs took 0.47 seconds
-- Epoch 1
Norm: 2.86, NNZs: 50, Bias: -0.620555, T: 29932, Avg. loss: 5.682633
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 2.03, NNZs: 50, Bias: -0.010171, T: 59864, Avg. loss: 1.335660
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 1.88, NNZs: 50, Bias: -0.557423, T: 89796, Avg. loss: 1.174606
Total training time: 0.05 seconds.
-- Epoch 4
Norm: 1.46, NNZs: 50, Bias: -0.219683, T: 119728, Avg. loss: 1.125067
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 1.58, NNZs: 50, Bias: -0.316867, T: 149660, Avg. loss: 1.088315
```

Total training time: 0.08 seconds.
-- Epoch 6
Norm: 1.45, NNZs: 50, Bias: -0.220655, T: 179592, Avg. loss: 1.092618
Total training time: 0.10 seconds.
-- Epoch 7
Norm: 1.38, NNZs: 50, Bias: -0.331983, T: 209524, Avg. loss: 1.072300
Total training time: 0.11 seconds.
-- Epoch 8
Norm: 1.40, NNZs: 50, Bias: -0.331361, T: 239456, Avg. loss: 1.070366
Total training time: 0.13 seconds.
-- Epoch 9
Norm: 1.35, NNZs: 50, Bias: -0.287101, T: 269388, Avg. loss: 1.053964
Total training time: 0.15 seconds.
-- Epoch 10
Norm: 1.29, NNZs: 50, Bias: -0.252035, T: 299320, Avg. loss: 1.043548
Total training time: 0.17 seconds.
-- Epoch 11
Norm: 1.24, NNZs: 50, Bias: -0.283933, T: 329252, Avg. loss: 1.046628
Total training time: 0.18 seconds.
-- Epoch 12
Norm: 1.25, NNZs: 50, Bias: -0.338490, T: 359184, Avg. loss: 1.027618
Total training time: 0.20 seconds.
-- Epoch 13
Norm: 1.23, NNZs: 50, Bias: -0.306121, T: 389116, Avg. loss: 1.049653
Total training time: 0.21 seconds.
-- Epoch 14
Norm: 1.23, NNZs: 50, Bias: -0.339684, T: 419048, Avg. loss: 1.040549
Total training time: 0.22 seconds.
-- Epoch 15
Norm: 1.24, NNZs: 50, Bias: -0.301612, T: 448980, Avg. loss: 1.041978
Total training time: 0.24 seconds.
-- Epoch 16
Norm: 1.20, NNZs: 50, Bias: -0.237259, T: 478912, Avg. loss: 1.029920
Total training time: 0.25 seconds.
-- Epoch 17
Norm: 1.19, NNZs: 50, Bias: -0.342449, T: 508844, Avg. loss: 1.019778
Total training time: 0.27 seconds.
-- Epoch 18
Norm: 1.20, NNZs: 50, Bias: -0.315000, T: 538776, Avg. loss: 1.035421
Total training time: 0.29 seconds.
-- Epoch 19
Norm: 1.19, NNZs: 50, Bias: -0.343351, T: 568708, Avg. loss: 1.031739
Total training time: 0.30 seconds.
-- Epoch 20
Norm: 1.18, NNZs: 50, Bias: -0.333981, T: 598640, Avg. loss: 1.035838
Total training time: 0.32 seconds.
-- Epoch 21
Norm: 1.21, NNZs: 50, Bias: -0.368086, T: 628572, Avg. loss: 1.029326
Total training time: 0.33 seconds.
-- Epoch 22
Norm: 1.22, NNZs: 50, Bias: -0.325868, T: 658504, Avg. loss: 1.039273
Total training time: 0.35 seconds.
Convergence after 22 epochs took 0.35 seconds
[1 1 1 ... 1 0 1]

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

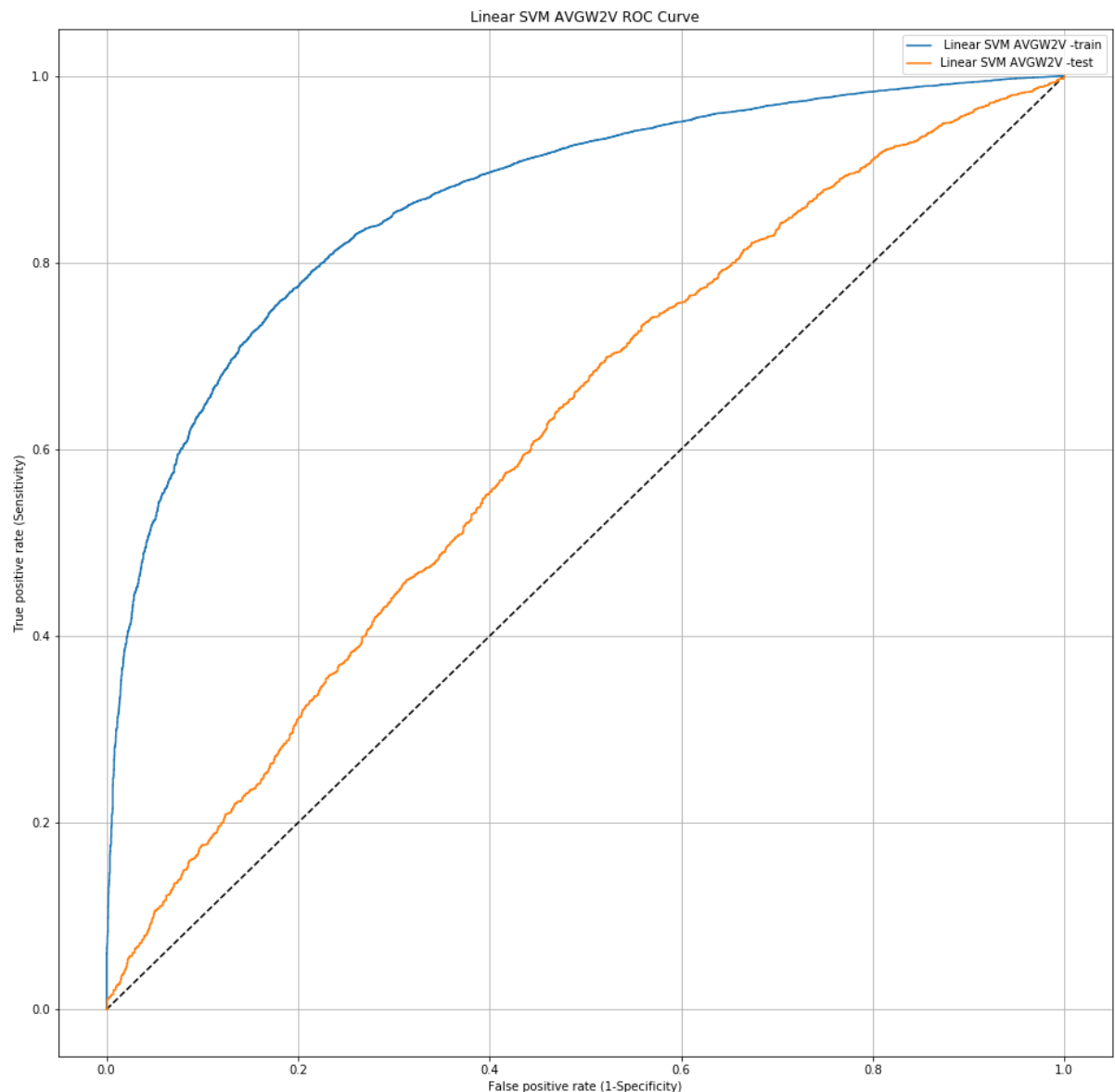
0	0.21	0.61	0.31	1218
---	------	------	------	------

1	0.88	0.55	0.67	6265
micro avg	0.56	0.56	0.56	7483
macro avg	0.54	0.58	0.49	7483
weighted avg	0.77	0.56	0.62	7483
[0.50983764 0.6268211 0.55984636 ... 0.56027372 0.31313719 0.52863894]				

```

In [27]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='Linear SVM AVGW2V ROC Curve'
displaygraph.legnd_1 = ' Linear SVM AVGW2V -train'
displaygraph.legnd_2 = 'Linear SVM AVGW2V -test'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='False positive rate (1-Specificity)'
displaygraph.label_y='True positive rate (Sensitivity)'
displaygraph.constructgraph(lnrsvmavgw2v.roc_curve_test['fpr_trn'],lnrsvmav
gw2v.roc_curve_test['tpr_trn'],\
                            lnrsvmavgw2v.roc_curve_test['fpr'],lnrsvmavgw2v
.roc_curve_test['tpr'])

```



```
In [70]: data = [[lnrsvmavgw2v.confsnmtxytstp[ 'tn' ] ,lnrsvmavgw2v.confsnmtxytstp[ 'fn' ]],
lnrsvmavgw2v.confsnmtxytstp[ 'fp' ],lnrsvmavgw2v.confsnmtxytstp[ 'tp' ]]]
displaygraph.draw_table(data)
data1= [[lnrsvmavgw2v.accuracy_score_val,lnrsvmavgw2v.accuracy_score_test]]
displaygraph.draw_accscore(data1)
```

	Predicted: NO	Predicted: YES
Actual: NO	837	3536
Actual: YES	381	2729

	Validation	Test
Accuracy Score	0.5526975112744279	0.4765468395028732

Precision, Recall, f-1 Score


```
In [5]: import tabulate
res_tab = [['Label', 'Precision', 'Recall', 'f-1 Score'],
           [0, 0.21, 0.61, 0.31 ],
           [1, 0.88, 0.55, 0.67]]
print(tabulate.tabulate(res_tab, tablefmt='fancy_grid'))
```

Label	Precision	Recall	f-1 Score
0	0.21	0.61	0.31
1	0.88	0.55	0.67

[5.1.4] Applying Linear SVM on TFIDF W2V, SET 4

```
In [3]: # Please write all the code with proper documentation
```

GridsearchCV output for TFIDF W2V

```
0.5 {'alpha': 0.0001, 'penalty': 'l2'} GridSearchCV(cv=10, error_score='raise-deprecating',
estimator=SGDClassifier(alpha=0.0001, average=False, class_weight=None, early_stopping=False,
epsilon=0.1, eta0=0.0, fit_intercept=True, l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2', power_t=0.5, random_state=42, shuffle=True,
tol=0.001, validation_fraction=0.1, verbose=100, warm_start=False), fit_params=None, iid='warn',
n_jobs=None, param_grid={'penalty': ['l2', 'l1'], 'alpha': [0.0001, 0.001, 0.01, 0.1, 1, 10, 100, 1000]},
pre_dispatch='2*n_jobs', refit=True, return_train_score='warn', scoring='roc_auc', verbose=100)
```

```
In [30]: lnrsvmtidfwtw2v = assign7SVM()
lnrsm_sgdc1f = lnrsvmtidfwtw2v.SGDClassifier()
lnrsvmtidfwtw2v.load_data('WTW2V')
lnrsvmtidfwtw2v.setpenaltyparm('l2')
```

```
Out[30]: SGDClassifier(alpha=0.0001, average=False, class_weight={0: 5.14, 1: 1},
early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
power_t=0.5, random_state=42, shuffle=True, tol=0.001,
validation_fraction=0.1, verbose=100, warm_start=False)
```

```
In [31]: lnrsvmtidfwtw2v.SVM_calcrocaucscore(1000000)
```

```
SGDClassifier(alpha=1e-07, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 6354.44, NNZs: 50, Bias: 81.369587, T: 23945, Avg. loss: 2134.681716
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 5652.11, NNZs: 50, Bias: -746.501325, T: 47890, Avg. loss: 1866.22985
2
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 4821.36, NNZs: 50, Bias: 630.549480, T: 71835, Avg. loss: 1687.779596
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 4054.67, NNZs: 50, Bias: 65.574890, T: 95780, Avg. loss: 1563.132261
Total training time: 0.04 seconds.
-- Epoch 5
Norm: 3649.82, NNZs: 50, Bias: -547.150912, T: 119725, Avg. loss: 1422.0649
72
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 3049.71, NNZs: 50, Bias: -652.805811, T: 143670, Avg. loss: 1341.2027
83
Total training time: 0.07 seconds.
-- Epoch 7
Norm: 2302.90, NNZs: 50, Bias: -623.244065, T: 167615, Avg. loss: 1234.3334
38
Total training time: 0.08 seconds.
-- Epoch 8
Norm: 2575.82, NNZs: 50, Bias: -14.659501, T: 191560, Avg. loss: 1130.87867
1
Total training time: 0.09 seconds.
-- Epoch 9
Norm: 2618.02, NNZs: 50, Bias: -108.416088, T: 215505, Avg. loss: 1066.6255
55
Total training time: 0.11 seconds.
-- Epoch 10
Norm: 2765.64, NNZs: 50, Bias: 134.003852, T: 239450, Avg. loss: 1026.63038
1
Total training time: 0.12 seconds.
-- Epoch 11
Norm: 2895.79, NNZs: 50, Bias: -379.733371, T: 263395, Avg. loss: 919.62562
1
Total training time: 0.13 seconds.
-- Epoch 12
Norm: 1977.88, NNZs: 50, Bias: -610.631282, T: 287340, Avg. loss: 898.96624
2
Total training time: 0.14 seconds.
-- Epoch 13
Norm: 2391.07, NNZs: 50, Bias: -429.620999, T: 311285, Avg. loss: 877.87739
3
Total training time: 0.16 seconds.
-- Epoch 14
Norm: 1767.01, NNZs: 50, Bias: 131.588850, T: 335230, Avg. loss: 826.543753
```

Total training time: 0.17 seconds.
-- Epoch 15
Norm: 1895.98, NNZs: 50, Bias: -361.866566, T: 359175, Avg. loss: 756.575673
Total training time: 0.19 seconds.
-- Epoch 16
Norm: 2076.47, NNZs: 50, Bias: -232.352593, T: 383120, Avg. loss: 744.040266
Total training time: 0.20 seconds.
-- Epoch 17
Norm: 1846.64, NNZs: 50, Bias: 118.377608, T: 407065, Avg. loss: 721.344157
Total training time: 0.21 seconds.
-- Epoch 18
Norm: 1509.06, NNZs: 50, Bias: 2.435050, T: 431010, Avg. loss: 680.025205
Total training time: 0.23 seconds.
-- Epoch 19
Norm: 1618.69, NNZs: 50, Bias: 55.955569, T: 454955, Avg. loss: 662.559163
Total training time: 0.24 seconds.
-- Epoch 20
Norm: 1597.68, NNZs: 50, Bias: -75.124896, T: 478900, Avg. loss: 640.360048
Total training time: 0.26 seconds.
-- Epoch 21
Norm: 1444.32, NNZs: 50, Bias: -205.364086, T: 502845, Avg. loss: 631.781477
Total training time: 0.27 seconds.
-- Epoch 22
Norm: 1897.10, NNZs: 50, Bias: -346.937172, T: 526790, Avg. loss: 584.935306
Total training time: 0.28 seconds.
-- Epoch 23
Norm: 1582.73, NNZs: 50, Bias: -233.876120, T: 550735, Avg. loss: 595.769458
Total training time: 0.29 seconds.
-- Epoch 24
Norm: 945.29, NNZs: 50, Bias: 142.211023, T: 574680, Avg. loss: 552.019715
Total training time: 0.31 seconds.
-- Epoch 25
Norm: 1882.50, NNZs: 50, Bias: 144.127118, T: 598625, Avg. loss: 545.409689
Total training time: 0.32 seconds.
-- Epoch 26
Norm: 1047.00, NNZs: 50, Bias: -145.872907, T: 622570, Avg. loss: 517.257797
Total training time: 0.34 seconds.
-- Epoch 27
Norm: 1259.74, NNZs: 50, Bias: 112.201789, T: 646515, Avg. loss: 506.489632
Total training time: 0.35 seconds.
-- Epoch 28
Norm: 1355.07, NNZs: 50, Bias: -156.647039, T: 670460, Avg. loss: 488.907336
Total training time: 0.36 seconds.
-- Epoch 29
Norm: 1083.39, NNZs: 50, Bias: 245.388793, T: 694405, Avg. loss: 471.928346
Total training time: 0.38 seconds.
-- Epoch 30
Norm: 946.28, NNZs: 50, Bias: 193.044862, T: 718350, Avg. loss: 458.304926
Total training time: 0.39 seconds.
-- Epoch 31

Norm: 876.01, NNZs: 50, Bias: -10.160572, T: 742295, Avg. loss: 449.636490
Total training time: 0.41 seconds.
-- Epoch 32
Norm: 968.84, NNZs: 50, Bias: 168.104294, T: 766240, Avg. loss: 427.280807
Total training time: 0.42 seconds.
-- Epoch 33
Norm: 1173.39, NNZs: 50, Bias: 148.881322, T: 790185, Avg. loss: 428.311382
Total training time: 0.44 seconds.
-- Epoch 34
Norm: 1015.36, NNZs: 50, Bias: -187.330325, T: 814130, Avg. loss: 418.538069
Total training time: 0.45 seconds.
-- Epoch 35
Norm: 1145.18, NNZs: 50, Bias: -114.333666, T: 838075, Avg. loss: 408.195211
Total training time: 0.47 seconds.
-- Epoch 36
Norm: 1089.42, NNZs: 50, Bias: -126.118229, T: 862020, Avg. loss: 398.014049
Total training time: 0.49 seconds.
-- Epoch 37
Norm: 841.19, NNZs: 50, Bias: 62.980801, T: 885965, Avg. loss: 390.873307
Total training time: 0.50 seconds.
-- Epoch 38
Norm: 947.10, NNZs: 50, Bias: -60.095272, T: 909910, Avg. loss: 385.542472
Total training time: 0.52 seconds.
-- Epoch 39
Norm: 882.52, NNZs: 50, Bias: -197.524493, T: 933855, Avg. loss: 372.124531
Total training time: 0.53 seconds.
-- Epoch 40
Norm: 771.92, NNZs: 50, Bias: 107.894545, T: 957800, Avg. loss: 364.661995
Total training time: 0.55 seconds.
-- Epoch 41
Norm: 592.90, NNZs: 50, Bias: -134.273037, T: 981745, Avg. loss: 359.739663
Total training time: 0.56 seconds.
-- Epoch 42
Norm: 740.78, NNZs: 50, Bias: -94.187157, T: 1005690, Avg. loss: 346.212748
Total training time: 0.58 seconds.
-- Epoch 43
Norm: 840.15, NNZs: 50, Bias: 12.385825, T: 1029635, Avg. loss: 347.953664
Total training time: 0.59 seconds.
-- Epoch 44
Norm: 875.98, NNZs: 50, Bias: -217.525340, T: 1053580, Avg. loss: 334.993891
Total training time: 0.60 seconds.
-- Epoch 45
Norm: 624.76, NNZs: 50, Bias: 8.251897, T: 1077525, Avg. loss: 329.819210
Total training time: 0.62 seconds.
-- Epoch 46
Norm: 682.85, NNZs: 50, Bias: -18.798650, T: 1101470, Avg. loss: 323.427625
Total training time: 0.63 seconds.
-- Epoch 47
Norm: 760.28, NNZs: 50, Bias: -111.565368, T: 1125415, Avg. loss: 319.518664
Total training time: 0.65 seconds.
-- Epoch 48
Norm: 754.18, NNZs: 50, Bias: 0.148106, T: 1149360, Avg. loss: 303.161423

Total training time: 0.67 seconds.
-- Epoch 49
Norm: 633.83, NNZs: 50, Bias: 129.393614, T: 1173305, Avg. loss: 306.926439
Total training time: 0.68 seconds.
-- Epoch 50
Norm: 806.11, NNZs: 50, Bias: -217.188525, T: 1197250, Avg. loss: 289.106176
Total training time: 0.70 seconds.
-- Epoch 51
Norm: 622.66, NNZs: 50, Bias: 80.242715, T: 1221195, Avg. loss: 298.977749
Total training time: 0.71 seconds.
-- Epoch 52
Norm: 862.01, NNZs: 50, Bias: 16.915708, T: 1245140, Avg. loss: 292.999845
Total training time: 0.73 seconds.
-- Epoch 53
Norm: 525.30, NNZs: 50, Bias: -54.526724, T: 1269085, Avg. loss: 293.706285
Total training time: 0.75 seconds.
-- Epoch 54
Norm: 842.10, NNZs: 50, Bias: -189.827134, T: 1293030, Avg. loss: 286.625274
Total training time: 0.76 seconds.
-- Epoch 55
Norm: 705.41, NNZs: 50, Bias: 0.614697, T: 1316975, Avg. loss: 271.061630
Total training time: 0.77 seconds.
-- Epoch 56
Norm: 603.29, NNZs: 50, Bias: -2.000006, T: 1340920, Avg. loss: 274.252478
Total training time: 0.79 seconds.
-- Epoch 57
Norm: 515.13, NNZs: 50, Bias: 156.866747, T: 1364865, Avg. loss: 265.148320
Total training time: 0.80 seconds.
-- Epoch 58
Norm: 844.73, NNZs: 50, Bias: -117.998547, T: 1388810, Avg. loss: 259.558732
Total training time: 0.82 seconds.
-- Epoch 59
Norm: 493.69, NNZs: 50, Bias: -32.131495, T: 1412755, Avg. loss: 265.973665
Total training time: 0.83 seconds.
-- Epoch 60
Norm: 599.86, NNZs: 50, Bias: -19.367065, T: 1436700, Avg. loss: 256.254106
Total training time: 0.85 seconds.
-- Epoch 61
Norm: 511.52, NNZs: 50, Bias: 26.787468, T: 1460645, Avg. loss: 258.106413
Total training time: 0.86 seconds.
-- Epoch 62
Norm: 502.87, NNZs: 50, Bias: -115.657381, T: 1484590, Avg. loss: 252.011709
Total training time: 0.88 seconds.
-- Epoch 63
Norm: 527.46, NNZs: 50, Bias: -15.021732, T: 1508535, Avg. loss: 248.613012
Total training time: 0.90 seconds.
-- Epoch 64
Norm: 507.75, NNZs: 50, Bias: -31.847968, T: 1532480, Avg. loss: 247.915294
Total training time: 0.91 seconds.
-- Epoch 65
Norm: 610.10, NNZs: 50, Bias: -0.654290, T: 1556425, Avg. loss: 239.014346
Total training time: 0.93 seconds.
-- Epoch 66

Norm: 339.66, NNZs: 50, Bias: 83.396042, T: 1580370, Avg. loss: 245.351111
Total training time: 0.94 seconds.
-- Epoch 67
Norm: 499.49, NNZs: 50, Bias: -89.736109, T: 1604315, Avg. loss: 229.146300
Total training time: 0.96 seconds.
-- Epoch 68
Norm: 562.49, NNZs: 50, Bias: 40.309848, T: 1628260, Avg. loss: 224.358896
Total training time: 0.97 seconds.
-- Epoch 69
Norm: 546.48, NNZs: 50, Bias: -10.552096, T: 1652205, Avg. loss: 214.876270
Total training time: 0.98 seconds.
-- Epoch 70
Norm: 515.49, NNZs: 50, Bias: 9.704626, T: 1676150, Avg. loss: 222.999888
Total training time: 1.00 seconds.
-- Epoch 71
Norm: 419.61, NNZs: 50, Bias: 44.601462, T: 1700095, Avg. loss: 220.687644
Total training time: 1.01 seconds.
-- Epoch 72
Norm: 503.48, NNZs: 50, Bias: 18.046796, T: 1724040, Avg. loss: 208.891024
Total training time: 1.03 seconds.
-- Epoch 73
Norm: 504.47, NNZs: 50, Bias: -127.459336, T: 1747985, Avg. loss: 209.315574
Total training time: 1.04 seconds.
-- Epoch 74
Norm: 515.25, NNZs: 50, Bias: -177.600157, T: 1771930, Avg. loss: 213.686840
Total training time: 1.06 seconds.
-- Epoch 75
Norm: 483.00, NNZs: 50, Bias: -59.479055, T: 1795875, Avg. loss: 206.302275
Total training time: 1.07 seconds.
-- Epoch 76
Norm: 361.75, NNZs: 50, Bias: 6.441501, T: 1819820, Avg. loss: 207.250979
Total training time: 1.09 seconds.
-- Epoch 77
Norm: 520.85, NNZs: 50, Bias: -66.610059, T: 1843765, Avg. loss: 210.457885
Total training time: 1.11 seconds.
-- Epoch 78
Norm: 465.25, NNZs: 50, Bias: 10.676542, T: 1867710, Avg. loss: 209.037537
Total training time: 1.12 seconds.
-- Epoch 79
Norm: 500.99, NNZs: 50, Bias: 95.613534, T: 1891655, Avg. loss: 205.232639
Total training time: 1.14 seconds.
-- Epoch 80
Norm: 525.52, NNZs: 50, Bias: 13.145992, T: 1915600, Avg. loss: 203.430525
Total training time: 1.15 seconds.
-- Epoch 81
Norm: 481.46, NNZs: 50, Bias: 25.324582, T: 1939545, Avg. loss: 196.022979
Total training time: 1.17 seconds.
-- Epoch 82
Norm: 554.31, NNZs: 50, Bias: -116.744359, T: 1963490, Avg. loss: 192.423037
Total training time: 1.18 seconds.
-- Epoch 83
Norm: 396.99, NNZs: 50, Bias: 38.699558, T: 1987435, Avg. loss: 191.601474
Total training time: 1.19 seconds.
-- Epoch 84

Norm: 396.58, NNZs: 50, Bias: 18.688325, T: 2011380, Avg. loss: 188.237630
Total training time: 1.21 seconds.
-- Epoch 85
Norm: 362.80, NNZs: 50, Bias: -164.815827, T: 2035325, Avg. loss: 185.17513
2
Total training time: 1.23 seconds.
-- Epoch 86
Norm: 420.79, NNZs: 50, Bias: 52.469019, T: 2059270, Avg. loss: 188.441636
Total training time: 1.24 seconds.
-- Epoch 87
Norm: 357.37, NNZs: 50, Bias: 0.911777, T: 2083215, Avg. loss: 184.153394
Total training time: 1.25 seconds.
-- Epoch 88
Norm: 414.72, NNZs: 50, Bias: -116.987607, T: 2107160, Avg. loss: 179.10381
7
Total training time: 1.27 seconds.
-- Epoch 89
Norm: 332.92, NNZs: 50, Bias: -56.013557, T: 2131105, Avg. loss: 176.298451
Total training time: 1.29 seconds.
-- Epoch 90
Norm: 404.90, NNZs: 50, Bias: -151.565674, T: 2155050, Avg. loss: 183.08346
8
Total training time: 1.30 seconds.
-- Epoch 91
Norm: 447.85, NNZs: 50, Bias: -39.386107, T: 2178995, Avg. loss: 180.840998
Total training time: 1.32 seconds.
-- Epoch 92
Norm: 374.17, NNZs: 50, Bias: -68.665667, T: 2202940, Avg. loss: 173.784772
Total training time: 1.33 seconds.
-- Epoch 93
Norm: 465.92, NNZs: 50, Bias: -130.290624, T: 2226885, Avg. loss: 168.57672
6
Total training time: 1.34 seconds.
-- Epoch 94
Norm: 391.01, NNZs: 50, Bias: -32.921357, T: 2250830, Avg. loss: 168.836866
Total training time: 1.36 seconds.
-- Epoch 95
Norm: 375.79, NNZs: 50, Bias: 23.898660, T: 2274775, Avg. loss: 169.415025
Total training time: 1.38 seconds.
-- Epoch 96
Norm: 390.62, NNZs: 50, Bias: 42.865653, T: 2298720, Avg. loss: 165.337318
Total training time: 1.39 seconds.
-- Epoch 97
Norm: 373.28, NNZs: 50, Bias: 119.608966, T: 2322665, Avg. loss: 163.590544
Total training time: 1.41 seconds.
-- Epoch 98
Norm: 394.72, NNZs: 50, Bias: 32.407925, T: 2346610, Avg. loss: 160.281604
Total training time: 1.42 seconds.
-- Epoch 99
Norm: 354.79, NNZs: 50, Bias: 21.166334, T: 2370555, Avg. loss: 157.716083
Total training time: 1.44 seconds.
-- Epoch 100
Norm: 379.04, NNZs: 50, Bias: -33.704470, T: 2394500, Avg. loss: 158.895920
Total training time: 1.45 seconds.
-- Epoch 101
Norm: 446.95, NNZs: 50, Bias: -11.787769, T: 2418445, Avg. loss: 159.273860
Total training time: 1.46 seconds.


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-- Epoch 102
Norm: 326.58, NNZs: 50, Bias: -80.132745, T: 2442390, Avg. loss: 162.817479
Total training time: 1.48 seconds.
-- Epoch 103
Norm: 319.73, NNZs: 50, Bias: 35.643168, T: 2466335, Avg. loss: 159.760122
Total training time: 1.50 seconds.
-- Epoch 104
Norm: 318.61, NNZs: 50, Bias: -68.084714, T: 2490280, Avg. loss: 157.131689
Total training time: 1.51 seconds.
-- Epoch 105
Norm: 336.68, NNZs: 50, Bias: -23.654704, T: 2514225, Avg. loss: 155.649628
Total training time: 1.53 seconds.
-- Epoch 106
Norm: 286.38, NNZs: 50, Bias: -62.634768, T: 2538170, Avg. loss: 148.789720
Total training time: 1.54 seconds.
-- Epoch 107
Norm: 319.48, NNZs: 50, Bias: -45.889738, T: 2562115, Avg. loss: 149.834910
Total training time: 1.56 seconds.
-- Epoch 108
Norm: 344.33, NNZs: 50, Bias: 65.219562, T: 2586060, Avg. loss: 144.566207
Total training time: 1.57 seconds.
-- Epoch 109
Norm: 369.03, NNZs: 50, Bias: -65.207995, T: 2610005, Avg. loss: 149.878060
Total training time: 1.59 seconds.
-- Epoch 110
Norm: 391.05, NNZs: 50, Bias: 21.587923, T: 2633950, Avg. loss: 145.409844
Total training time: 1.60 seconds.
-- Epoch 111
Norm: 352.59, NNZs: 50, Bias: -53.628377, T: 2657895, Avg. loss: 145.631256
Total training time: 1.62 seconds.
-- Epoch 112
Norm: 254.24, NNZs: 50, Bias: -66.888175, T: 2681840, Avg. loss: 147.876307
Total training time: 1.63 seconds.
-- Epoch 113
Norm: 254.35, NNZs: 50, Bias: -14.006958, T: 2705785, Avg. loss: 145.269069
Total training time: 1.65 seconds.
Convergence after 113 epochs took 1.65 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=1e-06, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 2350.70, NNZs: 50, Bias: -105.401641, T: 23945, Avg. loss: 945.734873
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 1482.30, NNZs: 50, Bias: -139.575031, T: 47890, Avg. loss: 613.723040
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 1007.73, NNZs: 50, Bias: 241.238223, T: 71835, Avg. loss: 439.278148
Total training time: 0.04 seconds.
-- Epoch 4
```

Norm: 892.29, NNZs: 50, Bias: 92.816689, T: 95780, Avg. loss: 349.457413
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 733.43, NNZs: 50, Bias: -105.973429, T: 119725, Avg. loss: 287.046294
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 661.04, NNZs: 50, Bias: -125.713488, T: 143670, Avg. loss: 253.446141
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 430.35, NNZs: 50, Bias: 20.675934, T: 167615, Avg. loss: 222.356220
Total training time: 0.10 seconds.
-- Epoch 8
Norm: 426.12, NNZs: 50, Bias: -6.933377, T: 191560, Avg. loss: 193.945707
Total training time: 0.11 seconds.
-- Epoch 9
Norm: 392.36, NNZs: 50, Bias: 26.507779, T: 215505, Avg. loss: 175.732750
Total training time: 0.12 seconds.
-- Epoch 10
Norm: 424.31, NNZs: 50, Bias: 54.393398, T: 239450, Avg. loss: 157.217831
Total training time: 0.14 seconds.
-- Epoch 11
Norm: 478.36, NNZs: 50, Bias: -90.669998, T: 263395, Avg. loss: 142.186026
Total training time: 0.15 seconds.
-- Epoch 12
Norm: 311.63, NNZs: 50, Bias: -47.269429, T: 287340, Avg. loss: 137.079369
Total training time: 0.16 seconds.
-- Epoch 13
Norm: 365.04, NNZs: 50, Bias: -70.797934, T: 311285, Avg. loss: 129.286602
Total training time: 0.17 seconds.
-- Epoch 14
Norm: 267.23, NNZs: 50, Bias: 7.514753, T: 335230, Avg. loss: 118.672434
Total training time: 0.19 seconds.
-- Epoch 15
Norm: 217.35, NNZs: 50, Bias: -51.783639, T: 359175, Avg. loss: 108.385020
Total training time: 0.21 seconds.
-- Epoch 16
Norm: 252.85, NNZs: 50, Bias: -19.065681, T: 383120, Avg. loss: 101.712238
Total training time: 0.22 seconds.
-- Epoch 17
Norm: 222.13, NNZs: 50, Bias: 14.547769, T: 407065, Avg. loss: 98.042916
Total training time: 0.23 seconds.
-- Epoch 18
Norm: 177.47, NNZs: 50, Bias: 8.534506, T: 431010, Avg. loss: 93.194951
Total training time: 0.25 seconds.
-- Epoch 19
Norm: 220.41, NNZs: 50, Bias: -8.491681, T: 454955, Avg. loss: 87.917144
Total training time: 0.26 seconds.
-- Epoch 20
Norm: 199.42, NNZs: 50, Bias: 34.534974, T: 478900, Avg. loss: 84.848834
Total training time: 0.27 seconds.
-- Epoch 21
Norm: 188.72, NNZs: 50, Bias: -18.813351, T: 502845, Avg. loss: 80.102635
Total training time: 0.28 seconds.
-- Epoch 22
Norm: 183.88, NNZs: 50, Bias: -23.464407, T: 526790, Avg. loss: 74.065095
Total training time: 0.29 seconds.
-- Epoch 23

Norm: 163.44, NNZs: 50, Bias: -19.127592, T: 550735, Avg. loss: 73.653648
Total training time: 0.31 seconds.
-- Epoch 24
Norm: 124.04, NNZs: 50, Bias: 9.034986, T: 574680, Avg. loss: 70.174610
Total training time: 0.32 seconds.
-- Epoch 25
Norm: 186.53, NNZs: 50, Bias: 27.565310, T: 598625, Avg. loss: 67.885774
Total training time: 0.33 seconds.
-- Epoch 26
Norm: 135.22, NNZs: 50, Bias: -4.781116, T: 622570, Avg. loss: 63.958721
Total training time: 0.34 seconds.
-- Epoch 27
Norm: 142.65, NNZs: 50, Bias: -2.812615, T: 646515, Avg. loss: 62.448367
Total training time: 0.36 seconds.
-- Epoch 28
Norm: 153.26, NNZs: 50, Bias: -32.423880, T: 670460, Avg. loss: 60.920717
Total training time: 0.37 seconds.
-- Epoch 29
Norm: 123.36, NNZs: 50, Bias: 22.188884, T: 694405, Avg. loss: 58.384301
Total training time: 0.38 seconds.
-- Epoch 30
Norm: 145.81, NNZs: 50, Bias: 26.911296, T: 718350, Avg. loss: 57.090907
Total training time: 0.40 seconds.
-- Epoch 31
Norm: 122.04, NNZs: 50, Bias: -18.626926, T: 742295, Avg. loss: 53.211060
Total training time: 0.41 seconds.
-- Epoch 32
Norm: 99.39, NNZs: 50, Bias: 20.779684, T: 766240, Avg. loss: 51.531044
Total training time: 0.43 seconds.
-- Epoch 33
Norm: 138.23, NNZs: 50, Bias: 14.123199, T: 790185, Avg. loss: 51.002415
Total training time: 0.44 seconds.
-- Epoch 34
Norm: 92.65, NNZs: 50, Bias: 3.858389, T: 814130, Avg. loss: 49.981116
Total training time: 0.45 seconds.
-- Epoch 35
Norm: 138.44, NNZs: 50, Bias: -22.523343, T: 838075, Avg. loss: 48.708448
Total training time: 0.46 seconds.
-- Epoch 36
Norm: 132.63, NNZs: 50, Bias: -19.724307, T: 862020, Avg. loss: 45.709862
Total training time: 0.48 seconds.
-- Epoch 37
Norm: 107.69, NNZs: 50, Bias: 7.741911, T: 885965, Avg. loss: 44.828266
Total training time: 0.49 seconds.
-- Epoch 38
Norm: 118.22, NNZs: 50, Bias: -16.661306, T: 909910, Avg. loss: 45.041872
Total training time: 0.50 seconds.
-- Epoch 39
Norm: 110.70, NNZs: 50, Bias: -24.032395, T: 933855, Avg. loss: 44.237073
Total training time: 0.51 seconds.
-- Epoch 40
Norm: 102.92, NNZs: 50, Bias: 4.546927, T: 957800, Avg. loss: 43.222913
Total training time: 0.52 seconds.
-- Epoch 41
Norm: 85.88, NNZs: 50, Bias: -30.950238, T: 981745, Avg. loss: 42.586259
Total training time: 0.54 seconds.
-- Epoch 42

Norm: 77.69, NNZs: 50, Bias: -3.705450, T: 1005690, Avg. loss: 40.425511
Total training time: 0.55 seconds.
-- Epoch 43
Norm: 84.87, NNZs: 50, Bias: 8.277107, T: 1029635, Avg. loss: 40.346191
Total training time: 0.56 seconds.
-- Epoch 44
Norm: 117.31, NNZs: 50, Bias: -42.794221, T: 1053580, Avg. loss: 39.306516
Total training time: 0.57 seconds.
-- Epoch 45
Norm: 68.84, NNZs: 50, Bias: 4.809174, T: 1077525, Avg. loss: 38.017785
Total training time: 0.58 seconds.
-- Epoch 46
Norm: 77.71, NNZs: 50, Bias: -21.841941, T: 1101470, Avg. loss: 37.434781
Total training time: 0.60 seconds.
-- Epoch 47
Norm: 94.33, NNZs: 50, Bias: -21.914688, T: 1125415, Avg. loss: 36.992004
Total training time: 0.61 seconds.
-- Epoch 48
Norm: 61.49, NNZs: 50, Bias: 7.747323, T: 1149360, Avg. loss: 34.488582
Total training time: 0.62 seconds.
-- Epoch 49
Norm: 73.38, NNZs: 50, Bias: 5.666159, T: 1173305, Avg. loss: 34.845291
Total training time: 0.64 seconds.
-- Epoch 50
Norm: 76.90, NNZs: 50, Bias: -21.022639, T: 1197250, Avg. loss: 33.887227
Total training time: 0.65 seconds.
-- Epoch 51
Norm: 71.69, NNZs: 50, Bias: 4.952228, T: 1221195, Avg. loss: 34.239019
Total training time: 0.66 seconds.
-- Epoch 52
Norm: 82.56, NNZs: 50, Bias: 1.033385, T: 1245140, Avg. loss: 32.819856
Total training time: 0.67 seconds.
-- Epoch 53
Norm: 66.98, NNZs: 50, Bias: -13.743582, T: 1269085, Avg. loss: 32.289966
Total training time: 0.69 seconds.
-- Epoch 54
Norm: 91.01, NNZs: 50, Bias: -12.254199, T: 1293030, Avg. loss: 32.569757
Total training time: 0.70 seconds.
-- Epoch 55
Norm: 68.43, NNZs: 50, Bias: -0.885567, T: 1316975, Avg. loss: 32.067817
Total training time: 0.71 seconds.
-- Epoch 56
Norm: 59.27, NNZs: 50, Bias: -7.649020, T: 1340920, Avg. loss: 30.925936
Total training time: 0.73 seconds.
-- Epoch 57
Norm: 47.68, NNZs: 50, Bias: 20.867757, T: 1364865, Avg. loss: 29.896706
Total training time: 0.74 seconds.
-- Epoch 58
Norm: 92.21, NNZs: 50, Bias: -18.415360, T: 1388810, Avg. loss: 28.940038
Total training time: 0.75 seconds.
-- Epoch 59
Norm: 51.71, NNZs: 50, Bias: -9.156389, T: 1412755, Avg. loss: 30.059117
Total training time: 0.76 seconds.
-- Epoch 60
Norm: 69.52, NNZs: 50, Bias: -11.809005, T: 1436700, Avg. loss: 29.252762
Total training time: 0.77 seconds.
-- Epoch 61

Norm: 55.83, NNZs: 50, Bias: 6.989981, T: 1460645, Avg. loss: 28.661536
Total training time: 0.79 seconds.
-- Epoch 62
Norm: 53.09, NNZs: 50, Bias: -16.747507, T: 1484590, Avg. loss: 27.564185
Total training time: 0.80 seconds.
-- Epoch 63
Norm: 48.60, NNZs: 50, Bias: 2.942966, T: 1508535, Avg. loss: 27.679005
Total training time: 0.81 seconds.
-- Epoch 64
Norm: 49.87, NNZs: 50, Bias: -16.221441, T: 1532480, Avg. loss: 27.524672
Total training time: 0.82 seconds.
-- Epoch 65
Norm: 63.73, NNZs: 50, Bias: 1.592121, T: 1556425, Avg. loss: 26.809007
Total training time: 0.83 seconds.
-- Epoch 66
Norm: 43.53, NNZs: 50, Bias: 5.528412, T: 1580370, Avg. loss: 26.637861
Total training time: 0.85 seconds.
-- Epoch 67
Norm: 52.82, NNZs: 50, Bias: -3.785920, T: 1604315, Avg. loss: 25.530090
Total training time: 0.86 seconds.
-- Epoch 68
Norm: 62.45, NNZs: 50, Bias: 4.026647, T: 1628260, Avg. loss: 25.576710
Total training time: 0.87 seconds.
-- Epoch 69
Norm: 52.67, NNZs: 50, Bias: -1.159728, T: 1652205, Avg. loss: 24.133998
Total training time: 0.88 seconds.
-- Epoch 70
Norm: 65.24, NNZs: 50, Bias: -5.205487, T: 1676150, Avg. loss: 24.423155
Total training time: 0.89 seconds.
-- Epoch 71
Norm: 56.04, NNZs: 50, Bias: 4.289899, T: 1700095, Avg. loss: 24.625879
Total training time: 0.91 seconds.
-- Epoch 72
Norm: 58.09, NNZs: 50, Bias: 0.378093, T: 1724040, Avg. loss: 23.590804
Total training time: 0.92 seconds.
-- Epoch 73
Norm: 48.57, NNZs: 50, Bias: -12.276292, T: 1747985, Avg. loss: 23.445511
Total training time: 0.93 seconds.
-- Epoch 74
Norm: 62.18, NNZs: 50, Bias: -13.846078, T: 1771930, Avg. loss: 23.791437
Total training time: 0.94 seconds.
-- Epoch 75
Norm: 62.88, NNZs: 50, Bias: -1.844708, T: 1795875, Avg. loss: 23.322096
Total training time: 0.95 seconds.
-- Epoch 76
Norm: 39.50, NNZs: 50, Bias: 4.599734, T: 1819820, Avg. loss: 23.249365
Total training time: 0.97 seconds.
-- Epoch 77
Norm: 47.30, NNZs: 50, Bias: 6.322113, T: 1843765, Avg. loss: 22.740356
Total training time: 0.98 seconds.
-- Epoch 78
Norm: 49.52, NNZs: 50, Bias: 2.229451, T: 1867710, Avg. loss: 23.001248
Total training time: 0.99 seconds.
-- Epoch 79
Norm: 49.20, NNZs: 50, Bias: -0.808039, T: 1891655, Avg. loss: 22.429210
Total training time: 1.00 seconds.
-- Epoch 80

Norm: 54.90, NNZs: 50, Bias: -4.426421, T: 1915600, Avg. loss: 22.259399
Total training time: 1.01 seconds.
-- Epoch 81
Norm: 45.98, NNZs: 50, Bias: -1.060418, T: 1939545, Avg. loss: 21.610848
Total training time: 1.02 seconds.
-- Epoch 82
Norm: 55.89, NNZs: 50, Bias: -9.392699, T: 1963490, Avg. loss: 21.647479
Total training time: 1.04 seconds.
-- Epoch 83
Norm: 44.99, NNZs: 50, Bias: 3.897002, T: 1987435, Avg. loss: 21.731724
Total training time: 1.05 seconds.
-- Epoch 84
Norm: 49.50, NNZs: 50, Bias: 3.307655, T: 2011380, Avg. loss: 21.046752
Total training time: 1.06 seconds.
-- Epoch 85
Norm: 42.19, NNZs: 50, Bias: -5.960277, T: 2035325, Avg. loss: 20.466750
Total training time: 1.07 seconds.
-- Epoch 86
Norm: 34.89, NNZs: 50, Bias: 9.934021, T: 2059270, Avg. loss: 20.229382
Total training time: 1.09 seconds.
-- Epoch 87
Norm: 48.41, NNZs: 50, Bias: -4.054176, T: 2083215, Avg. loss: 19.954563
Total training time: 1.10 seconds.
-- Epoch 88
Norm: 47.41, NNZs: 50, Bias: -10.804850, T: 2107160, Avg. loss: 20.093529
Total training time: 1.11 seconds.
-- Epoch 89
Norm: 31.99, NNZs: 50, Bias: -5.156621, T: 2131105, Avg. loss: 19.230224
Total training time: 1.12 seconds.
-- Epoch 90
Norm: 38.09, NNZs: 50, Bias: -10.962214, T: 2155050, Avg. loss: 20.124432
Total training time: 1.13 seconds.
-- Epoch 91
Norm: 48.17, NNZs: 50, Bias: -2.901361, T: 2178995, Avg. loss: 19.804914
Total training time: 1.15 seconds.
-- Epoch 92
Norm: 39.45, NNZs: 50, Bias: -4.919049, T: 2202940, Avg. loss: 19.275982
Total training time: 1.16 seconds.
-- Epoch 93
Norm: 41.82, NNZs: 50, Bias: -7.688814, T: 2226885, Avg. loss: 18.758415
Total training time: 1.17 seconds.
-- Epoch 94
Norm: 47.43, NNZs: 50, Bias: -12.430878, T: 2250830, Avg. loss: 18.854709
Total training time: 1.18 seconds.
-- Epoch 95
Norm: 41.57, NNZs: 50, Bias: 1.414993, T: 2274775, Avg. loss: 18.625047
Total training time: 1.19 seconds.
-- Epoch 96
Norm: 42.35, NNZs: 50, Bias: 9.481892, T: 2298720, Avg. loss: 17.834311
Total training time: 1.21 seconds.
-- Epoch 97
Norm: 41.38, NNZs: 50, Bias: 14.542119, T: 2322665, Avg. loss: 17.636117
Total training time: 1.22 seconds.
-- Epoch 98
Norm: 54.21, NNZs: 50, Bias: 4.088399, T: 2346610, Avg. loss: 17.845485
Total training time: 1.23 seconds.
-- Epoch 99

Norm: 36.92, NNZs: 50, Bias: 1.377465, T: 2370555, Avg. loss: 17.832748
Total training time: 1.24 seconds.
-- Epoch 100
Norm: 42.08, NNZs: 50, Bias: -5.286527, T: 2394500, Avg. loss: 17.602098
Total training time: 1.25 seconds.
-- Epoch 101
Norm: 51.98, NNZs: 50, Bias: -1.470246, T: 2418445, Avg. loss: 17.979527
Total training time: 1.26 seconds.
-- Epoch 102
Norm: 31.06, NNZs: 50, Bias: -6.157635, T: 2442390, Avg. loss: 17.572492
Total training time: 1.27 seconds.
-- Epoch 103
Norm: 34.89, NNZs: 50, Bias: -2.169737, T: 2466335, Avg. loss: 17.709108
Total training time: 1.29 seconds.
-- Epoch 104
Norm: 30.62, NNZs: 50, Bias: -2.698429, T: 2490280, Avg. loss: 16.951116
Total training time: 1.30 seconds.
-- Epoch 105
Norm: 41.51, NNZs: 50, Bias: -0.194748, T: 2514225, Avg. loss: 17.348347
Total training time: 1.31 seconds.
-- Epoch 106
Norm: 37.19, NNZs: 50, Bias: -4.938646, T: 2538170, Avg. loss: 16.045874
Total training time: 1.32 seconds.
-- Epoch 107
Norm: 35.83, NNZs: 50, Bias: -4.062779, T: 2562115, Avg. loss: 16.889101
Total training time: 1.33 seconds.
-- Epoch 108
Norm: 37.31, NNZs: 50, Bias: 0.122060, T: 2586060, Avg. loss: 15.981486
Total training time: 1.35 seconds.
-- Epoch 109
Norm: 43.37, NNZs: 50, Bias: -2.999921, T: 2610005, Avg. loss: 16.648855
Total training time: 1.36 seconds.
-- Epoch 110
Norm: 40.90, NNZs: 50, Bias: 0.590081, T: 2633950, Avg. loss: 16.533641
Total training time: 1.37 seconds.
-- Epoch 111
Norm: 36.03, NNZs: 50, Bias: -3.566288, T: 2657895, Avg. loss: 15.997502
Total training time: 1.38 seconds.
-- Epoch 112
Norm: 24.67, NNZs: 50, Bias: -7.161839, T: 2681840, Avg. loss: 16.214173
Total training time: 1.40 seconds.
-- Epoch 113
Norm: 24.40, NNZs: 50, Bias: -1.595745, T: 2705785, Avg. loss: 15.694179
Total training time: 1.41 seconds.
-- Epoch 114
Norm: 45.08, NNZs: 50, Bias: -4.700847, T: 2729730, Avg. loss: 15.535573
Total training time: 1.43 seconds.
-- Epoch 115
Norm: 39.96, NNZs: 50, Bias: 3.551564, T: 2753675, Avg. loss: 15.785115
Total training time: 1.44 seconds.
-- Epoch 116
Norm: 37.66, NNZs: 50, Bias: -4.106828, T: 2777620, Avg. loss: 15.637367
Total training time: 1.45 seconds.
-- Epoch 117
Norm: 42.31, NNZs: 50, Bias: -0.416333, T: 2801565, Avg. loss: 14.755072
Total training time: 1.46 seconds.
-- Epoch 118

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Norm: 45.68, NNZs: 50, Bias: -4.113744, T: 2825510, Avg. loss: 15.786653
Total training time: 1.48 seconds.
-- Epoch 119
Norm: 24.55, NNZs: 50, Bias: 1.962391, T: 2849455, Avg. loss: 14.934445
Total training time: 1.49 seconds.
-- Epoch 120
Norm: 24.78, NNZs: 50, Bias: 3.261471, T: 2873400, Avg. loss: 15.019579
Total training time: 1.50 seconds.
-- Epoch 121
Norm: 36.42, NNZs: 50, Bias: 2.349078, T: 2897345, Avg. loss: 14.945160
Total training time: 1.51 seconds.
-- Epoch 122
Norm: 28.36, NNZs: 50, Bias: 2.597178, T: 2921290, Avg. loss: 14.765639
Total training time: 1.52 seconds.
Convergence after 122 epochs took 1.52 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=9.999999999999999e-06, average=False,
              class_weight={0: 5.14, 1: 1}, early_stopping=False, epsilon=0.1,
              eta0=0.0, fit_intercept=True, l1_ratio=0.15,
              learning_rate='optimal', loss='hinge', max_iter=1000, n_iter=None,
              n_iter_no_change=5, n_jobs=None, penalty='l2', power_t=0.5,
              random_state=42, shuffle=True, tol=0.001, validation_fraction=0.1,
              verbose=100, warm_start=False)
-- Epoch 1
Norm: 433.72, NNZs: 50, Bias: -4.183669, T: 23945, Avg. loss: 285.802680
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 210.86, NNZs: 50, Bias: -30.389825, T: 47890, Avg. loss: 101.767703
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 140.48, NNZs: 50, Bias: 22.919446, T: 71835, Avg. loss: 61.771131
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 103.48, NNZs: 50, Bias: 17.774348, T: 95780, Avg. loss: 46.047647
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 101.82, NNZs: 50, Bias: -21.054141, T: 119725, Avg. loss: 36.695370
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 70.28, NNZs: 50, Bias: -15.310641, T: 143670, Avg. loss: 31.000307
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 45.99, NNZs: 50, Bias: -11.928203, T: 167615, Avg. loss: 26.135392
Total training time: 0.10 seconds.
-- Epoch 8
Norm: 57.58, NNZs: 50, Bias: -5.009181, T: 191560, Avg. loss: 22.617888
Total training time: 0.11 seconds.
-- Epoch 9
Norm: 38.21, NNZs: 50, Bias: 1.318633, T: 215505, Avg. loss: 20.283898
Total training time: 0.12 seconds.
-- Epoch 10
Norm: 50.01, NNZs: 50, Bias: 3.675040, T: 239450, Avg. loss: 18.294005
Total training time: 0.14 seconds.
-- Epoch 11
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Norm: 47.82, NNZs: 50, Bias: -2.556698, T: 263395, Avg. loss: 16.295542
Total training time: 0.15 seconds.
-- Epoch 12
Norm: 28.94, NNZs: 50, Bias: -2.552958, T: 287340, Avg. loss: 15.473211
Total training time: 0.17 seconds.
-- Epoch 13
Norm: 45.09, NNZs: 50, Bias: -5.713962, T: 311285, Avg. loss: 14.631794
Total training time: 0.18 seconds.
-- Epoch 14
Norm: 27.91, NNZs: 50, Bias: 1.424289, T: 335230, Avg. loss: 13.701935
Total training time: 0.19 seconds.
-- Epoch 15
Norm: 22.02, NNZs: 50, Bias: -3.648844, T: 359175, Avg. loss: 12.042541
Total training time: 0.20 seconds.
-- Epoch 16
Norm: 20.98, NNZs: 50, Bias: -3.794876, T: 383120, Avg. loss: 11.584773
Total training time: 0.21 seconds.
-- Epoch 17
Norm: 28.10, NNZs: 50, Bias: 0.473304, T: 407065, Avg. loss: 11.176343
Total training time: 0.23 seconds.
-- Epoch 18
Norm: 23.39, NNZs: 50, Bias: 2.814309, T: 431010, Avg. loss: 10.312437
Total training time: 0.24 seconds.
-- Epoch 19
Norm: 25.41, NNZs: 50, Bias: -0.252403, T: 454955, Avg. loss: 9.801927
Total training time: 0.25 seconds.
-- Epoch 20
Norm: 25.09, NNZs: 50, Bias: 1.103137, T: 478900, Avg. loss: 9.471367
Total training time: 0.26 seconds.
-- Epoch 21
Norm: 20.00, NNZs: 50, Bias: -0.861943, T: 502845, Avg. loss: 9.108971
Total training time: 0.28 seconds.
-- Epoch 22
Norm: 26.21, NNZs: 50, Bias: -3.994687, T: 526790, Avg. loss: 8.502643
Total training time: 0.29 seconds.
-- Epoch 23
Norm: 20.55, NNZs: 50, Bias: -3.769021, T: 550735, Avg. loss: 8.438190
Total training time: 0.30 seconds.
-- Epoch 24
Norm: 17.49, NNZs: 50, Bias: 1.905248, T: 574680, Avg. loss: 8.042157
Total training time: 0.31 seconds.
-- Epoch 25
Norm: 22.63, NNZs: 50, Bias: -0.258206, T: 598625, Avg. loss: 7.724845
Total training time: 0.33 seconds.
-- Epoch 26
Norm: 15.65, NNZs: 50, Bias: 0.505237, T: 622570, Avg. loss: 7.409790
Total training time: 0.34 seconds.
-- Epoch 27
Norm: 14.52, NNZs: 50, Bias: 0.602161, T: 646515, Avg. loss: 7.217919
Total training time: 0.35 seconds.
-- Epoch 28
Norm: 18.56, NNZs: 50, Bias: -2.163833, T: 670460, Avg. loss: 6.863052
Total training time: 0.36 seconds.
-- Epoch 29
Norm: 12.74, NNZs: 50, Bias: 1.528170, T: 694405, Avg. loss: 6.640952
Total training time: 0.37 seconds.
-- Epoch 30

Norm: 11.93, NNZs: 50, Bias: 1.485593, T: 718350, Avg. loss: 6.529446
Total training time: 0.38 seconds.
-- Epoch 31
Norm: 9.21, NNZs: 50, Bias: -0.059464, T: 742295, Avg. loss: 6.245686
Total training time: 0.39 seconds.
-- Epoch 32
Norm: 10.47, NNZs: 50, Bias: 2.484144, T: 766240, Avg. loss: 6.021486
Total training time: 0.41 seconds.
-- Epoch 33
Norm: 15.28, NNZs: 50, Bias: 1.799005, T: 790185, Avg. loss: 5.854867
Total training time: 0.42 seconds.
-- Epoch 34
Norm: 14.50, NNZs: 50, Bias: -1.309106, T: 814130, Avg. loss: 5.754675
Total training time: 0.43 seconds.
-- Epoch 35
Norm: 13.70, NNZs: 50, Bias: -1.438300, T: 838075, Avg. loss: 5.632008
Total training time: 0.44 seconds.
-- Epoch 36
Norm: 14.89, NNZs: 50, Bias: -2.590875, T: 862020, Avg. loss: 5.492812
Total training time: 0.46 seconds.
-- Epoch 37
Norm: 10.00, NNZs: 50, Bias: 0.793521, T: 885965, Avg. loss: 5.414247
Total training time: 0.47 seconds.
-- Epoch 38
Norm: 13.80, NNZs: 50, Bias: -1.052393, T: 909910, Avg. loss: 5.272976
Total training time: 0.48 seconds.
-- Epoch 39
Norm: 10.62, NNZs: 50, Bias: -2.713225, T: 933855, Avg. loss: 5.167517
Total training time: 0.49 seconds.
-- Epoch 40
Norm: 9.53, NNZs: 50, Bias: 0.772939, T: 957800, Avg. loss: 5.044837
Total training time: 0.51 seconds.
-- Epoch 41
Norm: 8.66, NNZs: 50, Bias: -2.987713, T: 981745, Avg. loss: 4.964951
Total training time: 0.52 seconds.
-- Epoch 42
Norm: 10.26, NNZs: 50, Bias: -1.692259, T: 1005690, Avg. loss: 4.893537
Total training time: 0.53 seconds.
-- Epoch 43
Norm: 10.70, NNZs: 50, Bias: -0.282528, T: 1029635, Avg. loss: 4.795717
Total training time: 0.55 seconds.
-- Epoch 44
Norm: 11.42, NNZs: 50, Bias: -3.011439, T: 1053580, Avg. loss: 4.555052
Total training time: 0.56 seconds.
-- Epoch 45
Norm: 8.56, NNZs: 50, Bias: -0.511342, T: 1077525, Avg. loss: 4.604703
Total training time: 0.57 seconds.
-- Epoch 46
Norm: 6.72, NNZs: 50, Bias: -0.583025, T: 1101470, Avg. loss: 4.470848
Total training time: 0.58 seconds.
-- Epoch 47
Norm: 9.14, NNZs: 50, Bias: -1.327730, T: 1125415, Avg. loss: 4.400741
Total training time: 0.59 seconds.
-- Epoch 48
Norm: 8.84, NNZs: 50, Bias: 0.223456, T: 1149360, Avg. loss: 4.293786
Total training time: 0.61 seconds.
-- Epoch 49

Norm: 8.08, NNZs: 50, Bias: 0.752255, T: 1173305, Avg. loss: 4.183736
Total training time: 0.62 seconds.
-- Epoch 50
Norm: 9.56, NNZs: 50, Bias: -2.091220, T: 1197250, Avg. loss: 4.136642
Total training time: 0.63 seconds.
-- Epoch 51
Norm: 6.93, NNZs: 50, Bias: 1.733743, T: 1221195, Avg. loss: 4.120705
Total training time: 0.64 seconds.
-- Epoch 52
Norm: 9.97, NNZs: 50, Bias: 0.356853, T: 1245140, Avg. loss: 4.061541
Total training time: 0.66 seconds.
-- Epoch 53
Norm: 6.87, NNZs: 50, Bias: -0.865028, T: 1269085, Avg. loss: 4.004726
Total training time: 0.67 seconds.
-- Epoch 54
Norm: 9.52, NNZs: 50, Bias: -1.712709, T: 1293030, Avg. loss: 3.968930
Total training time: 0.68 seconds.
-- Epoch 55
Norm: 7.46, NNZs: 50, Bias: -0.621458, T: 1316975, Avg. loss: 3.883687
Total training time: 0.70 seconds.
-- Epoch 56
Norm: 6.48, NNZs: 50, Bias: -0.579706, T: 1340920, Avg. loss: 3.787775
Total training time: 0.71 seconds.
-- Epoch 57
Norm: 5.94, NNZs: 50, Bias: 1.251527, T: 1364865, Avg. loss: 3.704837
Total training time: 0.72 seconds.
-- Epoch 58
Norm: 9.75, NNZs: 50, Bias: -0.908953, T: 1388810, Avg. loss: 3.758055
Total training time: 0.73 seconds.
-- Epoch 59
Norm: 7.37, NNZs: 50, Bias: -0.101253, T: 1412755, Avg. loss: 3.812543
Total training time: 0.74 seconds.
-- Epoch 60
Norm: 7.51, NNZs: 50, Bias: -0.203528, T: 1436700, Avg. loss: 3.674247
Total training time: 0.76 seconds.
-- Epoch 61
Norm: 6.47, NNZs: 50, Bias: 0.773818, T: 1460645, Avg. loss: 3.559085
Total training time: 0.77 seconds.
-- Epoch 62
Norm: 4.82, NNZs: 50, Bias: -1.531965, T: 1484590, Avg. loss: 3.537515
Total training time: 0.78 seconds.
-- Epoch 63
Norm: 4.62, NNZs: 50, Bias: 1.004204, T: 1508535, Avg. loss: 3.544567
Total training time: 0.80 seconds.
-- Epoch 64
Norm: 5.10, NNZs: 50, Bias: -0.452197, T: 1532480, Avg. loss: 3.482439
Total training time: 0.81 seconds.
-- Epoch 65
Norm: 5.80, NNZs: 50, Bias: 0.625934, T: 1556425, Avg. loss: 3.457844
Total training time: 0.82 seconds.
-- Epoch 66
Norm: 4.54, NNZs: 50, Bias: 1.309124, T: 1580370, Avg. loss: 3.465315
Total training time: 0.83 seconds.
-- Epoch 67
Norm: 5.53, NNZs: 50, Bias: -0.275996, T: 1604315, Avg. loss: 3.329985
Total training time: 0.84 seconds.
-- Epoch 68

Norm: 7.74, NNZs: 50, Bias: 0.718386, T: 1628260, Avg. loss: 3.249677
Total training time: 0.86 seconds.
-- Epoch 69
Norm: 5.51, NNZs: 50, Bias: 0.187512, T: 1652205, Avg. loss: 3.168026
Total training time: 0.87 seconds.
-- Epoch 70
Norm: 7.17, NNZs: 50, Bias: -0.455790, T: 1676150, Avg. loss: 3.218270
Total training time: 0.89 seconds.
-- Epoch 71
Norm: 5.25, NNZs: 50, Bias: 0.398676, T: 1700095, Avg. loss: 3.184142
Total training time: 0.90 seconds.
-- Epoch 72
Norm: 6.47, NNZs: 50, Bias: 0.895803, T: 1724040, Avg. loss: 3.088590
Total training time: 0.92 seconds.
-- Epoch 73
Norm: 5.63, NNZs: 50, Bias: -1.517404, T: 1747985, Avg. loss: 3.109004
Total training time: 0.93 seconds.
-- Epoch 74
Norm: 5.41, NNZs: 50, Bias: -1.629359, T: 1771930, Avg. loss: 3.138949
Total training time: 0.94 seconds.
-- Epoch 75
Norm: 6.21, NNZs: 50, Bias: -0.040785, T: 1795875, Avg. loss: 3.041157
Total training time: 0.95 seconds.
-- Epoch 76
Norm: 5.11, NNZs: 50, Bias: -0.211147, T: 1819820, Avg. loss: 3.032911
Total training time: 0.97 seconds.
-- Epoch 77
Norm: 6.66, NNZs: 50, Bias: -0.243982, T: 1843765, Avg. loss: 3.070932
Total training time: 0.98 seconds.
-- Epoch 78
Norm: 6.20, NNZs: 50, Bias: 0.078586, T: 1867710, Avg. loss: 2.952087
Total training time: 0.99 seconds.
-- Epoch 79
Norm: 6.24, NNZs: 50, Bias: -0.393326, T: 1891655, Avg. loss: 2.984979
Total training time: 1.00 seconds.
-- Epoch 80
Norm: 6.72, NNZs: 50, Bias: 0.192481, T: 1915600, Avg. loss: 2.980502
Total training time: 1.01 seconds.
-- Epoch 81
Norm: 5.68, NNZs: 50, Bias: 0.276800, T: 1939545, Avg. loss: 2.887915
Total training time: 1.03 seconds.
-- Epoch 82
Norm: 5.90, NNZs: 50, Bias: -1.158750, T: 1963490, Avg. loss: 2.894675
Total training time: 1.04 seconds.
-- Epoch 83
Norm: 5.35, NNZs: 50, Bias: 0.227266, T: 1987435, Avg. loss: 2.901661
Total training time: 1.05 seconds.
-- Epoch 84
Norm: 5.52, NNZs: 50, Bias: 0.309320, T: 2011380, Avg. loss: 2.809747
Total training time: 1.06 seconds.
-- Epoch 85
Norm: 4.95, NNZs: 50, Bias: -1.980486, T: 2035325, Avg. loss: 2.735797
Total training time: 1.08 seconds.
-- Epoch 86
Norm: 5.94, NNZs: 50, Bias: 0.651432, T: 2059270, Avg. loss: 2.827491
Total training time: 1.09 seconds.
-- Epoch 87

Norm: 4.82, NNZs: 50, Bias: 0.129621, T: 2083215, Avg. loss: 2.776974
Total training time: 1.10 seconds.
-- Epoch 88
Norm: 5.30, NNZs: 50, Bias: -0.850571, T: 2107160, Avg. loss: 2.735615
Total training time: 1.11 seconds.
-- Epoch 89
Norm: 3.35, NNZs: 50, Bias: -0.571807, T: 2131105, Avg. loss: 2.702833
Total training time: 1.13 seconds.
-- Epoch 90
Norm: 4.10, NNZs: 50, Bias: -1.037178, T: 2155050, Avg. loss: 2.779520
Total training time: 1.14 seconds.
-- Epoch 91
Norm: 4.88, NNZs: 50, Bias: 0.237141, T: 2178995, Avg. loss: 2.654595
Total training time: 1.15 seconds.
-- Epoch 92
Norm: 4.55, NNZs: 50, Bias: -0.474048, T: 2202940, Avg. loss: 2.689587
Total training time: 1.16 seconds.
-- Epoch 93
Norm: 6.05, NNZs: 50, Bias: -1.286332, T: 2226885, Avg. loss: 2.578359
Total training time: 1.18 seconds.
-- Epoch 94
Norm: 4.08, NNZs: 50, Bias: -0.567808, T: 2250830, Avg. loss: 2.620894
Total training time: 1.19 seconds.
-- Epoch 95
Norm: 5.00, NNZs: 50, Bias: 0.273360, T: 2274775, Avg. loss: 2.669479
Total training time: 1.20 seconds.
-- Epoch 96
Norm: 5.22, NNZs: 50, Bias: 0.665063, T: 2298720, Avg. loss: 2.565247
Total training time: 1.21 seconds.
-- Epoch 97
Norm: 4.93, NNZs: 50, Bias: 1.455613, T: 2322665, Avg. loss: 2.551741
Total training time: 1.22 seconds.
-- Epoch 98
Norm: 4.83, NNZs: 50, Bias: 1.059172, T: 2346610, Avg. loss: 2.552217
Total training time: 1.23 seconds.
-- Epoch 99
Norm: 4.56, NNZs: 50, Bias: 0.399404, T: 2370555, Avg. loss: 2.484628
Total training time: 1.25 seconds.
-- Epoch 100
Norm: 4.05, NNZs: 50, Bias: -0.503272, T: 2394500, Avg. loss: 2.482657
Total training time: 1.26 seconds.
-- Epoch 101
Norm: 5.37, NNZs: 50, Bias: 0.135345, T: 2418445, Avg. loss: 2.532283
Total training time: 1.27 seconds.
-- Epoch 102
Norm: 4.07, NNZs: 50, Bias: -0.413098, T: 2442390, Avg. loss: 2.514880
Total training time: 1.29 seconds.
-- Epoch 103
Norm: 3.89, NNZs: 50, Bias: -0.102935, T: 2466335, Avg. loss: 2.495821
Total training time: 1.30 seconds.
-- Epoch 104
Norm: 3.86, NNZs: 50, Bias: -0.442887, T: 2490280, Avg. loss: 2.423046
Total training time: 1.31 seconds.
-- Epoch 105
Norm: 4.28, NNZs: 50, Bias: 0.419604, T: 2514225, Avg. loss: 2.455507
Total training time: 1.32 seconds.
-- Epoch 106

Norm: 3.94, NNZs: 50, Bias: 0.191595, T: 2538170, Avg. loss: 2.379657
Total training time: 1.33 seconds.
-- Epoch 107
Norm: 3.66, NNZs: 50, Bias: -0.332478, T: 2562115, Avg. loss: 2.440778
Total training time: 1.34 seconds.
-- Epoch 108
Norm: 4.47, NNZs: 50, Bias: 0.272964, T: 2586060, Avg. loss: 2.312495
Total training time: 1.36 seconds.
-- Epoch 109
Norm: 4.41, NNZs: 50, Bias: -0.288502, T: 2610005, Avg. loss: 2.421316
Total training time: 1.37 seconds.
-- Epoch 110
Norm: 4.09, NNZs: 50, Bias: 0.636838, T: 2633950, Avg. loss: 2.381460
Total training time: 1.38 seconds.
-- Epoch 111
Norm: 4.03, NNZs: 50, Bias: 0.123184, T: 2657895, Avg. loss: 2.342904
Total training time: 1.39 seconds.
-- Epoch 112
Norm: 3.43, NNZs: 50, Bias: -0.835225, T: 2681840, Avg. loss: 2.374474
Total training time: 1.41 seconds.
-- Epoch 113
Norm: 3.54, NNZs: 50, Bias: 0.018338, T: 2705785, Avg. loss: 2.310824
Total training time: 1.42 seconds.
-- Epoch 114
Norm: 5.50, NNZs: 50, Bias: -0.575661, T: 2729730, Avg. loss: 2.234364
Total training time: 1.43 seconds.
-- Epoch 115
Norm: 4.53, NNZs: 50, Bias: -0.696537, T: 2753675, Avg. loss: 2.333827
Total training time: 1.44 seconds.
-- Epoch 116
Norm: 3.99, NNZs: 50, Bias: -0.209605, T: 2777620, Avg. loss: 2.293698
Total training time: 1.46 seconds.
-- Epoch 117
Norm: 4.55, NNZs: 50, Bias: 0.342899, T: 2801565, Avg. loss: 2.259677
Total training time: 1.47 seconds.
-- Epoch 118
Norm: 4.36, NNZs: 50, Bias: -0.890827, T: 2825510, Avg. loss: 2.288715
Total training time: 1.48 seconds.
-- Epoch 119
Norm: 2.73, NNZs: 50, Bias: 0.231468, T: 2849455, Avg. loss: 2.211976
Total training time: 1.49 seconds.
-- Epoch 120
Norm: 3.18, NNZs: 50, Bias: 0.202673, T: 2873400, Avg. loss: 2.238067
Total training time: 1.50 seconds.
-- Epoch 121
Norm: 4.30, NNZs: 50, Bias: 0.229329, T: 2897345, Avg. loss: 2.236882
Total training time: 1.52 seconds.
-- Epoch 122
Norm: 3.33, NNZs: 50, Bias: 0.156127, T: 2921290, Avg. loss: 2.244661
Total training time: 1.53 seconds.
-- Epoch 123
Norm: 3.48, NNZs: 50, Bias: 0.378309, T: 2945235, Avg. loss: 2.186200
Total training time: 1.54 seconds.
-- Epoch 124
Norm: 4.69, NNZs: 50, Bias: 0.250033, T: 2969180, Avg. loss: 2.193397
Total training time: 1.55 seconds.
-- Epoch 125

Norm: 3.94, NNZs: 50, Bias: -0.331414, T: 2993125, Avg. loss: 2.156423
Total training time: 1.56 seconds.
-- Epoch 126
Norm: 3.55, NNZs: 50, Bias: 0.718064, T: 3017070, Avg. loss: 2.158015
Total training time: 1.58 seconds.
-- Epoch 127
Norm: 3.02, NNZs: 50, Bias: 0.490367, T: 3041015, Avg. loss: 2.127810
Total training time: 1.59 seconds.
-- Epoch 128
Norm: 3.69, NNZs: 50, Bias: -0.275237, T: 3064960, Avg. loss: 2.135767
Total training time: 1.60 seconds.
-- Epoch 129
Norm: 3.55, NNZs: 50, Bias: -0.141258, T: 3088905, Avg. loss: 2.168162
Total training time: 1.61 seconds.
-- Epoch 130
Norm: 2.77, NNZs: 50, Bias: -0.279169, T: 3112850, Avg. loss: 2.115761
Total training time: 1.63 seconds.
-- Epoch 131
Norm: 2.50, NNZs: 50, Bias: 0.767982, T: 3136795, Avg. loss: 2.128367
Total training time: 1.64 seconds.
-- Epoch 132
Norm: 3.73, NNZs: 50, Bias: -1.180360, T: 3160740, Avg. loss: 2.142680
Total training time: 1.65 seconds.
-- Epoch 133
Norm: 3.00, NNZs: 50, Bias: 0.620553, T: 3184685, Avg. loss: 2.127147
Total training time: 1.66 seconds.
-- Epoch 134
Norm: 3.66, NNZs: 50, Bias: -0.471488, T: 3208630, Avg. loss: 2.093330
Total training time: 1.68 seconds.
-- Epoch 135
Norm: 3.63, NNZs: 50, Bias: 0.051665, T: 3232575, Avg. loss: 2.135109
Total training time: 1.69 seconds.
-- Epoch 136
Norm: 2.82, NNZs: 50, Bias: -0.778488, T: 3256520, Avg. loss: 2.107705
Total training time: 1.70 seconds.
-- Epoch 137
Norm: 3.99, NNZs: 50, Bias: -0.088096, T: 3280465, Avg. loss: 2.024976
Total training time: 1.71 seconds.
-- Epoch 138
Norm: 3.05, NNZs: 50, Bias: 0.092005, T: 3304410, Avg. loss: 2.037825
Total training time: 1.72 seconds.
-- Epoch 139
Norm: 2.84, NNZs: 50, Bias: -0.350894, T: 3328355, Avg. loss: 2.090115
Total training time: 1.74 seconds.
-- Epoch 140
Norm: 3.56, NNZs: 50, Bias: -0.443897, T: 3352300, Avg. loss: 2.002126
Total training time: 1.75 seconds.
-- Epoch 141
Norm: 2.31, NNZs: 50, Bias: 0.136156, T: 3376245, Avg. loss: 2.031779
Total training time: 1.76 seconds.
-- Epoch 142
Norm: 3.39, NNZs: 50, Bias: -0.869643, T: 3400190, Avg. loss: 1.994227
Total training time: 1.78 seconds.
-- Epoch 143
Norm: 3.61, NNZs: 50, Bias: -0.361779, T: 3424135, Avg. loss: 2.037249
Total training time: 1.79 seconds.
-- Epoch 144

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Norm: 3.14, NNZs: 50, Bias: -0.298349, T: 3448080, Avg. loss: 1.984731
Total training time: 1.80 seconds.
-- Epoch 145
Norm: 3.21, NNZs: 50, Bias: 0.419292, T: 3472025, Avg. loss: 2.019850
Total training time: 1.81 seconds.
-- Epoch 146
Norm: 2.37, NNZs: 50, Bias: -0.322987, T: 3495970, Avg. loss: 1.974427
Total training time: 1.83 seconds.
-- Epoch 147
Norm: 3.04, NNZs: 50, Bias: 1.231994, T: 3519915, Avg. loss: 1.990601
Total training time: 1.84 seconds.
-- Epoch 148
Norm: 2.62, NNZs: 50, Bias: -0.563957, T: 3543860, Avg. loss: 1.973424
Total training time: 1.85 seconds.
-- Epoch 149
Norm: 2.65, NNZs: 50, Bias: 0.210778, T: 3567805, Avg. loss: 1.965756
Total training time: 1.86 seconds.
-- Epoch 150
Norm: 3.33, NNZs: 50, Bias: -1.097621, T: 3591750, Avg. loss: 1.911125
Total training time: 1.88 seconds.
-- Epoch 151
Norm: 3.71, NNZs: 50, Bias: -0.707854, T: 3615695, Avg. loss: 1.927772
Total training time: 1.89 seconds.
-- Epoch 152
Norm: 3.20, NNZs: 50, Bias: 0.289855, T: 3639640, Avg. loss: 1.949684
Total training time: 1.90 seconds.
-- Epoch 153
Norm: 2.79, NNZs: 50, Bias: -0.014601, T: 3663585, Avg. loss: 1.938284
Total training time: 1.91 seconds.
-- Epoch 154
Norm: 3.59, NNZs: 50, Bias: -0.353029, T: 3687530, Avg. loss: 1.953481
Total training time: 1.93 seconds.
-- Epoch 155
Norm: 3.33, NNZs: 50, Bias: -0.356377, T: 3711475, Avg. loss: 1.973281
Total training time: 1.94 seconds.
Convergence after 155 epochs took 1.95 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=9.999999999999999e-05, average=False,
               class_weight={0: 5.14, 1: 1}, early_stopping=False, epsilon=0.1,
               eta0=0.0, fit_intercept=True, l1_ratio=0.15,
               learning_rate='optimal', loss='hinge', max_iter=1000, n_iter=None,
               n_iter_no_change=5, n_jobs=None, penalty='l2', power_t=0.5,
               random_state=42, shuffle=True, tol=0.001, validation_fraction=0.1,
               verbose=100, warm_start=False)
-- Epoch 1
Norm: 45.89, NNZs: 50, Bias: -0.311155, T: 23945, Avg. loss: 53.142821
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 22.23, NNZs: 50, Bias: -2.467433, T: 47890, Avg. loss: 12.159360
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 14.74, NNZs: 50, Bias: 2.702874, T: 71835, Avg. loss: 7.351867
Total training time: 0.04 seconds.
-- Epoch 4
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Norm: 11.16, NNZs: 50, Bias: 1.234201, T: 95780, Avg. loss: 5.419817
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 10.47, NNZs: 50, Bias: -2.203815, T: 119725, Avg. loss: 4.609003
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 8.25, NNZs: 50, Bias: -1.130465, T: 143670, Avg. loss: 3.919132
Total training time: 0.09 seconds.
-- Epoch 7
Norm: 4.86, NNZs: 50, Bias: -0.102371, T: 167615, Avg. loss: 3.429508
Total training time: 0.10 seconds.
-- Epoch 8
Norm: 7.20, NNZs: 50, Bias: -0.367142, T: 191560, Avg. loss: 3.033743
Total training time: 0.12 seconds.
-- Epoch 9
Norm: 4.75, NNZs: 50, Bias: -0.008229, T: 215505, Avg. loss: 2.756310
Total training time: 0.13 seconds.
-- Epoch 10
Norm: 4.53, NNZs: 50, Bias: 0.614606, T: 239450, Avg. loss: 2.631570
Total training time: 0.14 seconds.
-- Epoch 11
Norm: 5.33, NNZs: 50, Bias: -0.617368, T: 263395, Avg. loss: 2.408272
Total training time: 0.16 seconds.
-- Epoch 12
Norm: 4.09, NNZs: 50, Bias: -1.234655, T: 287340, Avg. loss: 2.256587
Total training time: 0.17 seconds.
-- Epoch 13
Norm: 4.00, NNZs: 50, Bias: -0.420315, T: 311285, Avg. loss: 2.190852
Total training time: 0.18 seconds.
-- Epoch 14
Norm: 3.40, NNZs: 50, Bias: 0.598402, T: 335230, Avg. loss: 2.099242
Total training time: 0.19 seconds.
-- Epoch 15
Norm: 2.44, NNZs: 50, Bias: -1.205680, T: 359175, Avg. loss: 1.973273
Total training time: 0.21 seconds.
-- Epoch 16
Norm: 2.77, NNZs: 50, Bias: -0.178380, T: 383120, Avg. loss: 1.917536
Total training time: 0.22 seconds.
-- Epoch 17
Norm: 3.56, NNZs: 50, Bias: 0.417289, T: 407065, Avg. loss: 1.862300
Total training time: 0.23 seconds.
-- Epoch 18
Norm: 2.53, NNZs: 50, Bias: 0.052845, T: 431010, Avg. loss: 1.775247
Total training time: 0.24 seconds.
-- Epoch 19
Norm: 3.01, NNZs: 50, Bias: -0.021171, T: 454955, Avg. loss: 1.754958
Total training time: 0.25 seconds.
-- Epoch 20
Norm: 3.44, NNZs: 50, Bias: -0.308169, T: 478900, Avg. loss: 1.728541
Total training time: 0.27 seconds.
-- Epoch 21
Norm: 2.58, NNZs: 50, Bias: -0.416560, T: 502845, Avg. loss: 1.681822
Total training time: 0.28 seconds.
-- Epoch 22
Norm: 2.73, NNZs: 50, Bias: -0.078147, T: 526790, Avg. loss: 1.628128
Total training time: 0.29 seconds.
-- Epoch 23

Norm: 2.62, NNZs: 50, Bias: -0.493237, T: 550735, Avg. loss: 1.613947
Total training time: 0.31 seconds.
-- Epoch 24
Norm: 1.99, NNZs: 50, Bias: 0.274900, T: 574680, Avg. loss: 1.545908
Total training time: 0.32 seconds.
-- Epoch 25
Norm: 2.28, NNZs: 50, Bias: -0.131603, T: 598625, Avg. loss: 1.551536
Total training time: 0.33 seconds.
-- Epoch 26
Norm: 1.78, NNZs: 50, Bias: 0.369612, T: 622570, Avg. loss: 1.500611
Total training time: 0.34 seconds.
-- Epoch 27
Norm: 1.85, NNZs: 50, Bias: 0.419231, T: 646515, Avg. loss: 1.511863
Total training time: 0.35 seconds.
-- Epoch 28
Norm: 1.94, NNZs: 50, Bias: -0.189835, T: 670460, Avg. loss: 1.454956
Total training time: 0.37 seconds.
-- Epoch 29
Norm: 1.93, NNZs: 50, Bias: 0.626479, T: 694405, Avg. loss: 1.455688
Total training time: 0.38 seconds.
-- Epoch 30
Norm: 1.55, NNZs: 50, Bias: 0.331642, T: 718350, Avg. loss: 1.425913
Total training time: 0.39 seconds.
-- Epoch 31
Norm: 1.60, NNZs: 50, Bias: -0.267685, T: 742295, Avg. loss: 1.376641
Total training time: 0.40 seconds.
-- Epoch 32
Norm: 1.51, NNZs: 50, Bias: 0.291564, T: 766240, Avg. loss: 1.382989
Total training time: 0.42 seconds.
-- Epoch 33
Norm: 1.51, NNZs: 50, Bias: 0.386114, T: 790185, Avg. loss: 1.387565
Total training time: 0.43 seconds.
-- Epoch 34
Norm: 1.62, NNZs: 50, Bias: 0.039896, T: 814130, Avg. loss: 1.369303
Total training time: 0.45 seconds.
-- Epoch 35
Norm: 1.76, NNZs: 50, Bias: -0.023318, T: 838075, Avg. loss: 1.345490
Total training time: 0.46 seconds.
-- Epoch 36
Norm: 1.74, NNZs: 50, Bias: 0.026719, T: 862020, Avg. loss: 1.347973
Total training time: 0.47 seconds.
-- Epoch 37
Norm: 1.67, NNZs: 50, Bias: 0.215883, T: 885965, Avg. loss: 1.310600
Total training time: 0.48 seconds.
-- Epoch 38
Norm: 1.62, NNZs: 50, Bias: -0.132257, T: 909910, Avg. loss: 1.315674
Total training time: 0.50 seconds.
-- Epoch 39
Norm: 1.38, NNZs: 50, Bias: -0.119814, T: 933855, Avg. loss: 1.312573
Total training time: 0.51 seconds.
-- Epoch 40
Norm: 1.51, NNZs: 50, Bias: 0.045837, T: 957800, Avg. loss: 1.291082
Total training time: 0.52 seconds.
-- Epoch 41
Norm: 1.28, NNZs: 50, Bias: -0.066093, T: 981745, Avg. loss: 1.301605
Total training time: 0.53 seconds.
-- Epoch 42

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Norm: 1.73, NNZs: 50, Bias: -0.016367, T: 1005690, Avg. loss: 1.318098
Total training time: 0.54 seconds.
-- Epoch 43
Norm: 1.25, NNZs: 50, Bias: -0.083961, T: 1029635, Avg. loss: 1.297809
Total training time: 0.56 seconds.
-- Epoch 44
Norm: 1.45, NNZs: 50, Bias: 0.030527, T: 1053580, Avg. loss: 1.259878
Total training time: 0.57 seconds.
-- Epoch 45
Norm: 1.34, NNZs: 50, Bias: 0.021792, T: 1077525, Avg. loss: 1.264207
Total training time: 0.58 seconds.
-- Epoch 46
Norm: 1.28, NNZs: 50, Bias: -0.288674, T: 1101470, Avg. loss: 1.261398
Total training time: 0.59 seconds.
-- Epoch 47
Norm: 1.51, NNZs: 50, Bias: -0.075505, T: 1125415, Avg. loss: 1.215943
Total training time: 0.61 seconds.
-- Epoch 48
Norm: 1.23, NNZs: 50, Bias: -0.009288, T: 1149360, Avg. loss: 1.232143
Total training time: 0.62 seconds.
-- Epoch 49
Norm: 1.12, NNZs: 50, Bias: -0.028259, T: 1173305, Avg. loss: 1.216707
Total training time: 0.63 seconds.
-- Epoch 50
Norm: 1.11, NNZs: 50, Bias: -0.204561, T: 1197250, Avg. loss: 1.174732
Total training time: 0.64 seconds.
-- Epoch 51
Norm: 1.41, NNZs: 50, Bias: 0.186995, T: 1221195, Avg. loss: 1.216765
Total training time: 0.66 seconds.
-- Epoch 52
Norm: 1.36, NNZs: 50, Bias: -0.048822, T: 1245140, Avg. loss: 1.192544
Total training time: 0.67 seconds.
-- Epoch 53
Norm: 1.16, NNZs: 50, Bias: -0.015559, T: 1269085, Avg. loss: 1.210253
Total training time: 0.68 seconds.
-- Epoch 54
Norm: 1.29, NNZs: 50, Bias: -0.136478, T: 1293030, Avg. loss: 1.200190
Total training time: 0.70 seconds.
-- Epoch 55
Norm: 1.11, NNZs: 50, Bias: 0.072660, T: 1316975, Avg. loss: 1.199744
Total training time: 0.71 seconds.
Convergence after 55 epochs took 0.71 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=0.001, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 5.98, NNZs: 50, Bias: -0.120589, T: 23945, Avg. loss: 8.666726
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 2.44, NNZs: 50, Bias: -0.059091, T: 47890, Avg. loss: 1.990842
```

Total training time: 0.03 seconds.
-- Epoch 3
Norm: 2.19, NNZs: 50, Bias: 0.349901, T: 71835, Avg. loss: 1.496981
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 1.48, NNZs: 50, Bias: 0.256751, T: 95780, Avg. loss: 1.327199
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 1.49, NNZs: 50, Bias: -0.289260, T: 119725, Avg. loss: 1.257576
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 1.19, NNZs: 50, Bias: -0.129749, T: 143670, Avg. loss: 1.183267
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 0.94, NNZs: 50, Bias: -0.425573, T: 167615, Avg. loss: 1.154441
Total training time: 0.09 seconds.
-- Epoch 8
Norm: 0.87, NNZs: 50, Bias: -0.125449, T: 191560, Avg. loss: 1.128563
Total training time: 0.11 seconds.
-- Epoch 9
Norm: 0.85, NNZs: 50, Bias: 0.027636, T: 215505, Avg. loss: 1.090428
Total training time: 0.12 seconds.
-- Epoch 10
Norm: 1.11, NNZs: 50, Bias: -0.056592, T: 239450, Avg. loss: 1.087882
Total training time: 0.14 seconds.
-- Epoch 11
Norm: 0.98, NNZs: 50, Bias: 0.163772, T: 263395, Avg. loss: 1.092726
Total training time: 0.15 seconds.
-- Epoch 12
Norm: 0.81, NNZs: 50, Bias: -0.024281, T: 287340, Avg. loss: 1.051602
Total training time: 0.17 seconds.
-- Epoch 13
Norm: 0.89, NNZs: 50, Bias: -0.021731, T: 311285, Avg. loss: 1.061025
Total training time: 0.18 seconds.
-- Epoch 14
Norm: 0.68, NNZs: 50, Bias: 0.170201, T: 335230, Avg. loss: 1.067834
Total training time: 0.19 seconds.
-- Epoch 15
Norm: 0.60, NNZs: 50, Bias: -0.203138, T: 359175, Avg. loss: 1.045478
Total training time: 0.21 seconds.
-- Epoch 16
Norm: 0.68, NNZs: 50, Bias: -0.200457, T: 383120, Avg. loss: 1.061050
Total training time: 0.22 seconds.
-- Epoch 17
Norm: 0.71, NNZs: 50, Bias: -0.122388, T: 407065, Avg. loss: 1.055567
Total training time: 0.24 seconds.
-- Epoch 18
Norm: 0.59, NNZs: 50, Bias: -0.168431, T: 431010, Avg. loss: 1.068050
Total training time: 0.25 seconds.
-- Epoch 19
Norm: 0.73, NNZs: 50, Bias: -0.044116, T: 454955, Avg. loss: 1.030382
Total training time: 0.26 seconds.
-- Epoch 20
Norm: 0.79, NNZs: 50, Bias: -0.020813, T: 478900, Avg. loss: 1.058301
Total training time: 0.27 seconds.
-- Epoch 21
Norm: 0.63, NNZs: 50, Bias: -0.250339, T: 502845, Avg. loss: 1.060604

```
Total training time: 0.29 seconds.
-- Epoch 22
Norm: 0.63, NNZs: 50, Bias: -0.139288, T: 526790, Avg. loss: 1.030732
Total training time: 0.30 seconds.
-- Epoch 23
Norm: 0.66, NNZs: 50, Bias: -0.333957, T: 550735, Avg. loss: 1.034625
Total training time: 0.31 seconds.
-- Epoch 24
Norm: 0.64, NNZs: 50, Bias: -0.198304, T: 574680, Avg. loss: 1.053407
Total training time: 0.32 seconds.
Convergence after 24 epochs took 0.32 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=0.01, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.80, NNZs: 50, Bias: -0.062657, T: 23945, Avg. loss: 1.884310
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.59, NNZs: 50, Bias: -0.076822, T: 47890, Avg. loss: 1.053474
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.55, NNZs: 50, Bias: 0.030253, T: 71835, Avg. loss: 1.116382
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.55, NNZs: 50, Bias: -0.023048, T: 95780, Avg. loss: 1.086617
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 0.60, NNZs: 50, Bias: -0.209934, T: 119725, Avg. loss: 1.030034
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.54, NNZs: 50, Bias: -0.300029, T: 143670, Avg. loss: 1.092182
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 0.55, NNZs: 50, Bias: -0.301686, T: 167615, Avg. loss: 1.132164
Total training time: 0.10 seconds.
-- Epoch 8
Norm: 0.54, NNZs: 50, Bias: -0.240941, T: 191560, Avg. loss: 1.130733
Total training time: 0.11 seconds.
-- Epoch 9
Norm: 0.55, NNZs: 50, Bias: -0.243086, T: 215505, Avg. loss: 1.123112
Total training time: 0.13 seconds.
-- Epoch 10
Norm: 0.62, NNZs: 50, Bias: -0.291256, T: 239450, Avg. loss: 1.129878
Total training time: 0.14 seconds.
Convergence after 10 epochs took 0.14 seconds
Fitting probability generation and roc auc score generation for training data complete...
Fitting probability generation and roc auc score generation for validation data complete...
SGDClassifier(alpha=0.1, average=False, class_weight={0: 5.14, 1: 1},
```

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        early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
        l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
        n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
        power_t=0.5, random_state=42, shuffle=True, tol=0.001,
        validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.43, NNZs: 50, Bias: -0.037850, T: 23945, Avg. loss: 1.060958
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.44, NNZs: 50, Bias: -0.103204, T: 47890, Avg. loss: 1.018227
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.47, NNZs: 50, Bias: -0.132418, T: 71835, Avg. loss: 1.051337
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.46, NNZs: 50, Bias: -0.149414, T: 95780, Avg. loss: 1.063964
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 0.48, NNZs: 50, Bias: -0.152822, T: 119725, Avg. loss: 1.055553
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.48, NNZs: 50, Bias: -0.170185, T: 143670, Avg. loss: 1.058512
Total training time: 0.08 seconds.
-- Epoch 7
Norm: 0.49, NNZs: 50, Bias: -0.172061, T: 167615, Avg. loss: 1.064129
Total training time: 0.10 seconds.
Convergence after 7 epochs took 0.10 seconds
Fitting probability generation and roc auc score generation for training da
ta complete...
Fitting probability generation and roc auc score generation for validation
data complete...
SGDClassifier(alpha=1.0, average=False, class_weight={0: 5.14, 1: 1},
        early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
        l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
        n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
        power_t=0.5, random_state=42, shuffle=True, tol=0.001,
        validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.27, NNZs: 50, Bias: 0.066068, T: 23945, Avg. loss: 0.937526
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.28, NNZs: 50, Bias: 0.071130, T: 47890, Avg. loss: 0.915172
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.28, NNZs: 50, Bias: 0.074085, T: 71835, Avg. loss: 0.914007
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.28, NNZs: 50, Bias: 0.075975, T: 95780, Avg. loss: 0.912198
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 0.28, NNZs: 50, Bias: 0.077793, T: 119725, Avg. loss: 0.910212
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.28, NNZs: 50, Bias: 0.078849, T: 143670, Avg. loss: 0.908171
Total training time: 0.09 seconds.
-- Epoch 7
Norm: 0.28, NNZs: 50, Bias: 0.080408, T: 167615, Avg. loss: 0.907769

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```
Total training time: 0.10 seconds.
-- Epoch 8
Norm: 0.28, NNZs: 50, Bias: 0.081144, T: 191560, Avg. loss: 0.907154
Total training time: 0.11 seconds.
-- Epoch 9
Norm: 0.28, NNZs: 50, Bias: 0.082183, T: 215505, Avg. loss: 0.906122
Total training time: 0.13 seconds.
-- Epoch 10
Norm: 0.28, NNZs: 50, Bias: 0.083142, T: 239450, Avg. loss: 0.905842
Total training time: 0.14 seconds.
-- Epoch 11
Norm: 0.28, NNZs: 50, Bias: 0.083535, T: 263395, Avg. loss: 0.905619
Total training time: 0.15 seconds.
-- Epoch 12
Norm: 0.28, NNZs: 50, Bias: 0.083870, T: 287340, Avg. loss: 0.905119
Total training time: 0.17 seconds.
-- Epoch 13
Norm: 0.28, NNZs: 50, Bias: 0.084682, T: 311285, Avg. loss: 0.904506
Total training time: 0.18 seconds.
-- Epoch 14
Norm: 0.28, NNZs: 50, Bias: 0.085197, T: 335230, Avg. loss: 0.903937
Total training time: 0.20 seconds.
Convergence after 14 epochs took 0.20 seconds
Fitting probability generation and roc auc score generation for training da
ta complete...
Fitting probability generation and roc auc score generation for validation
data complete...
SGDClassifier(alpha=10.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.05, NNZs: 50, Bias: 0.131001, T: 23945, Avg. loss: 0.904318
Total training time: 0.02 seconds.
-- Epoch 2
Norm: 0.05, NNZs: 50, Bias: 0.131069, T: 47890, Avg. loss: 0.904109
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.05, NNZs: 50, Bias: 0.130970, T: 71835, Avg. loss: 0.904239
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.05, NNZs: 50, Bias: 0.130902, T: 95780, Avg. loss: 0.904196
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 0.05, NNZs: 50, Bias: 0.130876, T: 119725, Avg. loss: 0.904125
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.05, NNZs: 50, Bias: 0.130882, T: 143670, Avg. loss: 0.904070
Total training time: 0.08 seconds.
Convergence after 6 epochs took 0.09 seconds
Fitting probability generation and roc auc score generation for training da
ta complete...
Fitting probability generation and roc auc score generation for validation
data complete...
SGDClassifier(alpha=100.0, average=False, class_weight={0: 5.14, 1: 1},
```

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        early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
        l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
        n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
        power_t=0.5, random_state=42, shuffle=True, tol=0.001,
        validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 50, Bias: 0.279067, T: 23945, Avg. loss: 0.811175
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 50, Bias: 0.279074, T: 47890, Avg. loss: 0.811126
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 50, Bias: 0.279064, T: 71835, Avg. loss: 0.811139
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 50, Bias: 0.279057, T: 95780, Avg. loss: 0.811135
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 50, Bias: 0.279055, T: 119725, Avg. loss: 0.811128
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 50, Bias: 0.279055, T: 143670, Avg. loss: 0.811122
Total training time: 0.08 seconds.
Convergence after 6 epochs took 0.08 seconds
Fitting probability generation and roc auc score generation for training da
ta complete...
Fitting probability generation and roc auc score generation for validation
data complete...
SGDClassifier(alpha=1000.0, average=False, class_weight={0: 5.14, 1: 1},
        early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
        l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
        n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
        power_t=0.5, random_state=42, shuffle=True, tol=0.001,
        validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 50, Bias: 0.174100, T: 23945, Avg. loss: 0.882600
Total training time: 0.02 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 50, Bias: 0.174101, T: 47890, Avg. loss: 0.882566
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 50, Bias: 0.174100, T: 71835, Avg. loss: 0.882567
Total training time: 0.05 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 50, Bias: 0.174099, T: 95780, Avg. loss: 0.882567
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 50, Bias: 0.174099, T: 119725, Avg. loss: 0.882566
Total training time: 0.08 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 50, Bias: 0.174099, T: 143670, Avg. loss: 0.882565
Total training time: 0.09 seconds.
Convergence after 6 epochs took 0.09 seconds
Fitting probability generation and roc auc score generation for training da
ta complete...
Fitting probability generation and roc auc score generation for validation
data complete...

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SGDClassifier(alpha=10000.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 50, Bias: 0.099627, T: 23945, Avg. loss: 0.932855
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 50, Bias: 0.099627, T: 47890, Avg. loss: 0.932835
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 50, Bias: 0.099627, T: 71835, Avg. loss: 0.932835
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 50, Bias: 0.099627, T: 95780, Avg. loss: 0.932835
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 50, Bias: 0.099627, T: 119725, Avg. loss: 0.932835
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 50, Bias: 0.099627, T: 143670, Avg. loss: 0.932835
Total training time: 0.09 seconds.
Convergence after 6 epochs took 0.09 seconds
Fitting probability generation and roc auc score generation for training da
ta complete...
Fitting probability generation and roc auc score generation for validation
data complete...
SGDClassifier(alpha=100000.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 50, Bias: 0.056197, T: 23945, Avg. loss: 0.962129
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 50, Bias: 0.056197, T: 47890, Avg. loss: 0.962118
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 50, Bias: 0.056197, T: 71835, Avg. loss: 0.962118
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 50, Bias: 0.056197, T: 95780, Avg. loss: 0.962118
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 50, Bias: 0.056197, T: 119725, Avg. loss: 0.962118
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 50, Bias: 0.056197, T: 143670, Avg. loss: 0.962118
Total training time: 0.08 seconds.
Convergence after 6 epochs took 0.09 seconds
Fitting probability generation and roc auc score generation for training da
ta complete...
Fitting probability generation and roc auc score generation for validation

```

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data complete...
SGDClassifier(alpha=1000000.0, average=False, class_weight={0: 5.14, 1: 1},
              early_stopping=False, epsilon=0.1, eta0=0.0, fit_intercept=True,
              l1_ratio=0.15, learning_rate='optimal', loss='hinge', max_iter=1000,
              n_iter=None, n_iter_no_change=5, n_jobs=None, penalty='l2',
              power_t=0.5, random_state=42, shuffle=True, tol=0.001,
              validation_fraction=0.1, verbose=100, warm_start=False)
-- Epoch 1
Norm: 0.00, NNZs: 50, Bias: 0.031619, T: 23945, Avg. loss: 0.978692
Total training time: 0.02 seconds.
-- Epoch 2
Norm: 0.00, NNZs: 50, Bias: 0.031619, T: 47890, Avg. loss: 0.978686
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 0.00, NNZs: 50, Bias: 0.031619, T: 71835, Avg. loss: 0.978686
Total training time: 0.04 seconds.
-- Epoch 4
Norm: 0.00, NNZs: 50, Bias: 0.031619, T: 95780, Avg. loss: 0.978686
Total training time: 0.06 seconds.
-- Epoch 5
Norm: 0.00, NNZs: 50, Bias: 0.031619, T: 119725, Avg. loss: 0.978686
Total training time: 0.07 seconds.
-- Epoch 6
Norm: 0.00, NNZs: 50, Bias: 0.031619, T: 143670, Avg. loss: 0.978686
Total training time: 0.08 seconds.
Convergence after 6 epochs took 0.09 seconds
Fitting probability generation and roc auc score generation for training da
ta complete...
Fitting probability generation and roc auc score generation for validation
data complete...
Function exiting...

```

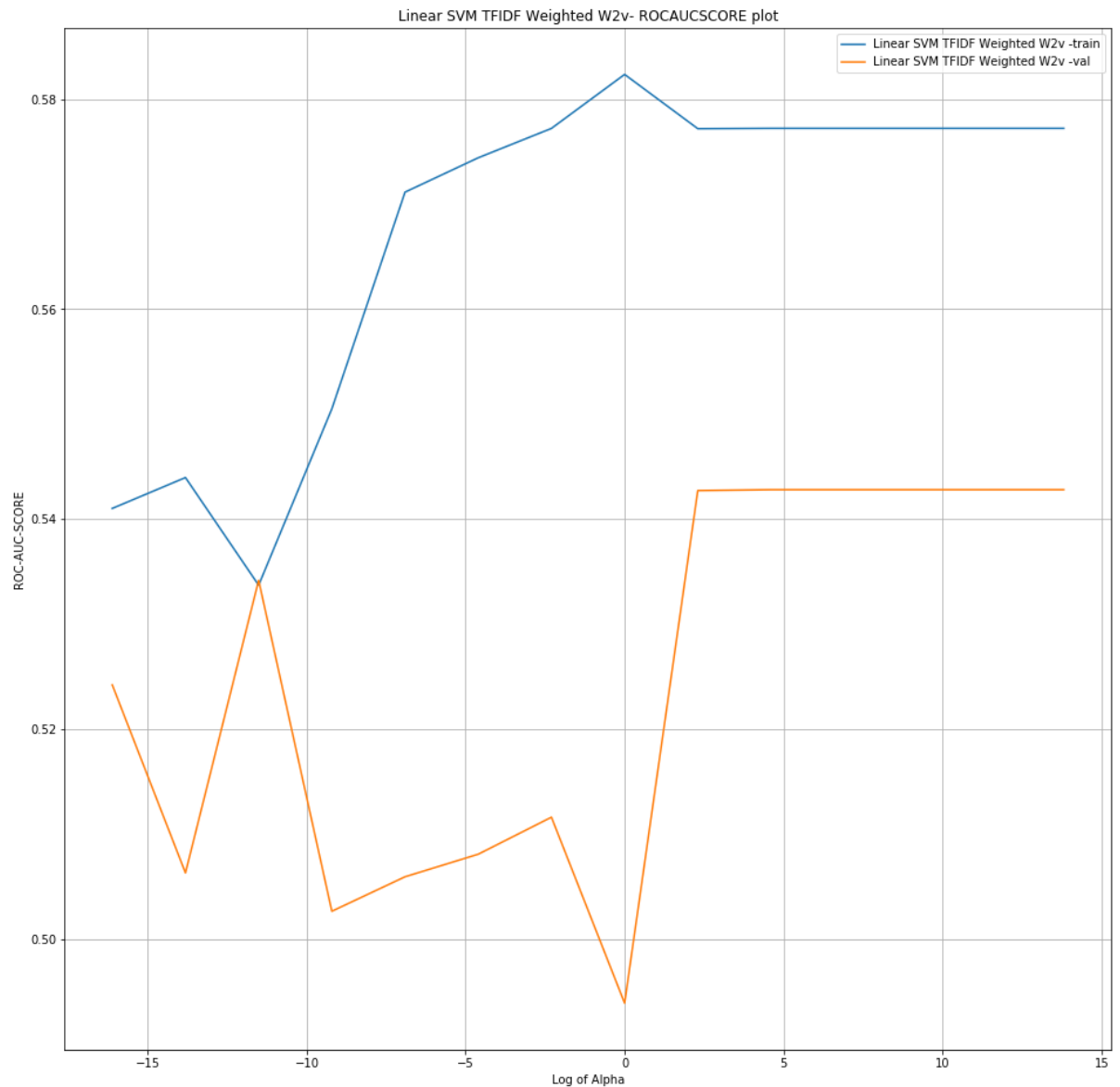
```

In [32]: print(lnrsvmtidfwtw2v.rocaucscoretrn)
          print(lnrsvmtidfwtw2v.rocaucscoreval)
          print(lnrsvmtidfwtw2v.SVM_alpha)

[0.541025480506506, 0.5439656864854864, 0.5337152492719842, 0.5505088713290
005, 0.5711432363013065, 0.5744150652724014, 0.5772105861684921, 0.58235131
47399416, 0.5771850516264455, 0.5772205020610096, 0.5772204956677844, 0.577
2204956677842, 0.5772204956677842, 0.5772205851729393]
[0.5242227960125949, 0.506316758566203, 0.5341812482240147, 0.5026697266994
844, 0.5059515010257598, 0.5080991085991358, 0.51162397731995, 0.4939213055
8115166, 0.5427269195833888, 0.5428110992301464, 0.5428110992301464, 0.5428
110992301464, 0.5428110992301464, 0.5428114072044637]
[1e-07, 1e-06, 9.999999999999999e-06, 9.999999999999999e-05, 0.001, 0.01,
0.1, 1.0, 10.0, 100.0, 1000.0, 10000.0, 100000.0, 1000000.0]

```

```
In [33]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='Linear SVM TFIDF Weighted W2v- ROCAUCSCORE plot'
displaygraph.legnd_1 = 'Linear SVM TFIDF Weighted W2v -train'
displaygraph.legnd_2 = 'Linear SVM TFIDF Weighted W2v -val'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='Log of Alpha'
displaygraph.label_y='ROC-AUC-SCORE'
displaygraph.Xdata = lnrsvmtidfwtw2v.SVM_alpha
displaygraph.ydatatrn = lnrsvmtidfwtw2v.rocaucscoretrn
displaygraph.ydataval = lnrsvmtidfwtw2v.rocaucscoreval
displaygraph.rocacscoregraph()
```



```
In [78]: lnrsvmtidfwtw2v.setniterparm(1000)
         print((lnrsvmtidfwtw2v.getSGDClassifier))
         lnrsvmtidfwtw2v.SVM_actualClassifier(0.0001)
```

```
<bound method assign7SVM.getSGDClassifier of <__main__.assign7SVM object at
0x0000000011AB4CF8>>
-- Epoch 1
Norm: 217.72, NNZs: 50, Bias: -188.334189, T: 23945, Avg. loss: 494.034636
Total training time: 0.01 seconds.
-- Epoch 2
Norm: 148.48, NNZs: 50, Bias: -97.784214, T: 47890, Avg. loss: 107.246683
Total training time: 0.02 seconds.
-- Epoch 3
Norm: 81.71, NNZs: 50, Bias: -40.689726, T: 71835, Avg. loss: 60.420862
Total training time: 0.03 seconds.
-- Epoch 4
Norm: 42.11, NNZs: 50, Bias: -19.331255, T: 95780, Avg. loss: 43.061958
Total training time: 0.05 seconds.
-- Epoch 5
Norm: 33.36, NNZs: 50, Bias: -25.170514, T: 119725, Avg. loss: 32.662299
Total training time: 0.06 seconds.
-- Epoch 6
Norm: 39.10, NNZs: 50, Bias: -30.387368, T: 143670, Avg. loss: 28.261639
Total training time: 0.07 seconds.
-- Epoch 7
Norm: 27.70, NNZs: 50, Bias: -27.124701, T: 167615, Avg. loss: 24.444282
Total training time: 0.08 seconds.
-- Epoch 8
Norm: 21.17, NNZs: 50, Bias: -16.004990, T: 191560, Avg. loss: 21.111591
Total training time: 0.10 seconds.
-- Epoch 9
Norm: 22.53, NNZs: 50, Bias: -16.057344, T: 215505, Avg. loss: 19.282263
Total training time: 0.11 seconds.
-- Epoch 10
Norm: 25.24, NNZs: 50, Bias: -17.512840, T: 239450, Avg. loss: 17.143331
Total training time: 0.13 seconds.
-- Epoch 11
Norm: 23.65, NNZs: 50, Bias: -16.122205, T: 263395, Avg. loss: 16.198633
Total training time: 0.15 seconds.
-- Epoch 12
Norm: 17.85, NNZs: 50, Bias: -15.976371, T: 287340, Avg. loss: 14.618543
Total training time: 0.16 seconds.
-- Epoch 13
Norm: 17.90, NNZs: 50, Bias: -12.562282, T: 311285, Avg. loss: 13.796597
Total training time: 0.17 seconds.
-- Epoch 14
Norm: 13.53, NNZs: 50, Bias: -8.293875, T: 335230, Avg. loss: 12.599185
Total training time: 0.19 seconds.
-- Epoch 15
Norm: 14.33, NNZs: 50, Bias: -11.225540, T: 359175, Avg. loss: 11.465660
Total training time: 0.21 seconds.
-- Epoch 16
Norm: 15.28, NNZs: 50, Bias: -13.651711, T: 383120, Avg. loss: 11.119385
Total training time: 0.22 seconds.
-- Epoch 17
Norm: 17.23, NNZs: 50, Bias: -10.484112, T: 407065, Avg. loss: 10.162523
Total training time: 0.24 seconds.
-- Epoch 18
Norm: 12.28, NNZs: 50, Bias: -10.066674, T: 431010, Avg. loss: 10.228321
Total training time: 0.25 seconds.
-- Epoch 19
```

Norm: 12.14, NNZs: 50, Bias: -11.852680, T: 454955, Avg. loss: 9.716160
Total training time: 0.27 seconds.
-- Epoch 20
Norm: 13.49, NNZs: 50, Bias: -12.536110, T: 478900, Avg. loss: 9.321288
Total training time: 0.28 seconds.
-- Epoch 21
Norm: 11.24, NNZs: 50, Bias: -10.236776, T: 502845, Avg. loss: 9.091687
Total training time: 0.30 seconds.
-- Epoch 22
Norm: 11.63, NNZs: 50, Bias: -8.795101, T: 526790, Avg. loss: 8.504983
Total training time: 0.31 seconds.
-- Epoch 23
Norm: 10.47, NNZs: 50, Bias: -7.440995, T: 550735, Avg. loss: 8.479092
Total training time: 0.32 seconds.
-- Epoch 24
Norm: 8.24, NNZs: 50, Bias: -7.711412, T: 574680, Avg. loss: 7.826802
Total training time: 0.34 seconds.
-- Epoch 25
Norm: 7.64, NNZs: 50, Bias: -4.778259, T: 598625, Avg. loss: 7.515407
Total training time: 0.35 seconds.
-- Epoch 26
Norm: 9.64, NNZs: 50, Bias: -7.292593, T: 622570, Avg. loss: 7.375050
Total training time: 0.36 seconds.
-- Epoch 27
Norm: 8.46, NNZs: 50, Bias: -5.066998, T: 646515, Avg. loss: 7.094567
Total training time: 0.38 seconds.
-- Epoch 28
Norm: 7.49, NNZs: 50, Bias: -7.151213, T: 670460, Avg. loss: 7.149480
Total training time: 0.39 seconds.
-- Epoch 29
Norm: 7.38, NNZs: 50, Bias: -6.546823, T: 694405, Avg. loss: 6.618454
Total training time: 0.41 seconds.
-- Epoch 30
Norm: 6.52, NNZs: 50, Bias: -4.516107, T: 718350, Avg. loss: 6.558835
Total training time: 0.42 seconds.
-- Epoch 31
Norm: 5.23, NNZs: 50, Bias: -6.653358, T: 742295, Avg. loss: 6.597477
Total training time: 0.44 seconds.
-- Epoch 32
Norm: 7.16, NNZs: 50, Bias: -5.652687, T: 766240, Avg. loss: 6.211926
Total training time: 0.46 seconds.
-- Epoch 33
Norm: 7.53, NNZs: 50, Bias: -5.096436, T: 790185, Avg. loss: 6.106483
Total training time: 0.47 seconds.
-- Epoch 34
Norm: 7.45, NNZs: 50, Bias: -6.905706, T: 814130, Avg. loss: 5.998007
Total training time: 0.48 seconds.
-- Epoch 35
Norm: 6.69, NNZs: 50, Bias: -4.756338, T: 838075, Avg. loss: 6.002382
Total training time: 0.50 seconds.
-- Epoch 36
Norm: 4.57, NNZs: 50, Bias: -5.662018, T: 862020, Avg. loss: 5.930326
Total training time: 0.51 seconds.
-- Epoch 37
Norm: 6.44, NNZs: 50, Bias: -4.926014, T: 885965, Avg. loss: 5.543947
Total training time: 0.53 seconds.
-- Epoch 38

Norm: 6.58, NNZs: 50, Bias: -4.257978, T: 909910, Avg. loss: 5.517617
Total training time: 0.54 seconds.
-- Epoch 39
Norm: 6.21, NNZs: 50, Bias: -5.250426, T: 933855, Avg. loss: 5.338519
Total training time: 0.55 seconds.
-- Epoch 40
Norm: 5.03, NNZs: 50, Bias: -4.916881, T: 957800, Avg. loss: 5.184552
Total training time: 0.57 seconds.
-- Epoch 41
Norm: 5.15, NNZs: 50, Bias: -5.916931, T: 981745, Avg. loss: 5.291324
Total training time: 0.58 seconds.
-- Epoch 42
Norm: 6.41, NNZs: 50, Bias: -5.347969, T: 1005690, Avg. loss: 5.254178
Total training time: 0.59 seconds.
-- Epoch 43
Norm: 6.30, NNZs: 50, Bias: -5.265617, T: 1029635, Avg. loss: 5.025289
Total training time: 0.60 seconds.
-- Epoch 44
Norm: 5.35, NNZs: 50, Bias: -5.129342, T: 1053580, Avg. loss: 4.981462
Total training time: 0.62 seconds.
-- Epoch 45
Norm: 5.44, NNZs: 50, Bias: -5.530415, T: 1077525, Avg. loss: 4.937691
Total training time: 0.63 seconds.
-- Epoch 46
Norm: 5.42, NNZs: 50, Bias: -4.645043, T: 1101470, Avg. loss: 4.945302
Total training time: 0.64 seconds.
-- Epoch 47
Norm: 5.02, NNZs: 50, Bias: -5.318107, T: 1125415, Avg. loss: 4.723142
Total training time: 0.66 seconds.
-- Epoch 48
Norm: 4.93, NNZs: 50, Bias: -4.947265, T: 1149360, Avg. loss: 4.738893
Total training time: 0.67 seconds.
-- Epoch 49
Norm: 3.56, NNZs: 50, Bias: -3.514294, T: 1173305, Avg. loss: 4.521324
Total training time: 0.68 seconds.
-- Epoch 50
Norm: 4.29, NNZs: 50, Bias: -4.758495, T: 1197250, Avg. loss: 4.644902
Total training time: 0.70 seconds.
-- Epoch 51
Norm: 4.14, NNZs: 50, Bias: -3.635714, T: 1221195, Avg. loss: 4.521115
Total training time: 0.71 seconds.
-- Epoch 52
Norm: 3.80, NNZs: 50, Bias: -4.843111, T: 1245140, Avg. loss: 4.516369
Total training time: 0.72 seconds.
-- Epoch 53
Norm: 3.92, NNZs: 50, Bias: -5.359073, T: 1269085, Avg. loss: 4.452814
Total training time: 0.74 seconds.
-- Epoch 54
Norm: 2.95, NNZs: 50, Bias: -2.672821, T: 1293030, Avg. loss: 4.158314
Total training time: 0.75 seconds.
-- Epoch 55
Norm: 4.44, NNZs: 50, Bias: -3.432984, T: 1316975, Avg. loss: 4.266215
Total training time: 0.76 seconds.
-- Epoch 56
Norm: 4.88, NNZs: 50, Bias: -2.816099, T: 1340920, Avg. loss: 4.248673
Total training time: 0.78 seconds.
-- Epoch 57

Norm: 3.95, NNZs: 50, Bias: -3.255668, T: 1364865, Avg. loss: 4.223502
Total training time: 0.79 seconds.
-- Epoch 58
Norm: 5.14, NNZs: 50, Bias: -4.422867, T: 1388810, Avg. loss: 4.330762
Total training time: 0.80 seconds.
-- Epoch 59
Norm: 4.18, NNZs: 50, Bias: -2.798068, T: 1412755, Avg. loss: 4.158707
Total training time: 0.81 seconds.
Convergence after 59 epochs took 0.82 seconds
-- Epoch 1
Norm: 169.76, NNZs: 50, Bias: -100.419635, T: 29932, Avg. loss: 418.628452
Total training time: 0.02 seconds.
-- Epoch 2
Norm: 76.06, NNZs: 50, Bias: -69.869387, T: 59864, Avg. loss: 82.250110
Total training time: 0.03 seconds.
-- Epoch 3
Norm: 59.15, NNZs: 50, Bias: -36.588344, T: 89796, Avg. loss: 49.120833
Total training time: 0.05 seconds.
-- Epoch 4
Norm: 31.94, NNZs: 50, Bias: -21.378828, T: 119728, Avg. loss: 35.276763
Total training time: 0.07 seconds.
-- Epoch 5
Norm: 35.25, NNZs: 50, Bias: -29.396894, T: 149660, Avg. loss: 27.635597
Total training time: 0.08 seconds.
-- Epoch 6
Norm: 33.40, NNZs: 50, Bias: -21.837555, T: 179592, Avg. loss: 23.664976
Total training time: 0.10 seconds.
-- Epoch 7
Norm: 21.98, NNZs: 50, Bias: -20.864221, T: 209524, Avg. loss: 19.909451
Total training time: 0.12 seconds.
-- Epoch 8
Norm: 16.45, NNZs: 50, Bias: -17.173422, T: 239456, Avg. loss: 17.731671
Total training time: 0.14 seconds.
-- Epoch 9
Norm: 16.89, NNZs: 50, Bias: -14.968435, T: 269388, Avg. loss: 15.212387
Total training time: 0.15 seconds.
-- Epoch 10
Norm: 19.95, NNZs: 50, Bias: -16.000006, T: 299320, Avg. loss: 13.702150
Total training time: 0.17 seconds.
-- Epoch 11
Norm: 14.47, NNZs: 50, Bias: -9.066679, T: 329252, Avg. loss: 12.797744
Total training time: 0.19 seconds.
-- Epoch 12
Norm: 17.62, NNZs: 50, Bias: -13.240225, T: 359184, Avg. loss: 11.617211
Total training time: 0.20 seconds.
-- Epoch 13
Norm: 15.29, NNZs: 50, Bias: -14.894451, T: 389116, Avg. loss: 11.004219
Total training time: 0.21 seconds.
-- Epoch 14
Norm: 13.39, NNZs: 50, Bias: -14.485279, T: 419048, Avg. loss: 10.248236
Total training time: 0.23 seconds.
-- Epoch 15
Norm: 7.29, NNZs: 50, Bias: -8.843372, T: 448980, Avg. loss: 9.675435
Total training time: 0.24 seconds.
-- Epoch 16
Norm: 7.86, NNZs: 50, Bias: -8.087000, T: 478912, Avg. loss: 9.188769
Total training time: 0.26 seconds.


```
-- Epoch 17
Norm: 8.66, NNZs: 50, Bias: -8.989617, T: 508844, Avg. loss: 8.724260
Total training time: 0.27 seconds.
-- Epoch 18
Norm: 9.13, NNZs: 50, Bias: -5.602643, T: 538776, Avg. loss: 8.152008
Total training time: 0.28 seconds.
-- Epoch 19
Norm: 8.35, NNZs: 50, Bias: -7.638485, T: 568708, Avg. loss: 7.940895
Total training time: 0.30 seconds.
-- Epoch 20
Norm: 10.11, NNZs: 50, Bias: -9.072125, T: 598640, Avg. loss: 7.492566
Total training time: 0.32 seconds.
-- Epoch 21
Norm: 7.42, NNZs: 50, Bias: -6.365672, T: 628572, Avg. loss: 7.369366
Total training time: 0.33 seconds.
-- Epoch 22
Norm: 5.59, NNZs: 50, Bias: -5.121551, T: 658504, Avg. loss: 7.043909
Total training time: 0.35 seconds.
-- Epoch 23
Norm: 8.94, NNZs: 50, Bias: -7.104640, T: 688436, Avg. loss: 6.953450
Total training time: 0.36 seconds.
-- Epoch 24
Norm: 7.90, NNZs: 50, Bias: -6.602444, T: 718368, Avg. loss: 6.461484
Total training time: 0.38 seconds.
-- Epoch 25
Norm: 7.01, NNZs: 50, Bias: -6.127840, T: 748300, Avg. loss: 6.404813
Total training time: 0.40 seconds.
-- Epoch 26
Norm: 6.33, NNZs: 50, Bias: -4.495385, T: 778232, Avg. loss: 6.466030
Total training time: 0.41 seconds.
-- Epoch 27
Norm: 5.66, NNZs: 50, Bias: -5.588170, T: 808164, Avg. loss: 6.046936
Total training time: 0.43 seconds.
-- Epoch 28
Norm: 6.04, NNZs: 50, Bias: -6.172698, T: 838096, Avg. loss: 5.706222
Total training time: 0.44 seconds.
-- Epoch 29
Norm: 5.20, NNZs: 50, Bias: -6.221881, T: 868028, Avg. loss: 5.667221
Total training time: 0.46 seconds.
-- Epoch 30
Norm: 5.35, NNZs: 50, Bias: -4.353344, T: 897960, Avg. loss: 5.425408
Total training time: 0.47 seconds.
-- Epoch 31
Norm: 6.45, NNZs: 50, Bias: -4.774689, T: 927892, Avg. loss: 5.446871
Total training time: 0.48 seconds.
-- Epoch 32
Norm: 5.19, NNZs: 50, Bias: -4.436682, T: 957824, Avg. loss: 5.355402
Total training time: 0.50 seconds.
-- Epoch 33
Norm: 4.41, NNZs: 50, Bias: -3.159695, T: 987756, Avg. loss: 5.263997
Total training time: 0.51 seconds.
-- Epoch 34
Norm: 6.50, NNZs: 50, Bias: -5.426857, T: 1017688, Avg. loss: 5.056962
Total training time: 0.53 seconds.
-- Epoch 35
Norm: 4.09, NNZs: 50, Bias: -4.671052, T: 1047620, Avg. loss: 5.039312
Total training time: 0.54 seconds.
```

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-- Epoch 36
Norm: 5.14, NNZs: 50, Bias: -4.940399, T: 1077552, Avg. loss: 5.000588
Total training time: 0.56 seconds.
-- Epoch 37
Norm: 4.87, NNZs: 50, Bias: -5.067667, T: 1107484, Avg. loss: 4.708493
Total training time: 0.57 seconds.
-- Epoch 38
Norm: 5.18, NNZs: 50, Bias: -3.899050, T: 1137416, Avg. loss: 4.644024
Total training time: 0.58 seconds.
-- Epoch 39
Norm: 4.81, NNZs: 50, Bias: -3.316750, T: 1167348, Avg. loss: 4.583788
Total training time: 0.60 seconds.
-- Epoch 40
Norm: 4.32, NNZs: 50, Bias: -3.341173, T: 1197280, Avg. loss: 4.536315
Total training time: 0.61 seconds.
-- Epoch 41
Norm: 3.62, NNZs: 50, Bias: -3.691837, T: 1227212, Avg. loss: 4.505459
Total training time: 0.62 seconds.
-- Epoch 42
Norm: 4.05, NNZs: 50, Bias: -3.097423, T: 1257144, Avg. loss: 4.389017
Total training time: 0.64 seconds.
-- Epoch 43
Norm: 4.04, NNZs: 50, Bias: -4.681803, T: 1287076, Avg. loss: 4.401030
Total training time: 0.65 seconds.
-- Epoch 44
Norm: 5.14, NNZs: 50, Bias: -4.374373, T: 1317008, Avg. loss: 4.281295
Total training time: 0.67 seconds.
-- Epoch 45
Norm: 3.15, NNZs: 50, Bias: -4.097771, T: 1346940, Avg. loss: 4.223615
Total training time: 0.68 seconds.
-- Epoch 46
Norm: 2.82, NNZs: 50, Bias: -3.543239, T: 1376872, Avg. loss: 4.197640
Total training time: 0.69 seconds.
-- Epoch 47
Norm: 3.18, NNZs: 50, Bias: -3.420466, T: 1406804, Avg. loss: 3.989221
Total training time: 0.71 seconds.
-- Epoch 48
Norm: 3.50, NNZs: 50, Bias: -4.437730, T: 1436736, Avg. loss: 4.043184
Total training time: 0.72 seconds.
-- Epoch 49
Norm: 3.99, NNZs: 50, Bias: -3.212165, T: 1466668, Avg. loss: 4.045322
Total training time: 0.74 seconds.
-- Epoch 50
Norm: 3.35, NNZs: 50, Bias: -3.069737, T: 1496600, Avg. loss: 3.908088
Total training time: 0.75 seconds.
-- Epoch 51
Norm: 3.67, NNZs: 50, Bias: -2.985062, T: 1526532, Avg. loss: 3.848833
Total training time: 0.77 seconds.
-- Epoch 52
Norm: 3.51, NNZs: 50, Bias: -3.904667, T: 1556464, Avg. loss: 3.836703
Total training time: 0.78 seconds.
-- Epoch 53
Norm: 3.17, NNZs: 50, Bias: -3.612001, T: 1586396, Avg. loss: 3.781731
Total training time: 0.80 seconds.
-- Epoch 54
Norm: 3.14, NNZs: 50, Bias: -3.484791, T: 1616328, Avg. loss: 3.805119
Total training time: 0.81 seconds.
```

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-- Epoch 55
Norm: 3.97, NNZs: 50, Bias: -3.281138, T: 1646260, Avg. loss: 3.735756
Total training time: 0.83 seconds.
-- Epoch 56
Norm: 4.08, NNZs: 50, Bias: -3.359906, T: 1676192, Avg. loss: 3.675307
Total training time: 0.84 seconds.
-- Epoch 57
Norm: 3.47, NNZs: 50, Bias: -2.806009, T: 1706124, Avg. loss: 3.571845
Total training time: 0.85 seconds.
-- Epoch 58
Norm: 3.03, NNZs: 50, Bias: -3.045535, T: 1736056, Avg. loss: 3.576947
Total training time: 0.87 seconds.
-- Epoch 59
Norm: 2.21, NNZs: 50, Bias: -2.498449, T: 1765988, Avg. loss: 3.574728
Total training time: 0.88 seconds.
-- Epoch 60
Norm: 2.09, NNZs: 50, Bias: -2.782360, T: 1795920, Avg. loss: 3.628308
Total training time: 0.89 seconds.
-- Epoch 61
Norm: 2.98, NNZs: 50, Bias: -3.095471, T: 1825852, Avg. loss: 3.520537
Total training time: 0.91 seconds.
-- Epoch 62
Norm: 3.09, NNZs: 50, Bias: -3.022723, T: 1855784, Avg. loss: 3.525932
Total training time: 0.92 seconds.
-- Epoch 63
Norm: 3.03, NNZs: 50, Bias: -3.017546, T: 1885716, Avg. loss: 3.489485
Total training time: 0.94 seconds.
-- Epoch 64
Norm: 2.76, NNZs: 50, Bias: -2.583187, T: 1915648, Avg. loss: 3.434755
Total training time: 0.95 seconds.
-- Epoch 65
Norm: 2.14, NNZs: 50, Bias: -1.993955, T: 1945580, Avg. loss: 3.425289
Total training time: 0.97 seconds.
-- Epoch 66
Norm: 3.46, NNZs: 50, Bias: -2.953545, T: 1975512, Avg. loss: 3.395498
Total training time: 0.98 seconds.
-- Epoch 67
Norm: 2.02, NNZs: 50, Bias: -2.341202, T: 2005444, Avg. loss: 3.389771
Total training time: 0.99 seconds.
-- Epoch 68
Norm: 2.10, NNZs: 50, Bias: -2.351552, T: 2035376, Avg. loss: 3.309426
Total training time: 1.01 seconds.
-- Epoch 69
Norm: 2.33, NNZs: 50, Bias: -2.590494, T: 2065308, Avg. loss: 3.269430
Total training time: 1.02 seconds.
-- Epoch 70
Norm: 2.79, NNZs: 50, Bias: -2.374221, T: 2095240, Avg. loss: 3.315734
Total training time: 1.04 seconds.
-- Epoch 71
Norm: 2.24, NNZs: 50, Bias: -2.810787, T: 2125172, Avg. loss: 3.239299
Total training time: 1.05 seconds.
-- Epoch 72
Norm: 2.60, NNZs: 50, Bias: -1.790273, T: 2155104, Avg. loss: 3.182679
Total training time: 1.07 seconds.
-- Epoch 73
Norm: 2.41, NNZs: 50, Bias: -2.645288, T: 2185036, Avg. loss: 3.201716
Total training time: 1.08 seconds.
```

```
-- Epoch 74
Norm: 2.50, NNZs: 50, Bias: -3.431851, T: 2214968, Avg. loss: 3.159623
Total training time: 1.10 seconds.
-- Epoch 75
Norm: 2.12, NNZs: 50, Bias: -2.793405, T: 2244900, Avg. loss: 3.166945
Total training time: 1.11 seconds.
-- Epoch 76
Norm: 2.31, NNZs: 50, Bias: -2.493532, T: 2274832, Avg. loss: 3.118524
Total training time: 1.13 seconds.
-- Epoch 77
Norm: 2.09, NNZs: 50, Bias: -2.629933, T: 2304764, Avg. loss: 3.076068
Total training time: 1.14 seconds.
-- Epoch 78
Norm: 1.67, NNZs: 50, Bias: -2.662308, T: 2334696, Avg. loss: 3.151618
Total training time: 1.16 seconds.
-- Epoch 79
Norm: 2.47, NNZs: 50, Bias: -3.047003, T: 2364628, Avg. loss: 3.069351
Total training time: 1.17 seconds.
-- Epoch 80
Norm: 1.44, NNZs: 50, Bias: -2.477238, T: 2394560, Avg. loss: 3.055731
Total training time: 1.19 seconds.
-- Epoch 81
Norm: 2.41, NNZs: 50, Bias: -2.812333, T: 2424492, Avg. loss: 3.025242
Total training time: 1.20 seconds.
-- Epoch 82
Norm: 2.23, NNZs: 50, Bias: -2.556526, T: 2454424, Avg. loss: 3.052033
Total training time: 1.22 seconds.
-- Epoch 83
Norm: 1.99, NNZs: 50, Bias: -2.511781, T: 2484356, Avg. loss: 3.018614
Total training time: 1.23 seconds.
-- Epoch 84
Norm: 1.90, NNZs: 50, Bias: -2.538349, T: 2514288, Avg. loss: 2.978152
Total training time: 1.24 seconds.
-- Epoch 85
Norm: 1.97, NNZs: 50, Bias: -2.643391, T: 2544220, Avg. loss: 2.996936
Total training time: 1.26 seconds.
-- Epoch 86
Norm: 2.38, NNZs: 50, Bias: -2.289157, T: 2574152, Avg. loss: 2.983750
Total training time: 1.27 seconds.
-- Epoch 87
Norm: 2.06, NNZs: 50, Bias: -2.415450, T: 2604084, Avg. loss: 2.912736
Total training time: 1.29 seconds.
-- Epoch 88
Norm: 1.59, NNZs: 50, Bias: -2.324640, T: 2634016, Avg. loss: 2.979992
Total training time: 1.30 seconds.
-- Epoch 89
Norm: 2.04, NNZs: 50, Bias: -2.378730, T: 2663948, Avg. loss: 2.900528
Total training time: 1.32 seconds.
-- Epoch 90
Norm: 1.73, NNZs: 50, Bias: -2.522009, T: 2693880, Avg. loss: 2.883860
Total training time: 1.33 seconds.
-- Epoch 91
Norm: 1.76, NNZs: 50, Bias: -1.884525, T: 2723812, Avg. loss: 2.920770
Total training time: 1.35 seconds.
-- Epoch 92
Norm: 2.33, NNZs: 50, Bias: -2.465344, T: 2753744, Avg. loss: 2.850782
Total training time: 1.36 seconds.
```

```
-- Epoch 93
Norm: 1.99, NNZs: 50, Bias: -2.176802, T: 2783676, Avg. loss: 2.850290
Total training time: 1.38 seconds.
-- Epoch 94
Norm: 2.00, NNZs: 50, Bias: -2.298143, T: 2813608, Avg. loss: 2.851358
Total training time: 1.39 seconds.
-- Epoch 95
Norm: 1.43, NNZs: 50, Bias: -2.303626, T: 2843540, Avg. loss: 2.788944
Total training time: 1.41 seconds.
-- Epoch 96
Norm: 1.87, NNZs: 50, Bias: -2.692146, T: 2873472, Avg. loss: 2.843997
Total training time: 1.42 seconds.
-- Epoch 97
Norm: 1.97, NNZs: 50, Bias: -2.357034, T: 2903404, Avg. loss: 2.773742
Total training time: 1.43 seconds.
-- Epoch 98
Norm: 2.05, NNZs: 50, Bias: -2.292547, T: 2933336, Avg. loss: 2.793821
Total training time: 1.45 seconds.
-- Epoch 99
Norm: 2.12, NNZs: 50, Bias: -2.475377, T: 2963268, Avg. loss: 2.748387
Total training time: 1.46 seconds.
-- Epoch 100
Norm: 1.41, NNZs: 50, Bias: -1.710469, T: 2993200, Avg. loss: 2.763615
Total training time: 1.48 seconds.
-- Epoch 101
Norm: 1.56, NNZs: 50, Bias: -2.420715, T: 3023132, Avg. loss: 2.745886
Total training time: 1.49 seconds.
-- Epoch 102
Norm: 1.39, NNZs: 50, Bias: -2.015011, T: 3053064, Avg. loss: 2.704289
Total training time: 1.51 seconds.
-- Epoch 103
Norm: 1.78, NNZs: 50, Bias: -1.969114, T: 3082996, Avg. loss: 2.796181
Total training time: 1.52 seconds.
-- Epoch 104
Norm: 1.76, NNZs: 50, Bias: -2.312149, T: 3112928, Avg. loss: 2.697758
Total training time: 1.54 seconds.
-- Epoch 105
Norm: 1.92, NNZs: 50, Bias: -2.112888, T: 3142860, Avg. loss: 2.655118
Total training time: 1.55 seconds.
-- Epoch 106
Norm: 1.84, NNZs: 50, Bias: -2.197601, T: 3172792, Avg. loss: 2.736385
Total training time: 1.56 seconds.
-- Epoch 107
Norm: 1.58, NNZs: 50, Bias: -1.828840, T: 3202724, Avg. loss: 2.667507
Total training time: 1.58 seconds.
-- Epoch 108
Norm: 1.68, NNZs: 50, Bias: -1.874864, T: 3232656, Avg. loss: 2.679442
Total training time: 1.60 seconds.
-- Epoch 109
Norm: 1.81, NNZs: 50, Bias: -2.234152, T: 3262588, Avg. loss: 2.650565
Total training time: 1.61 seconds.
-- Epoch 110
Norm: 1.95, NNZs: 50, Bias: -2.464683, T: 3292520, Avg. loss: 2.684502
Total training time: 1.63 seconds.
-- Epoch 111
Norm: 1.48, NNZs: 50, Bias: -2.526756, T: 3322452, Avg. loss: 2.635299
Total training time: 1.64 seconds.
```

```
-- Epoch 112
Norm: 1.61, NNZs: 50, Bias: -1.924702, T: 3352384, Avg. loss: 2.675266
Total training time: 1.66 seconds.
-- Epoch 113
Norm: 1.59, NNZs: 50, Bias: -2.466036, T: 3382316, Avg. loss: 2.612682
Total training time: 1.67 seconds.
-- Epoch 114
Norm: 2.00, NNZs: 50, Bias: -1.967579, T: 3412248, Avg. loss: 2.637242
Total training time: 1.69 seconds.
-- Epoch 115
Norm: 1.99, NNZs: 50, Bias: -2.248675, T: 3442180, Avg. loss: 2.619547
Total training time: 1.70 seconds.
-- Epoch 116
Norm: 1.19, NNZs: 50, Bias: -2.016142, T: 3472112, Avg. loss: 2.618085
Total training time: 1.72 seconds.
-- Epoch 117
Norm: 1.17, NNZs: 50, Bias: -1.834329, T: 3502044, Avg. loss: 2.563414
Total training time: 1.73 seconds.
-- Epoch 118
Norm: 1.41, NNZs: 50, Bias: -2.327217, T: 3531976, Avg. loss: 2.607694
Total training time: 1.74 seconds.
-- Epoch 119
Norm: 1.58, NNZs: 50, Bias: -2.193969, T: 3561908, Avg. loss: 2.559494
Total training time: 1.76 seconds.
-- Epoch 120
Norm: 1.35, NNZs: 50, Bias: -1.620927, T: 3591840, Avg. loss: 2.567456
Total training time: 1.77 seconds.
-- Epoch 121
Norm: 1.64, NNZs: 50, Bias: -1.871791, T: 3621772, Avg. loss: 2.560397
Total training time: 1.79 seconds.
-- Epoch 122
Norm: 1.35, NNZs: 50, Bias: -2.085512, T: 3651704, Avg. loss: 2.557940
Total training time: 1.80 seconds.
-- Epoch 123
Norm: 1.47, NNZs: 50, Bias: -2.445075, T: 3681636, Avg. loss: 2.575365
Total training time: 1.82 seconds.
-- Epoch 124
Norm: 1.56, NNZs: 50, Bias: -2.310219, T: 3711568, Avg. loss: 2.526708
Total training time: 1.83 seconds.
-- Epoch 125
Norm: 1.87, NNZs: 50, Bias: -1.856189, T: 3741500, Avg. loss: 2.510256
Total training time: 1.84 seconds.
-- Epoch 126
Norm: 1.07, NNZs: 50, Bias: -1.661189, T: 3771432, Avg. loss: 2.505820
Total training time: 1.86 seconds.
-- Epoch 127
Norm: 1.34, NNZs: 50, Bias: -1.751083, T: 3801364, Avg. loss: 2.514191
Total training time: 1.87 seconds.
-- Epoch 128
Norm: 0.98, NNZs: 50, Bias: -1.364756, T: 3831296, Avg. loss: 2.515009
Total training time: 1.89 seconds.
-- Epoch 129
Norm: 1.22, NNZs: 50, Bias: -1.501806, T: 3861228, Avg. loss: 2.524345
Total training time: 1.90 seconds.
-- Epoch 130
Norm: 1.42, NNZs: 50, Bias: -2.081583, T: 3891160, Avg. loss: 2.485890
Total training time: 1.92 seconds.
```

```
-- Epoch 131
Norm: 1.27, NNZs: 50, Bias: -2.007100, T: 3921092, Avg. loss: 2.535860
Total training time: 1.93 seconds.
-- Epoch 132
Norm: 1.57, NNZs: 50, Bias: -1.730042, T: 3951024, Avg. loss: 2.477312
Total training time: 1.94 seconds.
-- Epoch 133
Norm: 1.09, NNZs: 50, Bias: -1.728644, T: 3980956, Avg. loss: 2.480325
Total training time: 1.96 seconds.
-- Epoch 134
Norm: 1.52, NNZs: 50, Bias: -1.720080, T: 4010888, Avg. loss: 2.452818
Total training time: 1.97 seconds.
-- Epoch 135
Norm: 1.02, NNZs: 50, Bias: -1.838084, T: 4040820, Avg. loss: 2.459817
Total training time: 1.99 seconds.
-- Epoch 136
Norm: 1.62, NNZs: 50, Bias: -2.504608, T: 4070752, Avg. loss: 2.442212
Total training time: 2.00 seconds.
-- Epoch 137
Norm: 1.54, NNZs: 50, Bias: -2.107022, T: 4100684, Avg. loss: 2.440949
Total training time: 2.02 seconds.
-- Epoch 138
Norm: 1.39, NNZs: 50, Bias: -2.110684, T: 4130616, Avg. loss: 2.469654
Total training time: 2.03 seconds.
-- Epoch 139
Norm: 1.45, NNZs: 50, Bias: -1.827087, T: 4160548, Avg. loss: 2.452115
Total training time: 2.05 seconds.
-- Epoch 140
Norm: 1.35, NNZs: 50, Bias: -1.848882, T: 4190480, Avg. loss: 2.451439
Total training time: 2.06 seconds.
-- Epoch 141
Norm: 1.34, NNZs: 50, Bias: -1.753626, T: 4220412, Avg. loss: 2.442546
Total training time: 2.07 seconds.
-- Epoch 142
Norm: 1.31, NNZs: 50, Bias: -2.146196, T: 4250344, Avg. loss: 2.407346
Total training time: 2.09 seconds.
-- Epoch 143
Norm: 1.26, NNZs: 50, Bias: -1.977735, T: 4280276, Avg. loss: 2.438087
Total training time: 2.10 seconds.
-- Epoch 144
Norm: 0.81, NNZs: 50, Bias: -1.846461, T: 4310208, Avg. loss: 2.397153
Total training time: 2.12 seconds.
-- Epoch 145
Norm: 1.62, NNZs: 50, Bias: -1.728257, T: 4340140, Avg. loss: 2.399783
Total training time: 2.13 seconds.
-- Epoch 146
Norm: 1.20, NNZs: 50, Bias: -1.847629, T: 4370072, Avg. loss: 2.387765
Total training time: 2.14 seconds.
-- Epoch 147
Norm: 1.15, NNZs: 50, Bias: -1.608233, T: 4400004, Avg. loss: 2.369589
Total training time: 2.16 seconds.
-- Epoch 148
Norm: 1.25, NNZs: 50, Bias: -1.986821, T: 4429936, Avg. loss: 2.399763
Total training time: 2.17 seconds.
-- Epoch 149
Norm: 1.52, NNZs: 50, Bias: -2.040763, T: 4459868, Avg. loss: 2.356415
Total training time: 2.19 seconds.
```

```

-- Epoch 150
Norm: 0.96, NNZs: 50, Bias: -1.702838, T: 4489800, Avg. loss: 2.355375
Total training time: 2.20 seconds.
-- Epoch 151
Norm: 1.34, NNZs: 50, Bias: -2.117038, T: 4519732, Avg. loss: 2.325341
Total training time: 2.22 seconds.
-- Epoch 152
Norm: 1.12, NNZs: 50, Bias: -1.764666, T: 4549664, Avg. loss: 2.368666
Total training time: 2.23 seconds.
-- Epoch 153
Norm: 1.09, NNZs: 50, Bias: -1.590520, T: 4579596, Avg. loss: 2.376720
Total training time: 2.24 seconds.
-- Epoch 154
Norm: 1.32, NNZs: 50, Bias: -1.683223, T: 4609528, Avg. loss: 2.379676
Total training time: 2.26 seconds.
-- Epoch 155
Norm: 1.26, NNZs: 50, Bias: -1.864284, T: 4639460, Avg. loss: 2.344576
Total training time: 2.27 seconds.
-- Epoch 156
Norm: 1.09, NNZs: 50, Bias: -1.811300, T: 4669392, Avg. loss: 2.339771
Total training time: 2.29 seconds.
Convergence after 156 epochs took 2.29 seconds
[0 1 1 ... 0 1 0]

```

	precision	recall	f1-score	support
0	0.17	0.47	0.25	1218
1	0.85	0.56	0.68	6265
micro avg	0.55	0.55	0.55	7483
macro avg	0.51	0.52	0.46	7483
weighted avg	0.74	0.55	0.61	7483

```

[0.49025605 0.51565871 0.51565871 ... 0.48509758 0.51565871 0.4970685 ]

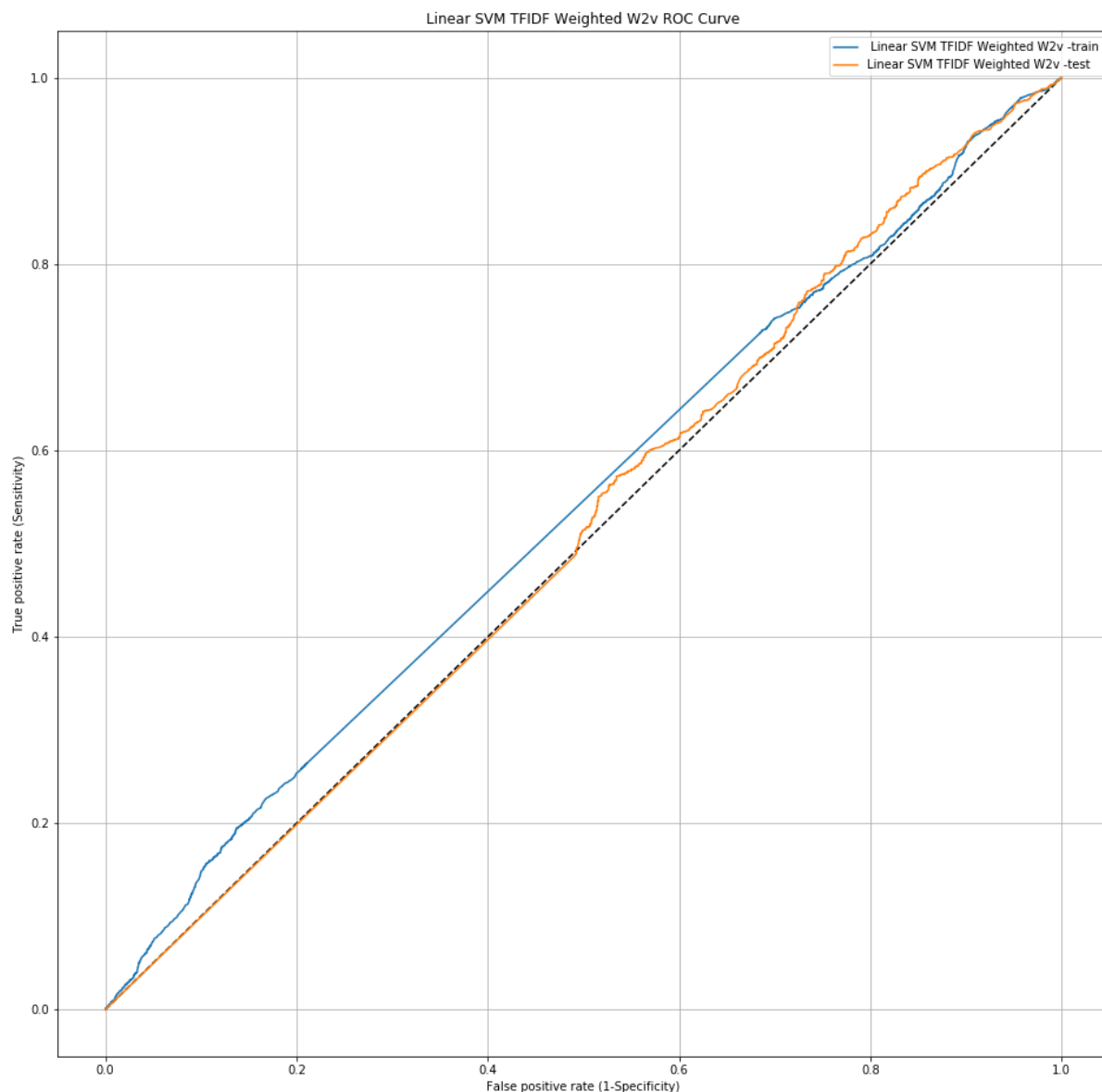
```



```

In [80]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='Linear SVM TFIDF Weighted W2v ROC Curve'
displaygraph.legend_1 = ' Linear SVM TFIDF Weighted W2v -train'
displaygraph.legend_2 = 'Linear SVM TFIDF Weighted W2v -test'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='False positive rate (1-Specificity)'
displaygraph.label_y='True positive rate (Sensitivity)'
displaygraph.constructgraph(lnrsvmtidfwtw2v.roc_curve_test['fpr_trn'],lnrsv
mtidfwtw2v.roc_curve_test['tpr_trn'],\
                             lnrsvmtidfwtw2v.roc_curve_test['fpr'],lnrsvmtid
fwtw2v.roc_curve_test['tpr'])

```



```
In [81]: data = [[lnrsvmtidfwtw2v.confnsmtxytstpred['tn'] ,lnrsvmtidfwtw2v.confnsmtx
ytstpred['fn']], [lnrsvmtidfwtw2v.confnsmtxytstpred['fp'],lnrsvmtidfwtw2v.co
nfsnmtxytstpred['tp']]]
displaygraph.draw_table(data)
```

	Predicted: NO	Predicted: YES
Actual: NO	576	2746
Actual: YES	642	3519

```
In [82]: data1= [[lnrsvmtidfwtw2v.accuracy_score_val,lnrsvmtidfwtw2v.accuracy_score_
test]]
displaygraph.draw_accscore(data1)
```

	Validation	Test
Accuracy Score	0.493903457491231	0.5472404115996258

Precision, Recall, f-1 Score

```
In [83]: import tabulate
res_tab = [['Label', 'Precision','Recall', 'f-1 Score'],
           [0,0.17,0.47,0.25],
           [1,0.85,0.56,0.64 ]]
print(tabulate.tabulate(res_tab, tablefmt='fancy_grid'))
```

Label	Precision	Recall	f-1 Score
0	0.17	0.47	0.25
1	0.85	0.56	0.64

[5.2] RBF SVM

[5.2.1] Applying RBF SVM on BOW, SET 1

```
In [3]: # Please write all the code with proper documentation
```

GridsearchCV output for BOW using RBF kernel

```
In [36]: svmrbfbow = assign7RBF()
svmrbfbow_sgdclf = svmrbfbow.SVMClassifier()
svmrbfbow.load_data('BOW')
```

```
In [37]: svmrbfbow.SVM_calcrocaucscore(1000000)
```

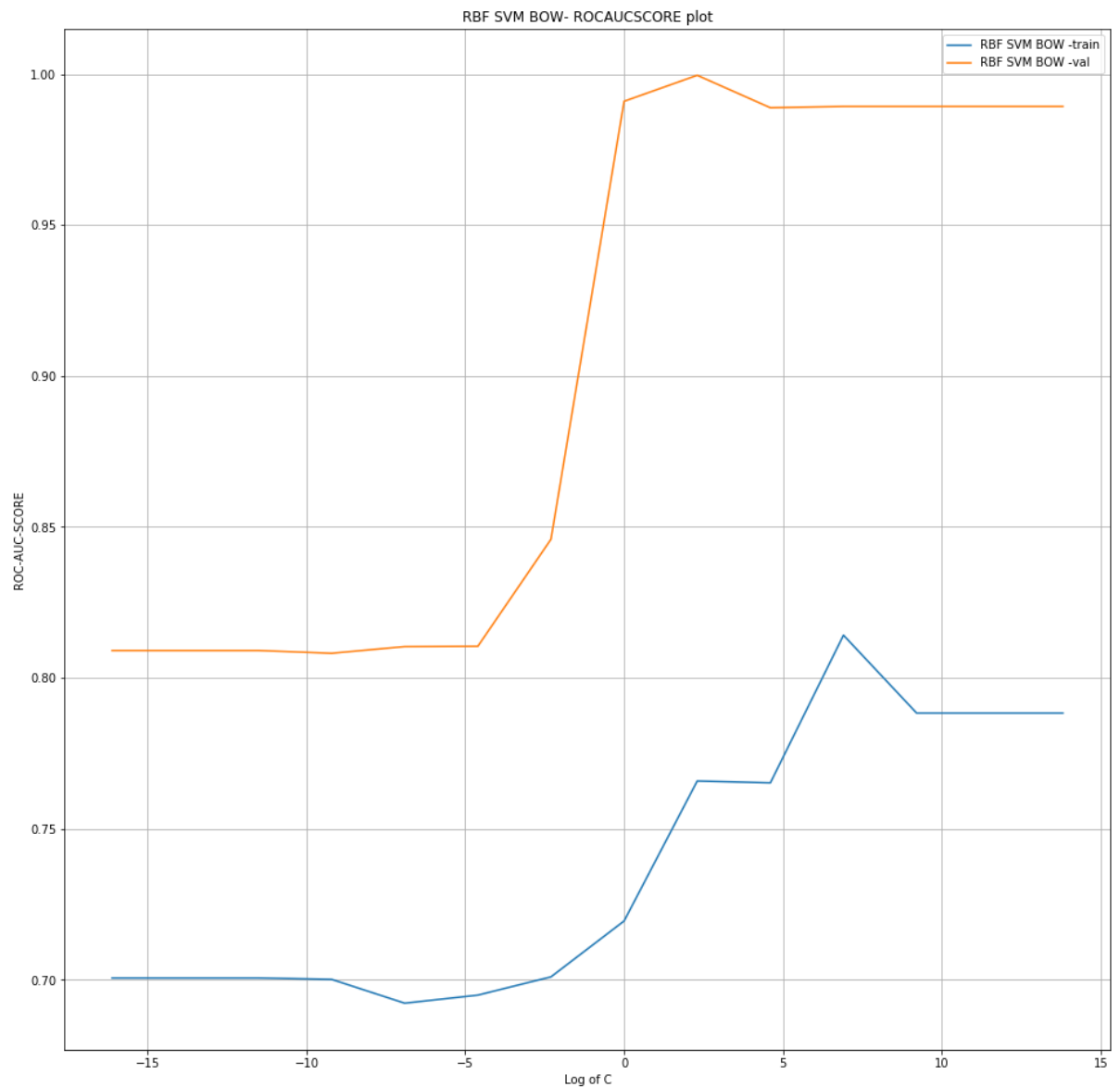
```
SVC(C=1e-07, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1e-06, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=9.999999999999999e-06, cache_size=200, class_weight={0: 5.14, 1: 1},
    coef0=0.0, decision_function_shape='ovr', degree=3,
    gamma='auto_deprecated', kernel='rbf', max_iter=1000, probability=False,
    random_state=42, shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=9.999999999999999e-05, cache_size=200, class_weight={0: 5.14, 1: 1},
    coef0=0.0, decision_function_shape='ovr', degree=3,
    gamma='auto_deprecated', kernel='rbf', max_iter=1000, probability=False,
    random_state=42, shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=0.001, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=0.01, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=0.1, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
```

```
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=10.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=100.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=10000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=100000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1000000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
Function exiting...
```

```
In [38]: print(svmrbfbow.rocaucscoretrn)
print(svmrbfbow.rocaucscoreval)
print(svmrbfbow.rbf_C)

[0.7006619264225176, 0.7006619839615458, 0.700661932815743, 0.7001861361987
667, 0.6922959307401951, 0.6949642008789253, 0.7010135090641743, 0.71952302
16592501, 0.7658744808349389, 0.7652572916461284, 0.8141683808821797, 0.788
3766649525152, 0.7883766649525152, 0.7883766649525151]
[0.8090971917669842, 0.8090971917669842, 0.8090971917669842, 0.808177375138
999, 0.8103956114891666, 0.8104927260572554, 0.8459358477177872, 0.99099216
18483059, 0.9996033290791814, 0.9888576945124726, 0.9892863947623014, 0.989
2863947623014, 0.9892863947623014, 0.9892863947623014]
[1e-07, 1e-06, 9.999999999999999e-06, 9.999999999999999e-05, 0.001, 0.01,
0.1, 1.0, 10.0, 100.0, 1000.0, 10000.0, 100000.0, 1000000.0]
```

```
In [43]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='RBF SVM BOW- ROCAUCSCORE plot'
displaygraph.legnd_1 = 'RBF SVM BOW -train'
displaygraph.legnd_2 = 'RBF SVM BOW -val'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='Log of C'
displaygraph.label_y='ROC-AUC-SCORE'
displaygraph.Xdata = svmrbbow.rbf_C
displaygraph.ydatatrn = svmrbbow.rocaucscoretrn
displaygraph.ydataval = svmrbbow.rocaucscoreval
displaygraph.rocacuscoregraph()
```



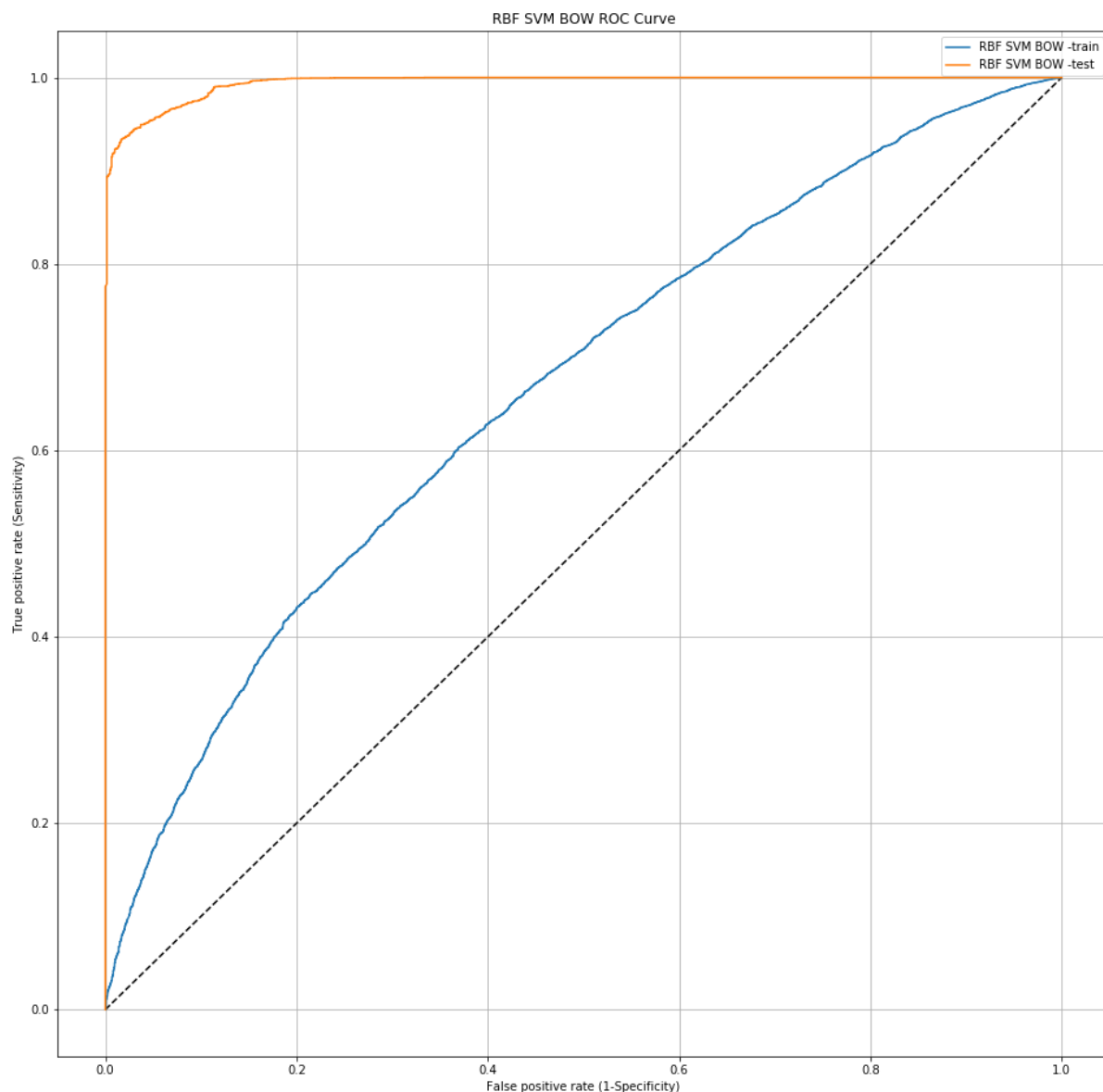
Without class and sample weights


```
In [54]: #has no weights  
svmrbbow.SVM_actualClassifier_0(10)  
  
SVC(C=10, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,  
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',  
    kernel='rbf', max_iter=1000, probability=False, random_state=42,  
    shrinking=True, tol=0.001, verbose=100)  
[LibSVM][LibSVM][LibSVM]
```

```

In [55]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='RBF SVM BOW ROC Curve'
displaygraph.legnd_1 = 'RBF SVM BOW -train'
displaygraph.legnd_2 = 'RBF SVM BOW -test'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='False positive rate (1-Specificity)'
displaygraph.label_y='True positive rate (Sensitivity)'
displaygraph.constructgraph(svmrbfbow.roc_curve_test['fpr_trn'],svmrbfbow.roc_curve_test['tpr_trn'],\
                             svmrbfbow.roc_curve_test['fpr'],svmrbfbow.roc_curve_test['tpr'])

```



```
In [56]: data = [[svmrbbow.confsnmtxytstpred['tn'] ,svmrbbow.confsnmtxytstpred['fn'],svmrbbow.confsnmtxytstpred['fp'],svmrbbow.confsnmtxytstpred['tp']]]
displaygraph.draw_table(data)
```

	Predicted: NO	Predicted: YES
Actual: NO	1061	56
Actual: YES	157	6209

Precision, Recall, f-1 Score no class or sample weights

```
In [8]: import tabulate
res_tab = [['Label', 'Precision', 'Recall', 'f-1 Score'],
           [0,0.95,0.87,0.91],
           [1,0.98,0.99,0.98]]
print(tabulate.tabulate(res_tab, tablefmt='fancy_grid'))
```

Label	Precision	Recall	f-1 Score
0	0.95	0.87	0.91
1	0.98	0.99	0.98

With sample weights

```
In [52]: data = [[svmrbbow.confsnmtxytstpred['tn'] ,svmrbbow.confsnmtxytstpred['f
n']], [svmrbbow.confsnmtxytstpred['fp'],svmrbbow.confsnmtxytstpred['tp']]]
displaygraph.draw_table(data)
```

	Predicted: NO	Predicted: YES
Actual: NO	744	2198
Actual: YES	474	4067

Precision, Recall, f-1 Score with Class and Sample weights

```
In [7]: import tabulate
res_tab = [['Label', 'Precision', 'Recall', 'f-1 Score'],
           [0,0.25,0.61,0.36],
           [1,0.90,0.65,0.75]]
print(tabulate.tabulate(res_tab, tablefmt='fancy_grid'))
```

Label	Precision	Recall	f-1 Score
0	0.25	0.61	0.36
1	0.9	0.65	0.75

```
In [53]: data1= [[svmrbbfow.accuracy_score_val,svmrbbfow.accuracy_score_test]]
displaygraph.draw_accscore(data1)
```

	Validation	Test
Accuracy Score	0.6555871053950225	0.6429239609782172

[5.2.2] Applying RBF SVM on TFIDF, SET 2

```
In [3]: # Please write all the code with proper documentation
```

GridsearchCV output for TFIDF using RBF kernel

```
0.8064366552836055 {'C': 0.1} GridSearchCV(cv=5, error_score='raise-deprecating', estimator=SVC(C=1.0,
cache_size=200, class_weight=None, coef0=0.0, decision_function_shape='ovr', degree=3,
gamma='auto_deprecated', kernel='rbf', max_iter=1000, probability=False, random_state=42, shrinking=True,
tol=0.001, verbose=100), fit_params=None, iid='warn', n_jobs=None, param_grid={'C': [0.0001, 0.001, 0.01,
0.1, 1, 10, 100, 1000]}, pre_dispatch='2*n_jobs', refit=True, return_train_score='warn', scoring='roc_auc',
verbose=100)
```

```
In [40]: rbfsvmtfidf = assign7RBF()
rbfsvm_clf = rbfsvmtfidf.SVMClassifier()
rbfsvmtfidf.load_data('TFIDF')
```

```
In [41]: rbfsvmtfidf.SVM_calcrocaucscore(1000000)
```

```
SVC(C=1e-07, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1e-06, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=9.999999999999999e-06, cache_size=200, class_weight={0: 5.14, 1: 1},
    coef0=0.0, decision_function_shape='ovr', degree=3,
    gamma='auto_deprecated', kernel='rbf', max_iter=1000, probability=False,
    random_state=42, shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=9.999999999999999e-05, cache_size=200, class_weight={0: 5.14, 1: 1},
    coef0=0.0, decision_function_shape='ovr', degree=3,
    gamma='auto_deprecated', kernel='rbf', max_iter=1000, probability=False,
    random_state=42, shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=0.001, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=0.01, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=0.1, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
```

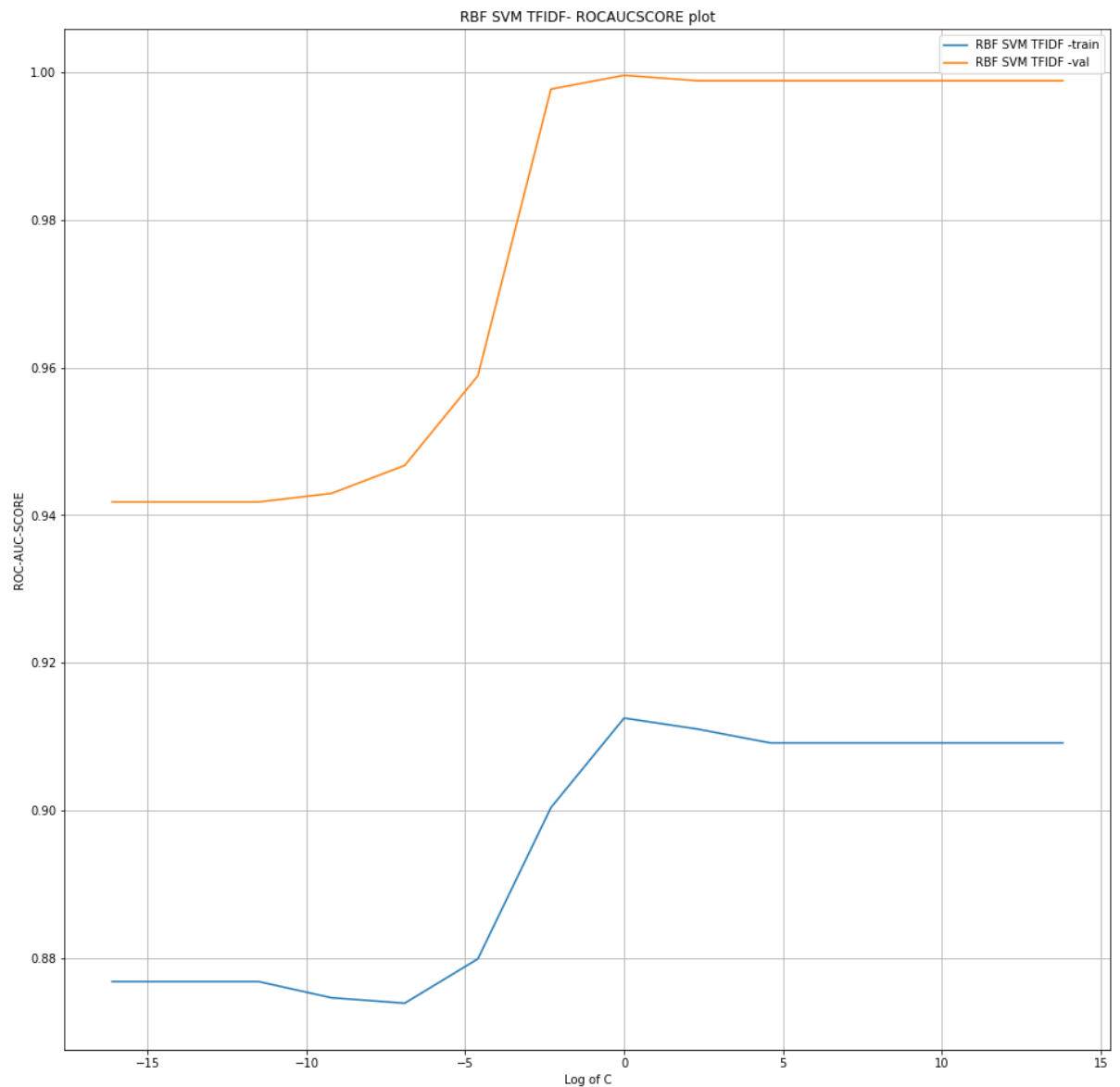
```
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=10.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=100.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=10000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=100000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1000000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
Function exiting...
```



```
In [42]: print(rbfsvmtfidf.rocaucscoretrn)
print(rbfsvmtfidf.rocaucscoreval)
print(rbfsvmtfidf.rbf_C)

[0.8767766613416215, 0.8767766613416215, 0.8767766613416215, 0.874577084946
504, 0.8738438331446948, 0.879842340761315, 0.9003607581986786, 0.912490138
7695594, 0.91101045233527, 0.9091221109366272, 0.9091221109366272, 0.909122
1109366272, 0.9091221109366272, 0.9091221109366272]
[0.941784230729431, 0.941784230729431, 0.941784230729431, 0.942952685289668
4, 0.9467383055992193, 0.9588897402667798, 0.9977474758424946, 0.9996248872
813999, 0.9988896499276466, 0.9988896499276466, 0.9988896499276466, 0.99888
96499276466, 0.9988896499276466, 0.9988896499276466]
[1e-07, 1e-06, 9.999999999999999e-06, 9.999999999999999e-05, 0.001, 0.01,
0.1, 1.0, 10.0, 100.0, 1000.0, 10000.0, 100000.0, 1000000.0]
```

```
In [44]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='RBF SVM TFIDF- ROCAUCSCORE plot'
displaygraph.legnd_1 = 'RBF SVM TFIDF -train'
displaygraph.legnd_2 = 'RBF SVM TFIDF -val'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='Log of C'
displaygraph.label_y='ROC-AUC-SCORE'
displaygraph.Xdata = rbfsvmtfidf.rfb_C
displaygraph.ydatatrn = rbfsvmtfidf.rocaucscoretrn
displaygraph.ydataval = rbfsvmtfidf.rocaucscoreval
displaygraph.rocacscoregraph()
```



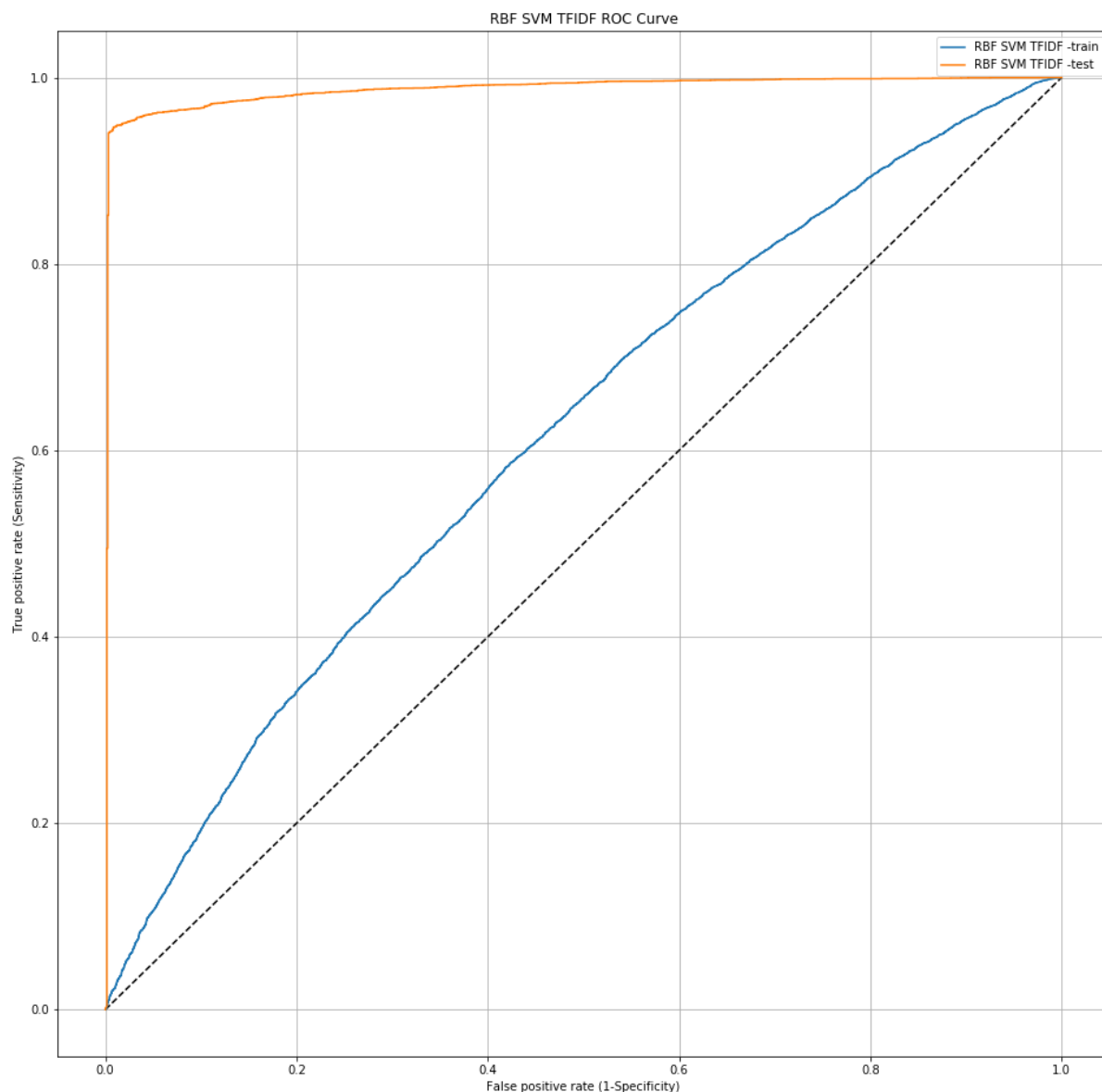
```
In [62]: rbfsvmtfidf.SVM_actualClasifier_0(0.1)
```

```
SVC(C=0.1, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,  
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',  
    kernel='rbf', max_iter=1000, probability=False, random_state=42,  
    shrinking=True, tol=0.001, verbose=100)  
[LibSVM][LibSVM][LibSVM]
```

```

In [63]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='RBF SVM TFIDF ROC Curve'
displaygraph.legnd_1 = 'RBF SVM TFIDF -train'
displaygraph.legnd_2 = 'RBF SVM TFIDF -test'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='False positive rate (1-Specificity)'
displaygraph.label_y='True positive rate (Sensitivity)'
displaygraph.constructgraph(rbfsvmtfidf.roc_curve_test['fpr_trn'],rbfsvmtfi
df.roc_curve_test['tpr_trn'],\
                           rbfsvmtfidf.roc_curve_test['fpr'],rbfsvmtfidf.r
oc_curve_test['tpr'])

```



```
In [65]: data = [[rbfsvmtdidf.confsnmtxytstpred['tn'] ,rbfsvmtdidf.confsnmtxytstpred
['fn']], [rbfsvmtdidf.confsnmtxytstpred['fp'], rbfsvmtdidf.confsnmtxytstpred
['tp']]]
displaygraph.draw_table(data)
```

	Predicted: NO	Predicted: YES
Actual: NO	1051	159
Actual: YES	167	6106

```
In [22]: data1= [[rbfsvmtdidf.accuracy_score_val,rbfsvmtdidf.accuracy_score_test]]
displaygraph.draw_accscore(data1)
```

	Validation	Test
Accuracy Score	0.9587439452146317	0.9305091540825872

Precision, Recall, f-1 Score

```
In [9]: import tabulate
res_tab = [['Label', 'Precision', 'Recall', 'f-1 Score'],
           [0, 0.87, 0.86, 0.87],
           [1, 0.97, 0.97, 0.97]]
print(tabulate.tabulate(res_tab, tablefmt='fancy_grid'))
```

Label	Precision	Recall	f-1 Score
0	0.87	0.86	0.87
1	0.97	0.97	0.97

[5.2.3] Applying RBF SVM on AVG W2V, SET 3

```
In [3]: # Please write all the code with proper documentation
```

GridsearchCV output for AVGW2V using RBF kernel

```
0.6715835848921192 {'C': 0.1} GridSearchCV(cv=5, error_score='raise-deprecating', estimator=SVC(C=1.0,
cache_size=200, class_weight=None, coef0=0.0, decision_function_shape='ovr', degree=3,
gamma='auto_deprecated', kernel='rbf', max_iter=1000, probability=False, random_state=42, shrinking=True,
tol=0.001, verbose=100), fit_params=None, iid='warn', n_jobs=None, param_grid={'C': [0.0001, 0.001, 0.01,
0.1, 1, 10, 100, 1000]}, pre_dispatch='2*n_jobs', refit=True, return_train_score='warn', scoring='roc_auc',
verbose=100)
```

```
In [45]: rbfsvmavgw2v = assign7RBF()
rbfsvm_avgw2vc1f = rbfsvmavgw2v.SVMClassifier()
rbfsvmavgw2v.load_data('AVGW2V')
```

```
In [46]: rbfsvmavgw2v.SVM_calcrocaucscore(1000000)
```

```
SVC(C=1e-07, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1e-06, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=9.999999999999999e-06, cache_size=200, class_weight={0: 5.14, 1: 1},
    coef0=0.0, decision_function_shape='ovr', degree=3,
    gamma='auto_deprecated', kernel='rbf', max_iter=1000, probability=False,
    random_state=42, shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=9.999999999999999e-05, cache_size=200, class_weight={0: 5.14, 1: 1},
    coef0=0.0, decision_function_shape='ovr', degree=3,
    gamma='auto_deprecated', kernel='rbf', max_iter=1000, probability=False,
    random_state=42, shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=0.001, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=0.01, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=0.1, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
```

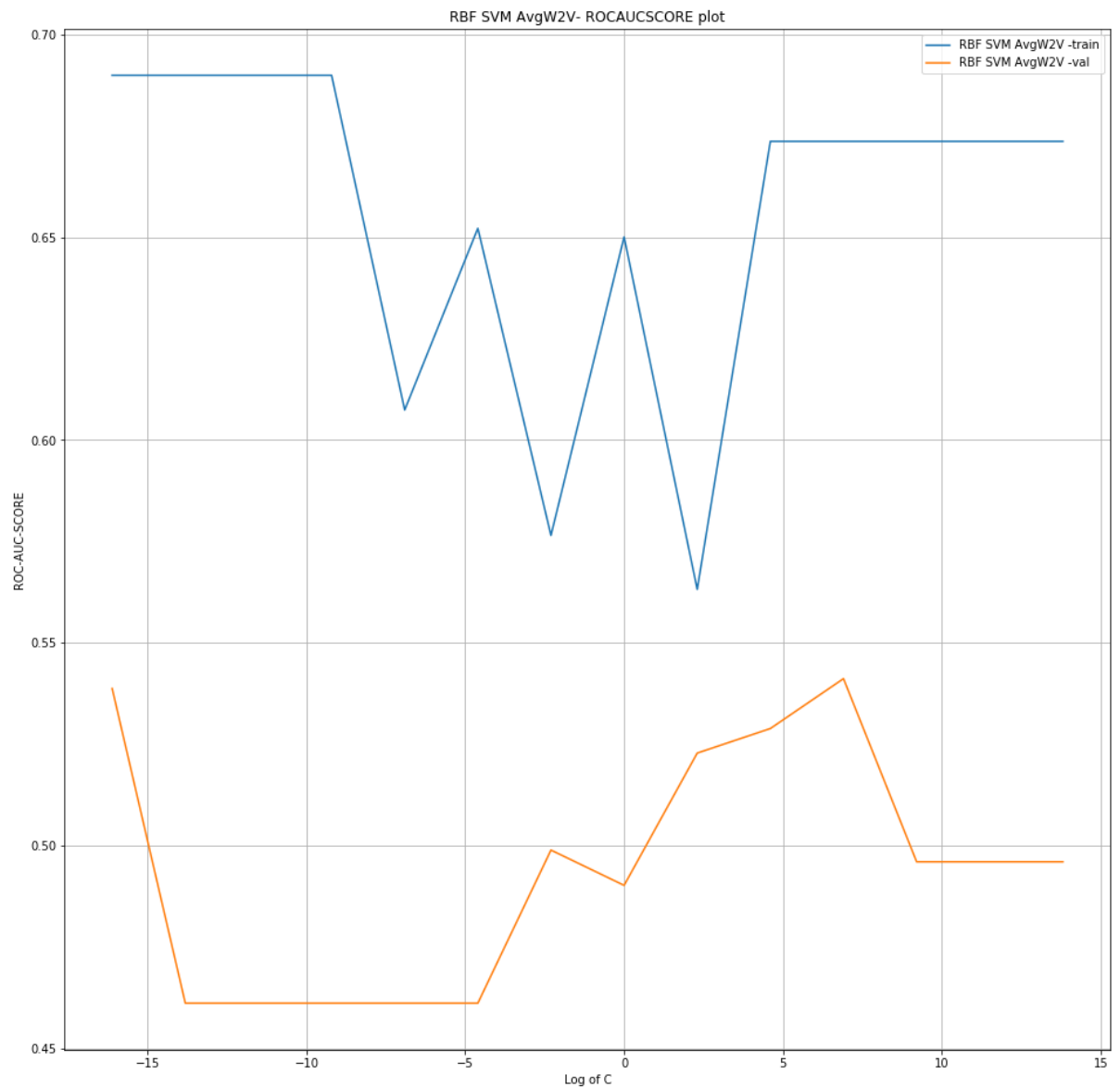


```
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=10.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=100.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=10000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=100000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1000000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
Function exiting...
```

```
In [47]: print(rbfsvmavgw2v.rocaucscoretrn)
print(rbfsvmavgw2v.rocaucscoreval)
print(rbfsvmavgw2v.rbf_C)
```

```
[0.689909633805514, 0.689909633805514, 0.689909633805514, 0.689909633805514, 0.6074283959400155, 0.6521907678092307, 0.5765311013918741, 0.6500693549872387, 0.5632229507174644, 0.6736341059443877, 0.6736341059443877, 0.6736341059443877, 0.6736341059443877, 0.6736341059443877]
[0.5387731452965341, 0.4612268547034659, 0.4612268547034659, 0.4612268547034659, 0.4612268547034659, 0.4612268547034659, 0.49896253718276595, 0.49026390524574714, 0.522866066486317, 0.5289159139774349, 0.541208400882367, 0.49607989757184834, 0.49607989757184834, 0.49607989757184834]
[1e-07, 1e-06, 9.999999999999999e-06, 9.999999999999999e-05, 0.001, 0.01, 0.1, 1.0, 10.0, 100.0, 1000.0, 10000.0, 100000.0, 1000000.0]
```

```
In [48]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='RBF SVM AvgW2V- ROCAUCSCORE plot'
displaygraph.legnd_1 = 'RBF SVM AvgW2V -train'
displaygraph.legnd_2 = 'RBF SVM AvgW2V -val'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='Log of C'
displaygraph.label_y='ROC-AUC-SCORE'
displaygraph.Xdata = rbfsvmavgw2v.rbf_C
displaygraph.ydatatrnr = rbfsvmavgw2v.rocaucscoretrnr
displaygraph.ydataval = rbfsvmavgw2v.rocaucscoreval
displaygraph.rocaucscoregraph()
```



```
In [99]: rbfsvmavgw2v.SVM_actualClasifier(0.1)
```

```
[LibSVM][LibSVM]***X_test predict [1 1 1 ... 0 1 0]
                precision    recall  f1-score   support
```

```

      0      0.18      0.64      0.28      1218
      1      0.86      0.43      0.57      6265

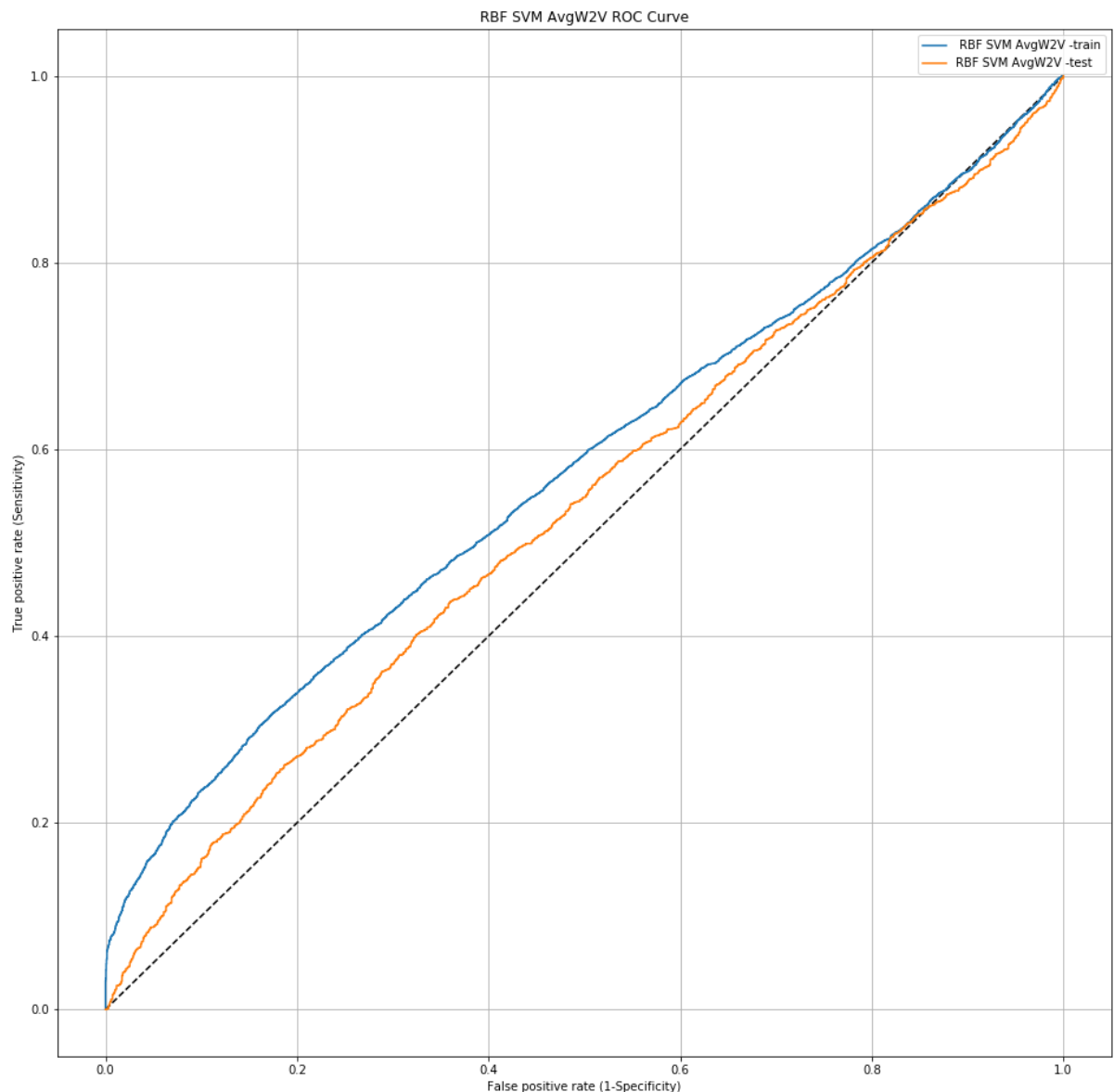
  micro avg      0.47      0.47      0.47      7483
  macro avg      0.52      0.54      0.43      7483
weighted avg      0.75      0.47      0.53      7483
```

```
*** predict probabilities*** [0.5261184  0.56073382 0.57145218 ... 0.492772
65 0.60571124 0.47123068]
```

```

In [100]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='RBF SVM AvgW2V ROC Curve'
displaygraph.legnd_1 = ' RBF SVM AvgW2V -train'
displaygraph.legnd_2 = 'RBF SVM AvgW2V -test'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='False positive rate (1-Specificity)'
displaygraph.label_y='True positive rate (Sensitivity)'
displaygraph.constructgraph(rbfsvmavgw2v.roc_curve_test['fpr_trn'],rbfsvmavgw2v.roc_curve_test['tpr_trn'],\
                             rbfsvmavgw2v.roc_curve_test['fpr'],rbfsvmavgw2v.roc_curve_test['tpr'])

```



```
In [101]: data = [[rbfsvmavgw2v.confsnmtxytstp[ 'tn' ] ,rbfsvmavgw2v.confsnmtxytstp[ 'fn' ]],
                  [rbfsvmavgw2v.confsnmtxytstp[ 'fp' ],rbfsvmavgw2v.confsnmtxytstp[ 'tp' ]]]
displaygraph.draw_table(data)
```

	Predicted: NO	Predicted: YES
Actual: NO	782	3567
Actual: YES	436	2698

```
In [102]: data1= [[rbfsvmavgw2v.accuracy_score_val,rbfsvmavgw2v.accuracy_score_test]]
displaygraph.draw_accscore(data1)
```

	Validation	Test
Accuracy Score	0.4685151160848505	0.4650541226780703

Precision, Recall, f-1 Score

```
In [103]: import tabulate
res_tab = [['Label', 'Precision', 'Recall', 'f-1 Score'],
           [0, 0.18, 0.64, 0.28],
           [1, 0.86, 0.43, 0.57]]
print(tabulate.tabulate(res_tab, tablefmt='fancy_grid'))
```

Label	Precision	Recall	f-1 Score
0	0.18	0.64	0.28
1	0.86	0.43	0.57

[5.2.4] Applying RBF SVM on TFIDF W2V, SET 4

```
In [3]: # Please write all the code with proper documentation
```

GridsearchCV output for TFIDF Wt W2V using RBF kernel

```
0.6715835848921192 {'C': 0.1} GridSearchCV(cv=5, error_score='raise-deprecating', estimator=SVC(C=1.0,
cache_size=200, class_weight=None, coef0=0.0, decision_function_shape='ovr', degree=3,
gamma='auto_deprecated', kernel='rbf', max_iter=1000, probability=False, random_state=42, shrinking=True,
tol=0.001, verbose=100), fit_params=None, iid='warn', n_jobs=None, param_grid={'C': [0.0001, 0.001, 0.01,
0.1, 1, 10, 100, 1000]}, pre_dispatch='2*n_jobs', refit=True, return_train_score='warn', scoring='roc_auc',
verbose=100)
```

```
In [49]: rbfsvmtidfwtw2v = assign7RBF()
rbfsvm_wtw2vclf = rbfsvmtidfwtw2v.SVMClassifier()
rbfsvmtidfwtw2v.load_data('WTW2V')
```

```
In [51]: rbfsvmtidfwtw2v.SVM_calcrocaucscore(1000000)
```



```
SVC(C=1e-07, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1e-06, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=9.999999999999999e-06, cache_size=200, class_weight={0: 5.14, 1: 1},
    coef0=0.0, decision_function_shape='ovr', degree=3,
    gamma='auto_deprecated', kernel='rbf', max_iter=1000, probability=False,
    random_state=42, shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=9.999999999999999e-05, cache_size=200, class_weight={0: 5.14, 1: 1},
    coef0=0.0, decision_function_shape='ovr', degree=3,
    gamma='auto_deprecated', kernel='rbf', max_iter=1000, probability=False,
    random_state=42, shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=0.001, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=0.01, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=0.1, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
    decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
    kernel='rbf', max_iter=1000, probability=False, random_state=42,
    shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
```

```
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=10.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=100.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=10000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=100000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
SVC(C=1000000.0, cache_size=200, class_weight={0: 5.14, 1: 1}, coef0=0.0,
decision_function_shape='ovr', degree=3, gamma='auto_deprecated',
kernel='rbf', max_iter=1000, probability=False, random_state=42,
shrinking=True, tol=0.001, verbose=100)
[LibSVM]Fitting probability generation and roc auc score generation for tra
ining data complete...
[LibSVM]Fitting probability generation and roc auc score generation for val
idation data complete...
Function exiting...
```

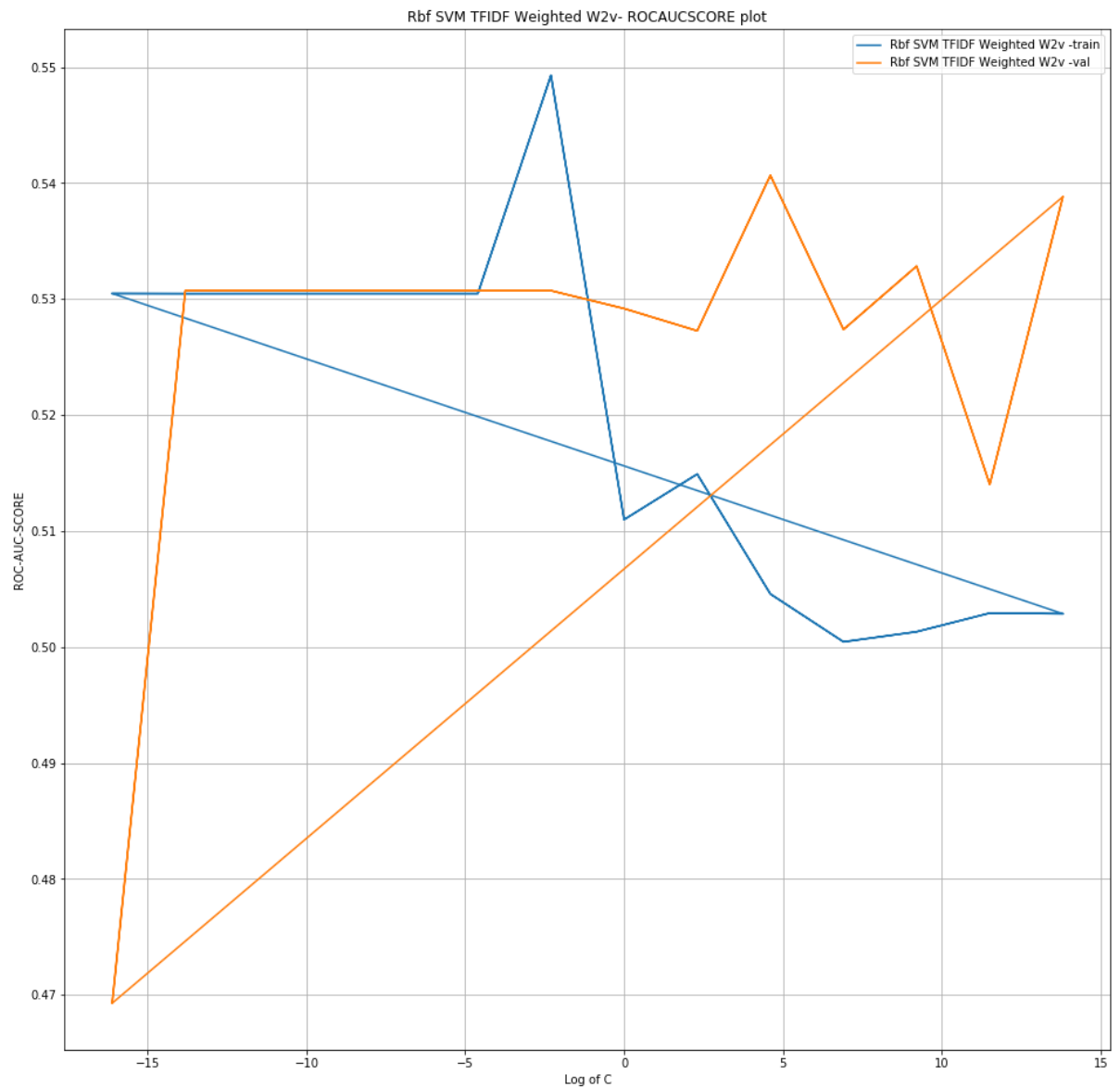
```
In [53]: print(rbfsvmtidfwtw2v.rocaucscoretrn)
print(rbfsvmtidfwtw2v.rocaucscoreval)
print(rbfsvmtidfwtw2v.rbf_C)
```

```
[0.5304857050933522, 0.5304737369754975, 0.5304773043952427, 0.530477694381
9889, 0.5304776176632848, 0.5304776752023128, 0.5492990812960745, 0.5109865
148209156, 0.5149120063314412, 0.5045744997819015, 0.500445665345903, 0.501
3175925987727, 0.5029250540349013, 0.5028679881054299, 0.5304857050933522,
0.5304737369754975, 0.5304773043952427, 0.5304776943819889, 0.5304776176632
848, 0.5304776752023128, 0.5492990812960745, 0.5109865148209156, 0.51491200
63314412, 0.5045744997819015, 0.500445665345903, 0.5013175925987727, 0.5029
250540349013, 0.5028679881054299]
[0.46928756917103165, 0.530726597647569, 0.5307299853650604, 0.530730703971
801, 0.5307304986555894, 0.5307307039718011, 0.5307308066299068, 0.52918446
75822128, 0.5272651716361403, 0.5406682139296373, 0.5273763503647237, 0.532
8409439946651, 0.514021352064742, 0.5388266301696569, 0.46928756917103165,
0.530726597647569, 0.5307299853650604, 0.530730703971801, 0.530730498655589
4, 0.5307307039718011, 0.5307308066299068, 0.5291844675822128, 0.5272651716
361403, 0.5406682139296373, 0.5273763503647237, 0.5328409439946651, 0.51402
1352064742, 0.5388266301696569]
[1e-07, 1e-06, 9.999999999999999e-06, 9.999999999999999e-05, 0.001, 0.01,
0.1, 1.0, 10.0, 100.0, 1000.0, 10000.0, 100000.0, 1000000.0, 1e-07, 1e-06,
9.999999999999999e-06, 9.999999999999999e-05, 0.001, 0.01, 0.1, 1.0, 10.0,
100.0, 1000.0, 10000.0, 100000.0, 1000000.0]
```

```

In [54]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='Rbf SVM TFIDF Weighted W2v- ROCAUCSCORE plot'
displaygraph.legnd_1 = 'Rbf SVM TFIDF Weighted W2v -train'
displaygraph.legnd_2 = 'Rbf SVM TFIDF Weighted W2v -val'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='Log of C'
displaygraph.label_y='ROC-AUC-SCORE'
displaygraph.Xdata = rbfsvmtidfwtw2v.rbf_C
displaygraph.ydatatrnr = rbfsvmtidfwtw2v.rocaucscoretrnr
displaygraph.ydataval = rbfsvmtidfwtw2v.rocaucscoreval
displaygraph.rocaucscoregraph()

```



In [94]: `rbfsvmtidftw2v.SVM_actualClassifier(0.1)`

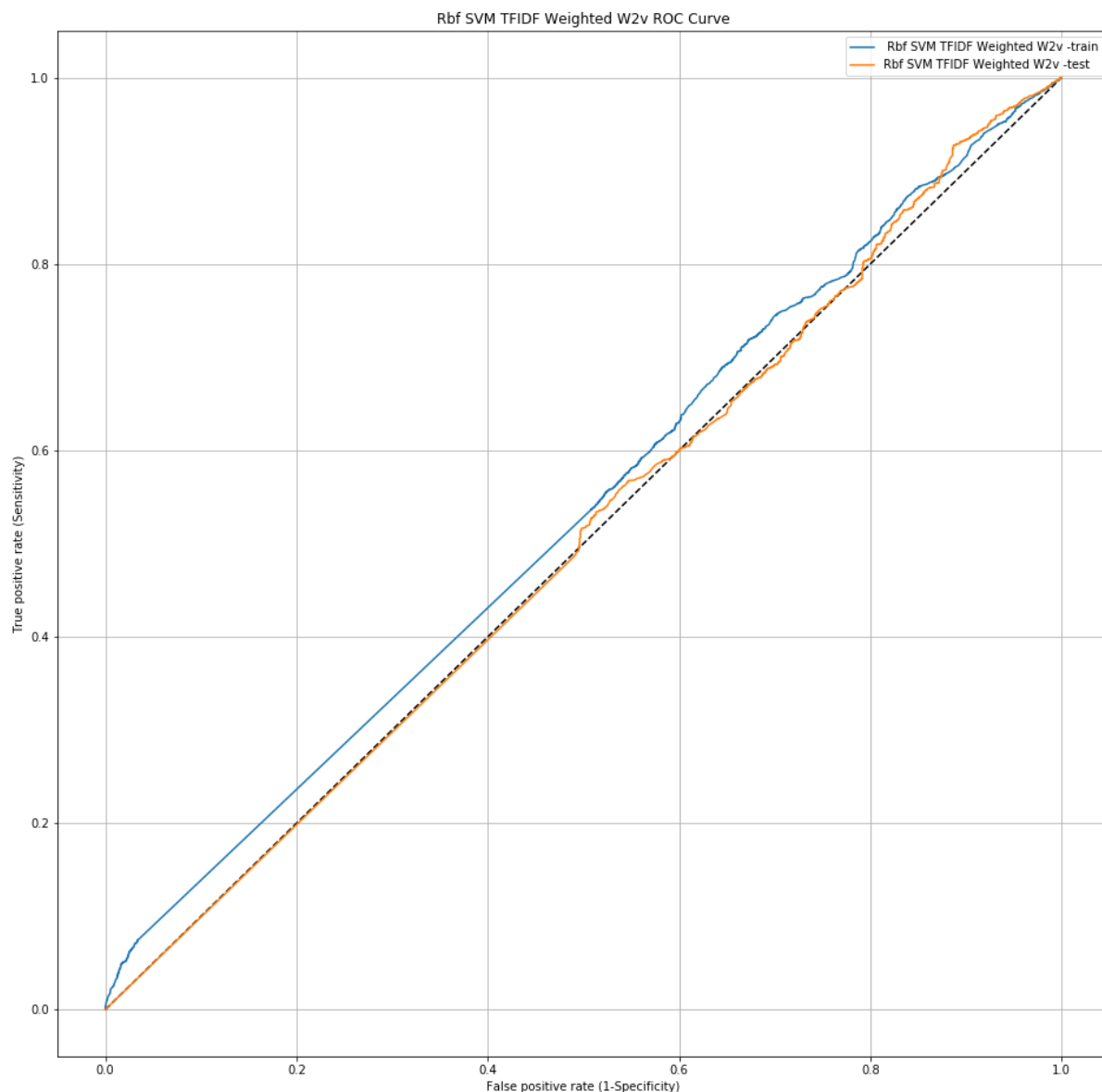
```
[LibSVM][LibSVM]***X_test predict [0 1 1 ... 0 1 1]
                precision    recall  f1-score   support

         0         0.16         0.39         0.23         1218
         1         0.84         0.60         0.70         6265

   micro avg         0.57         0.57         0.57         7483
   macro avg         0.50         0.50         0.47         7483
weighted avg         0.73         0.57         0.62         7483

*** predict probabilities*** [0.493416    0.50410752 0.50410752 ... 0.494913
76 0.50410752 0.50084061]
```

```
In [95]: # testing code for displayig graphs
displaygraph = drawgraphs()
displaygraph.setdefaultparm()
displaygraph.graph_title='Rbf SVM TFIDF Weighted W2v ROC Curve'
displaygraph.legnd_1 = ' Rbf SVM TFIDF Weighted W2v -train'
displaygraph.legnd_2 = 'Rbf SVM TFIDF Weighted W2v -test'
displaygraph.graph_parameters['show_legnd']= True
displaygraph.label_x='False positive rate (1-Specificity)'
displaygraph.label_y='True positive rate (Sensitivity)'
displaygraph.constructgraph(rbfsvmtidfwtw2v.roc_curve_test['fpr_trn'],rbfsvm
mtidfwtw2v.roc_curve_test['tpr_trn'],\
                             rbfsvmtidfwtw2v.roc_curve_test['fpr'],rbfsvmtid
fwtw2v.roc_curve_test['tpr'])
```



```
In [96]: data = [[rbfsvmtidfwtw2v.confsnmtxystpred['tn'] ,rbfsvmtidfwtw2v.confsnmtxystpred['fn']],
[rbfsvmtidfwtw2v.confsnmtxystpred['fp'],rbfsvmtidfwtw2v.confsnmtxystpred['tp']]]
displaygraph.draw_table(data)
```

	Predicted: NO	Predicted: YES
Actual: NO	477	2477
Actual: YES	741	3788

```
In [93]: data1= [[rbfsvmtidfwtw2v.accuracy_score_val,rbfsvmtidfwtw2v.accuracy_score_test]]
displaygraph.draw_accscore(data1)
```

	Validation	Test
Accuracy Score	0.8378152664105563	0.8372310570626754

Precision, Recall, f-1 Score

```
In [11]: import tabulate
res_tab = [['Label', 'Precision','Recall', 'f-1 Score'],
           [0,0.16,0.39,0.23],
           [1,0.84,0.60,0.70]]
print(tabulate.tabulate(res_tab, tablefmt='fancy_grid'))
```

Label	Precision	Recall	f-1 Score
0	0.16	0.39	0.23
1	0.84	0.6	0.7

[6] Conclusions

```
In [4]: # Please compare all your models using Prettytable Library
```

Hyperparameter Details

```
In [109]: import tabulate
hyprm_tab = [['Classification \nModel', 'Hyper \nParameter','Tf-Idf', 'AvgW
2v','WtW2v'],
             ['Linear SVM','Alpha',0.01,0.01,0.0001],
             ['SVC-RBF Kernel','C',0.1,0.1,0.1]]
print(tabulate.tabulate(hyprm_tab, tablefmt='fancy_grid'))
```

Classification Model	Hyper Parameter	Tf-Idf	AvgW2v	WtW2v
Linear SVM	Alpha	0.01	0.01	0.0001
SVC-RBF Kernel	C	0.1	0.1	0.1

AUC Scores


```
In [111]: accscore_tab = [['Vectorizer \nType', 'Linear \nSVM', 'SVC-RBF\nKernel'],  
                        ['Tf-Idf', 0.81, 0.93],  
                        ['AvgW2v', 0.56, 0.47],  
                        ['WtW2v', 0.51, 0.84]]  
print(tabulate.tabulate(accscore_tab, tablefmt='fancy_grid'))
```

Vectorizer Type	Linear SVM	SVC-RBF Kernel
Tf-Idf	0.81	0.93
AvgW2v	0.56	0.47
WtW2v	0.51	0.84

Remarks

1. Implementing Linear SVM using the BOW vectorizer with alpha value equal to 0.001(GridsearchCv output) is producing a lower AUC Score This being an imbalanced dataset, precision, re-call and f-1 score are better esitmates of the dataset. Processing the Linear SVM with Alpha equal to 0.1 , we find that precision and recall differ by +0.1/-0.1 but f-1 score differs by +0.03 Please let me know which output I should use to report my results
2. Implementing SVM with RBF kernel without class and sample weights is producing better results when compared to the output generated with class and sample weights. What numbers should I report since this is an imbalanced dataset ?