3vs6

February 13, 2018

1 Forsøk: Hvordan varier ML-performance for de forskjellige sifrene?

1.1 Hypotese: Det vil være lettere å klassifisere deweys dess flere siffer dem har, siden innholdet er mer spesifisert?

```
In [135]: # Importerer det egenproduserte biblioteket nb_ml
          import sys
          sys.path.append('/home/ubuntu/PycharmProjects_saved/tgpl_w_oop')
          from nb_ml import utils_nb
          import pandas as pd
          folder = "/home/ubuntu/PycharmProjects_saved/tgpl_w_oop/data_set/tgcForOptimization/tg
          articles = utils_nb.get_articles_from_folder_several_deweys(folder)

          print(articles.describe())
```

```
        dewey                                         file_name  \
count   14567                                             14567
unique   3552                                             14567
top     36229  urndoi104045tidsskr100190Ambulansesakennoeålæreav
freq      604                                                 1

                                              text
count                                        14567
unique                                       14278
top      samtideninnhold Billettmerket Ikke forambisiø...
freq                                            15
```

Det første steget er å få en oversikt over hvilke deweys vi har og hvor mange vi har av hver. For å få et inntrykk så skriver vi ut en liste over de 40 øverste. Dette vil også gi oss en formening om hvilke 3,4, 5 og 6 sifrede deweys som kan være aktuelle for videre forsøk.

```
In [175]: topN = articles["dewey"].value_counts().head(60)
          print("dewey       frekvens")
          print(topN)
```

```
dewey       frekvens
36229         604
```

839823	141
362293	137
3621	129
3622	126
34304	116
3627	100
362204	96
6168915	90
351481	90
362292	79
30223	75
306	70
34602	58
379481	58
3412422	57
61092	56
34705	54
34206	53
9072	53
34306	53
75981	52
657	51
34401	48
3521409481	47
30712	47
34606	47
0014	46
37817	45
30542	44
3637387	44
327481	44
61612	44
36211068	44
341481	43
34202	42
34603	42
33263	42
34604	42
610711	41
7114	40
331257	40
839821	40
34505	40
30072	39
193	39
61578	39
3523	39
6167	37

```
3058            36
3053            36
343055          35
610730711       34
3401            34
346043          34
351             33
36345           33
3701            33
36218           33
61689           32
Name: dewey, dtype: int64
```

Fra tabellen over ser vi at vi har en rekke lovende kandidater for videre forsøk. Jeg lister dem opp ved siden av antall deweys, frekvens er i parentes: - 10-siffer: 3521409481(47)

- 7-siffer: 6168915 (90), 3412422(57)
- 6-siffer: 839823 (141), 362293(137), 362204(96), 362292(79),379481(58)
- 5-siffer: 36229 (604), 34304(116), 30223(75), 34602(58)
- 4-siffer: 3621(129), 3622(126),3627(100), 34602(58),9072(53)
- 3-siffer: 306(70), 657(51)

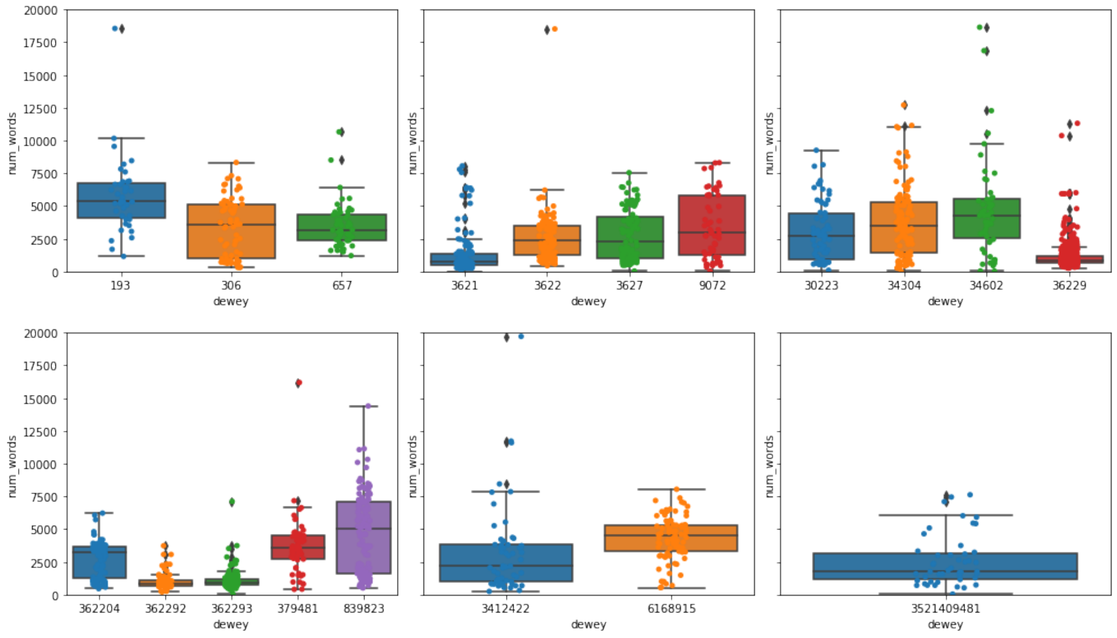
```
In [183]: #Making dataframes only containing articles from this selection of deweys. Dataframe f
          dewey10 = ["3521409481"]
          dewey10_df = articles.loc[articles['dewey'].isin(dewey10)].copy()



          dewey6 = ["839823", "362293", "362204", "362292", "379481"].copy()
          dewey6_df = articles.loc[articles['dewey'].isin(dewey6)]

          dewey5 = ["36229", "34304", "30223", "34602"]
          #dewey5 = ["34304", "30223", "34602"]
          dewey5_df = articles.loc[articles['dewey'].isin(dewey5)].copy()

          dewey4 = ["3621", "3622", "3627", "9072"]
          dewey4_df = articles.loc[articles['dewey'].isin(dewey4)].copy()

          dewey3 = ["306", "657", "193"]
          dewey3_df = articles.loc[articles['dewey'].isin(dewey3)].copy()
```

1.2 Tekstlengder målt i ord

```
In [184]: #For further analysis of the data I want to look at the length of the texts and how th
          # The first thing I need to do then is to add a column with length of text.
          dewey10_df["num_words"] = dewey10_df["text"].str.split().str.len()
          dewey7_df["num_words"] = dewey7_df["text"].str.split().str.len()
          dewey6_df["num_words"] = dewey6_df["text"].str.split().str.len()
```

```
dewey5_df["num_words"] = dewey5_df["text"].str.split().str.len()
dewey4_df["num_words"] = dewey4_df["text"].str.split().str.len()
dewey3_df["num_words"] = dewey3_df["text"].str.split().str.len()
#print(dewey3_df["char_length"])
import matplotlib as mpl
import matplotlib.pyplot as plt
import seaborn as sns

#dewey3_df.plot(x =dewey3_df["char_length"], style='o')
fig, axs = plt.subplots(nrows = 2, ncols=3, sharey = True)

sns.boxplot(x = "dewey", y = "num_words", data =dewey3_df, ax=axs[0,0])
sns.stripplot(x = "dewey", y = "num_words", data =dewey3_df, jitter = True,edgecolor=

sns.boxplot(x = "dewey", y = "num_words", data =dewey4_df, ax=axs[0,1])
sns.stripplot(x = "dewey", y = "num_words", data =dewey4_df, jitter = True,edgecolor=

sns.boxplot(x = "dewey", y = "num_words", data =dewey5_df, ax=axs[0,2])
sns.stripplot(x = "dewey", y = "num_words", data =dewey5_df, jitter = True,edgecolor=

sns.boxplot(x = "dewey", y = "num_words", data =dewey6_df, ax=axs[1,0])
sns.stripplot(x = "dewey", y = "num_words", data =dewey6_df, jitter = True,edgecolor=

sns.boxplot(x = "dewey", y = "num_words", data =dewey7_df, ax=axs[1,1])
sns.stripplot(x = "dewey", y = "num_words", data =dewey7_df, jitter = True,edgecolor=

sns.boxplot(x = "dewey", y = "num_words", data =dewey10_df, ax=axs[1,2])
sns.stripplot(x = "dewey", y = "num_words", data =dewey10_df, jitter = True,edgecolor=
plt.tight_layout(pad=1.0, w_pad=0.5, h_pad=2.0)
# Set figure width to 12 and height to 9
fig_size=[0,0]
fig_size[0] = 14
fig_size[1] = 8
plt.rcParams["figure.figsize"] = fig_size
plt.ylim(0, 20000)
plt.show()
```

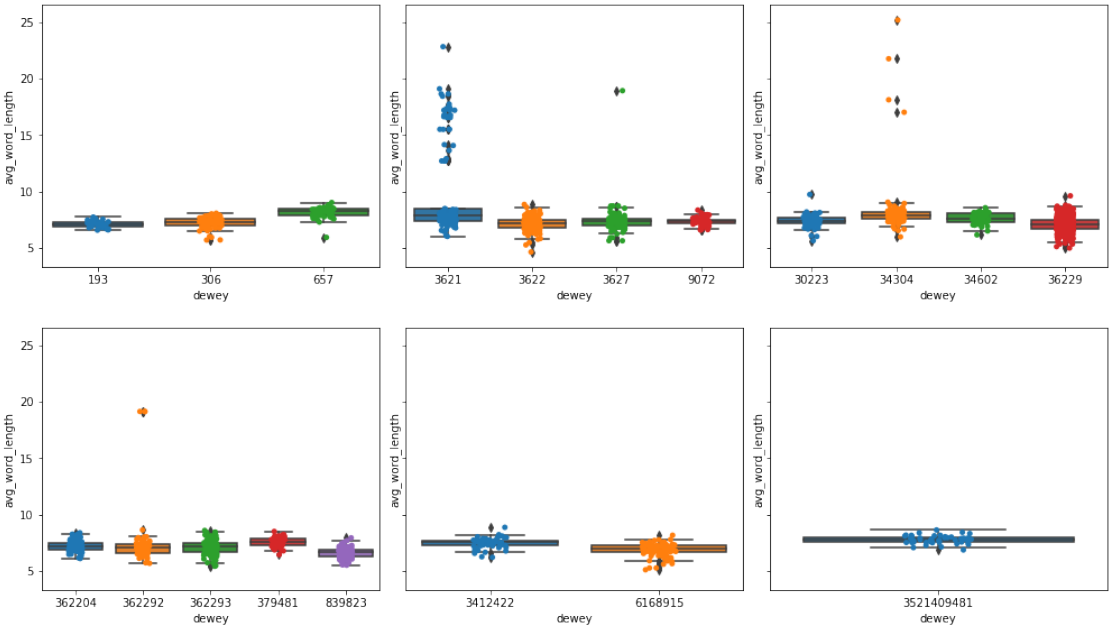
```
/usr/local/lib/python3.5/dist-packages/ipykernel_launcher.py:5: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#
  """
```



1.3 Gjennomsnittlig ordlengde

```
In [185]: ##La oss nå ta en kikk på gjennomsnittlig ordlengde for de forskjellige artiklene.
          dewey10_df["char_length"] = dewey10_df["text"].str.strip().str.len()
          dewey10_df["avg_word_length"] = dewey10_df["char_length"]/dewey10_df["num_words"]

          dewey7_df["char_length"] = dewey7_df["text"].str.strip().str.len()
          dewey7_df["avg_word_length"] = dewey7_df["char_length"]/dewey7_df["num_words"]

          dewey6_df["char_length"] = dewey6_df["text"].str.strip().str.len()
          dewey6_df["avg_word_length"] = dewey6_df["char_length"]/dewey6_df["num_words"]

          dewey5_df["char_length"] = dewey5_df["text"].str.strip().str.len()
          dewey5_df["avg_word_length"] = dewey5_df["char_length"]/dewey5_df["num_words"]

          dewey4_df["char_length"] = dewey4_df["text"].str.strip().str.len()
          dewey4_df["avg_word_length"] = dewey4_df["char_length"]/dewey4_df["num_words"]

          dewey3_df["char_length"] = dewey3_df["text"].str.strip().str.len()
          dewey3_df["avg_word_length"] = dewey3_df["char_length"]/dewey3_df["num_words"]


          fig, axs = plt.subplots(nrows = 2, ncols=3, sharey = True)

          sns.boxplot(x = "dewey", y = "avg_word_length", data =dewey3_df, ax=axs[0,0])
          sns.stripplot(x = "dewey", y = "avg_word_length", data =dewey3_df, jitter = True,edgec
sns.boxplot(x = "dewey", y = "avg_word_length", data =dewey4_df, ax=axs[0,1])
sns.stripplot(x = "dewey", y = "avg_word_length", data =dewey4_df, jitter = True,edgec

sns.boxplot(x = "dewey", y = "avg_word_length", data =dewey5_df, ax=axs[0,2])
sns.stripplot(x = "dewey", y = "avg_word_length", data =dewey5_df, jitter = True,edgec

sns.boxplot(x = "dewey", y = "avg_word_length", data =dewey6_df, ax=axs[1,0])
sns.stripplot(x = "dewey", y = "avg_word_length", data =dewey6_df, jitter = True,edgec

sns.boxplot(x = "dewey", y = "avg_word_length", data =dewey7_df, ax=axs[1,1])
sns.stripplot(x = "dewey", y = "avg_word_length", data =dewey7_df, jitter = True,edgec

sns.boxplot(x = "dewey", y = "avg_word_length", data =dewey10_df, ax=axs[1,2])
sns.stripplot(x = "dewey", y = "avg_word_length", data =dewey10_df, jitter = True,edge
plt.tight_layout(pad=1.0, w_pad=0.5, h_pad=2.0)
# Set figure width to 12 and height to 9
fig_size=[0,0]
fig_size[0] = 14
fig_size[1] = 8
plt.rcParams["figure.figsize"] = fig_size
#plt.ylim(0, 20000)
plt.show()
```

```
/usr/local/lib/python3.5/dist-packages/ipykernel_launcher.py:8: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#

/usr/local/lib/python3.5/dist-packages/ipykernel_launcher.py:9: SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead

See the caveats in the documentation: http://pandas.pydata.org/pandas-docs/stable/indexing.html#
  if __name__ == '__main__':
```



2 Scenarioer for testing

- 3 vs 4
- 3 vs 5
- 3 vs 6
- 3 vs 7
- 3 vs 10

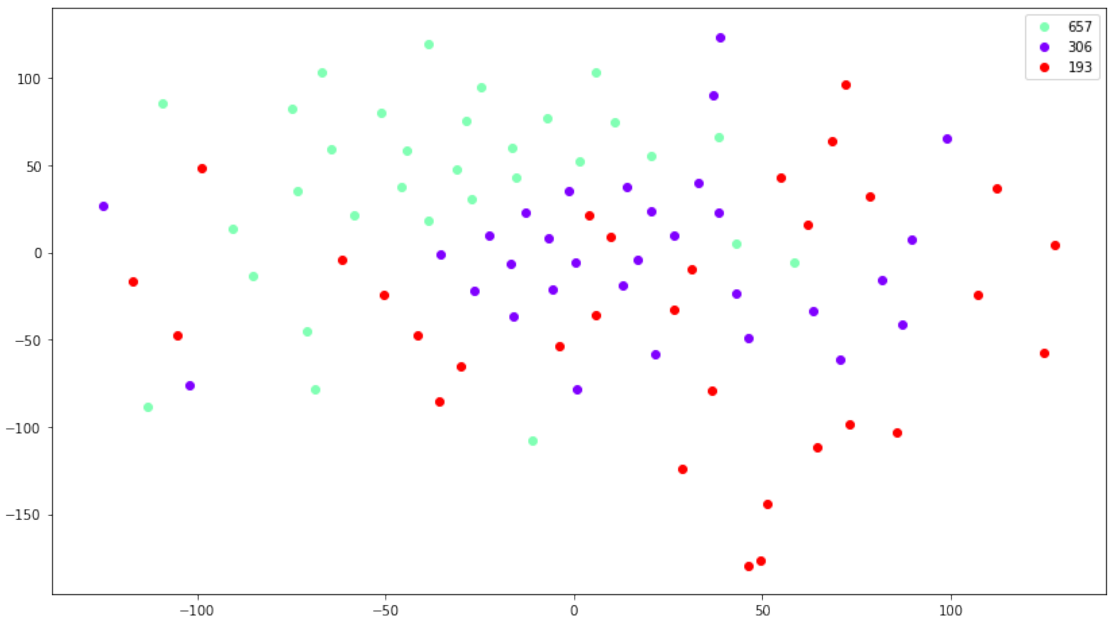
In [194]:
```
import sys
sys.path.append('/home/ubuntu/PycharmProjects_saved/tgpl_w_oop/nb_ml')
from nb_ml import logreg
from nltk.tokenize import word_tokenize
from nltk.corpus import stopwords
from sklearn.model_selection import train_test_split
from sklearn.feature_extraction.text import CountVectorizer
from sklearn.linear_model import LogisticRegression
from sklearn.metrics import classification_report
from sklearn.manifold import TSNE
from sklearn.decomposition import TruncatedSVD
from sklearn.metrics import accuracy_score
import matplotlib.cm as cm
import numpy as np
from collections import OrderedDict
import pylab
from sklearn.neighbors.classification import KNeighborsClassifier
class dewey_test():
```

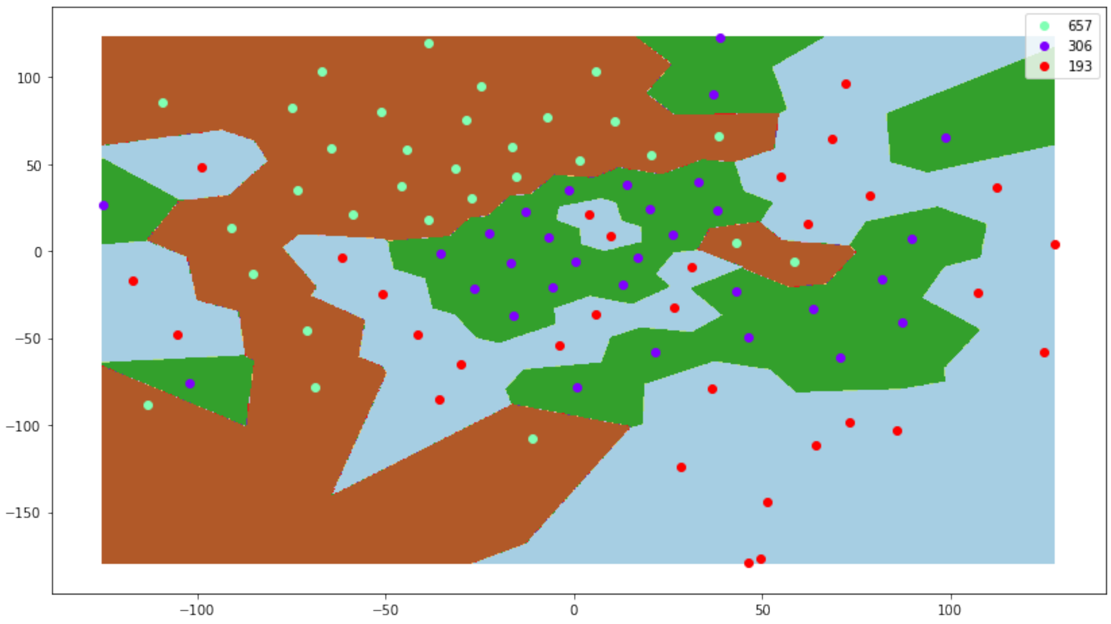
```
def __init__(self, data):
    self.corpus_dataframe = data.copy()
    self.filtered_corpus = []
    self.x_train = None
    self.y_train = None
    self.x_test = None
    self.y_test = None
    self.model = None
    self.predictions = None
    self.results = None
    self.accuracy = None
def preprocessing(self, numArticlesPerDewey=2, strict = False):
    filtered_texts = []
    if strict == True:
        self.getStrictArticleSelection(numArticlesPerDewey)
    for text in self.corpus_dataframe["text"].values:
        tokenized_text = word_tokenize(text = str(text), language = "norwegian")
    self.y_train = self.corpus_dataframe["dewey"].tolist()
    self.y_test = self.corpus_dataframe["dewey"].tolist()
def splitToTrainingAndTest(self, stratified):
    x = self.corpus_dataframe["text"].tolist()
    y = self.corpus_dataframe["dewey"].tolist()
    if stratified == True:
        self.x_train, self.x_test, self.y_train, self.y_test = train_test_split(x,
    #else:
    #    self.x_train, self.x_test, self.y_train, self.y_test = train_test_split(x
def fit(self):
    count_vectorizer = CountVectorizer(max_features = 10000)
    self.x_train = count_vectorizer.fit_transform(self.x_train)
    self.x_test = count_vectorizer.transform(self.x_test)
def train(self):
    self.model = LogisticRegression()
    self.model.fit(self.x_train, self.y_train)
def predict(self):
    #print(self.x_test[0])
    self.predictions = self.model.predict(self.x_test)
    self.results = classification_report(self.y_test, self.predictions)
    self.getAccuracy()
def getAccuracy(self):
    self.accuracy = accuracy_score(self.y_test, self.predictions)
def printResults(self):
    print(str(self.results) +"\n")
    print("Accuracy:"+ str(self.accuracy))

def tsne(self):

    X_reduced = TruncatedSVD(n_components = 50, random_state=0).fit_transform(self
        X_embedded = TSNE(n_components =2, perplexity = 40, random_state = 0).fit_tran

        colors = cm.rainbow(np.linspace(0,1,len(set(self.y_train))))
        unique_labels = set(self.y_train)
        color_dictionary = dict(zip(unique_labels, colors))

        color_list = []
        for label in self.y_train:
            color_list.append(color_dictionary[str(label)])
        for i in range(0,len(self.y_train)):
            plt.scatter(X_embedded[i,0], X_embedded[i,1], c = color_list[i],label = st
                        cmap = "tab20b" )
        handles, labels = plt.gca().get_legend_handles_labels()
        by_label = OrderedDict(zip(labels, handles))
        plt.legend(by_label.values(), by_label.keys())
        #%matplotlib inline
        plt.show()
    def getStrictArticleSelection(self, articlesPerDewey):
        np.random.seed(0)
        size = articlesPerDewey  # sample size
        replace = False  # with replacement

        self.corpus_dataframe =self.corpus_dataframe[self.corpus_dataframe['dewey'].is
        fn = lambda obj: obj.loc[np.random.choice(obj.index, size, replace), :]
        self.corpus_dataframe = self.corpus_dataframe.groupby('dewey', as_index=False)
        #self.corpus_dataframe = corpus_dataframe
        #return corpus_dataframe
    def plotDecisionSurface(self):
        # X - some data in 2dimensional np.array
        X_reduced = TruncatedSVD(n_components = 50, random_state=0).fit_transform(self
        X_embedded = TSNE(n_components =2, perplexity = 40, random_state = 0).fit_tran


        colors = cm.rainbow(np.linspace(0,1,len(set(self.y_train))))
        unique_labels = set(self.y_test)
        color_dictionary = dict(zip(unique_labels, colors))

        color_list = []
        for label in self.y_train:
            color_list.append(color_dictionary[str(label)])
        #for i in range(0,len(self.y_train)):
        #    plt.scatter(X_embedded[i,0], X_embedded[i,1], c = color_list[i],label = s
         #               cmap = "tab20b" )


        # create meshgrid
        resolution = 1000 # 100x100 background pixels
        X2d_xmin, X2d_xmax = np.min(X_embedded[:,0]), np.max(X_embedded[:,0])
        X2d_ymin, X2d_ymax = np.min(X_embedded[:,1]), np.max(X_embedded[:,1])
        xx, yy = np.meshgrid(np.linspace(X2d_xmin, X2d_xmax, resolution), np.linspace(

        # approximate Voronoi tesselation on resolution x resolution grid using 1-NN
        background_model = KNeighborsClassifier(n_neighbors=1).fit(X_embedded, self.y_
        voronoiBackground = background_model.predict(np.c_[xx.ravel(), yy.ravel()])
        voronoiBackground = voronoiBackground.reshape(xx.shape)
        #for i in range(0,len(self.y_train)):
        #plt.contourf(xx, yy, voronoiBackground, c = color_list, cmap=plt.cm.Paired)

        plt.contourf(xx, yy, voronoiBackground, cmap=plt.cm.Paired)
        handles, labels = plt.gca().get_legend_handles_labels()
        by_label = OrderedDict(zip(labels, handles))
        plt.legend(by_label.values(), by_label.keys())
        for i in range(0,len(self.y_train)):
            plt.scatter(X_embedded[i,0], X_embedded[i,1], c = color_list[i],label = st
                        cmap = "tab20b" )
        handles, labels = plt.gca().get_legend_handles_labels()
        by_label = OrderedDict(zip(labels, handles))
        plt.legend(by_label.values(), by_label.keys())
        #plt.scatter(X_embedded[:,0], X_embedded[:,1], c=self.y_train)
        plt.show()
```

2.0.1 Offisiell Test 1: 362

2.1 Deltest 1.1:

```
In [195]: test = dewey_test(dewey3_df)
          test.preprocessing(numArticlesPerDewey=39, strict = True)
          test.splitToTrainingAndTest(stratified = True)
          test.fit()
          test.train()
          test.predict()
          test.tsne()
          test.plotDecisionSurface()
          test.printResults()
```



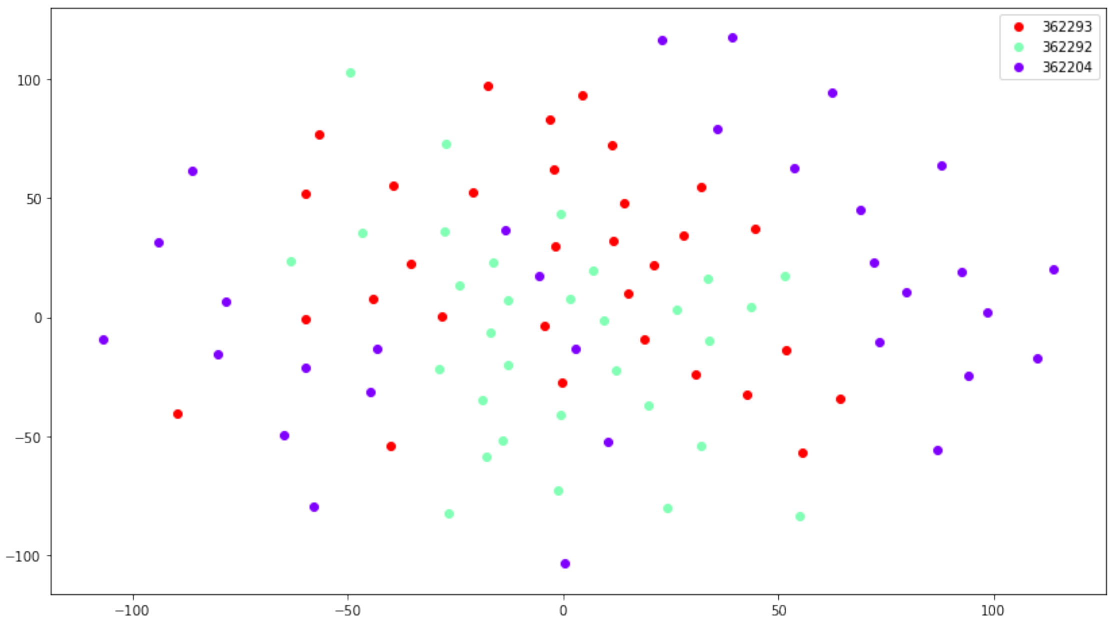


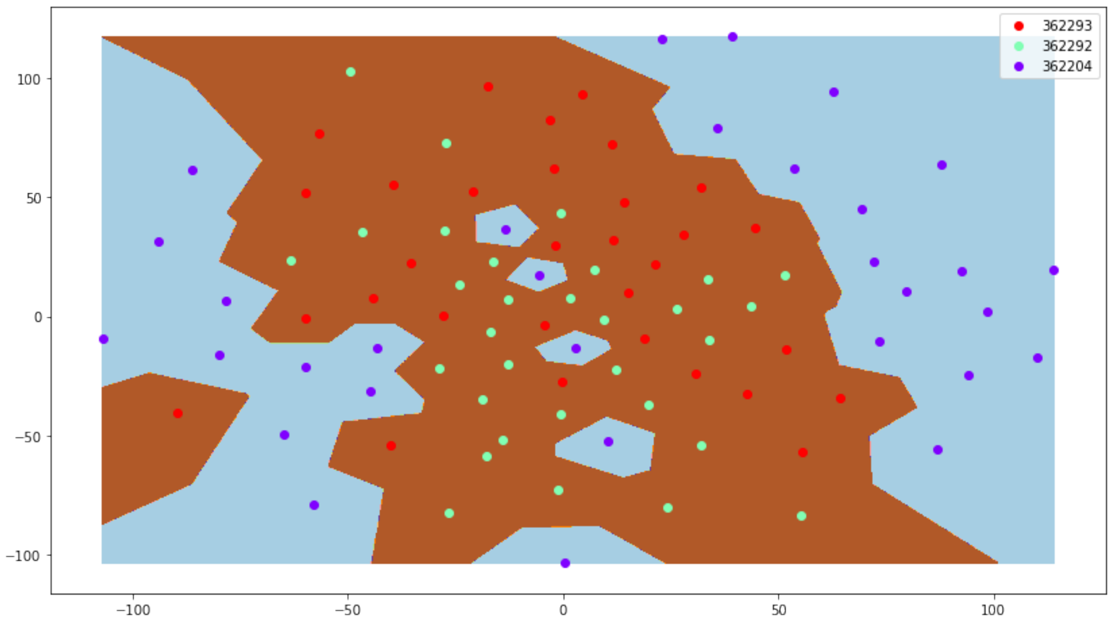
```
       precision    recall  f1-score   support

193         0.88      0.88      0.88         8
306         0.88      0.88      0.88         8
657         1.00      1.00      1.00         8
```

```
avg / total       0.92      0.92      0.92        24


Accuracy:0.916666666667
```

```
In [203]: ## Hjelpefunksjoner
          def getDeweyAndAllSubdeweys(deweynr, corpus):

              filter_col = [col for col in articles["dewey"] if col.startswith(deweynr)]
              dfWithDeweyAndSubdeweys = corpus.loc[corpus['dewey'].isin(filter_col)].copy()
              return dfWithDeweyAndSubdeweys

          def sliceDewey(x,length):
              if len(x)==length:
                  return x[:length]
              else:
                  return x[:]
          def joinDeweysDfs(*args):
              all_dfs = []
              for arg in args:
                  all_dfs.append(arg)
              joined_df = pd.concat(all_dfs)
              return joined_df
```

```
In [209]: df_362 = getDeweyAndAllSubdeweys("362", articles)
          mask = (df_362['dewey'].str.len() == 6)
          df_362 = df_362.loc[mask]

          test = dewey_test(df_362)
          test.preprocessing(numArticlesPerDewey=39, strict = True)
          test.splitToTrainingAndTest(stratified = True)
          test.fit()
          test.train()
          test.predict()
          test.tsne()
          test.plotDecisionSurface()
          test.printResults()
```

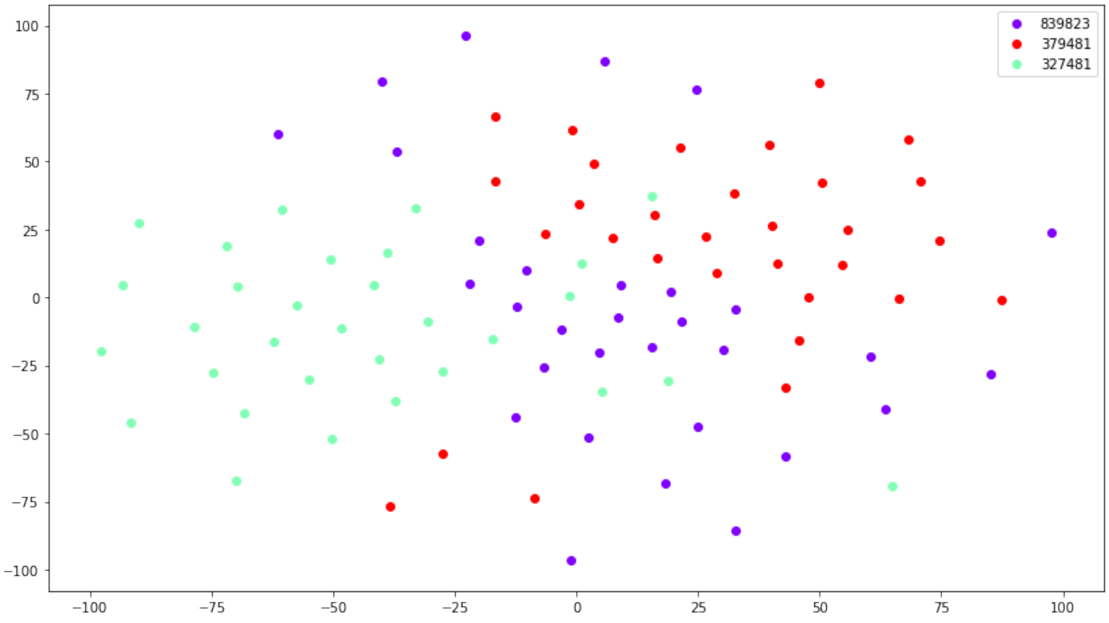


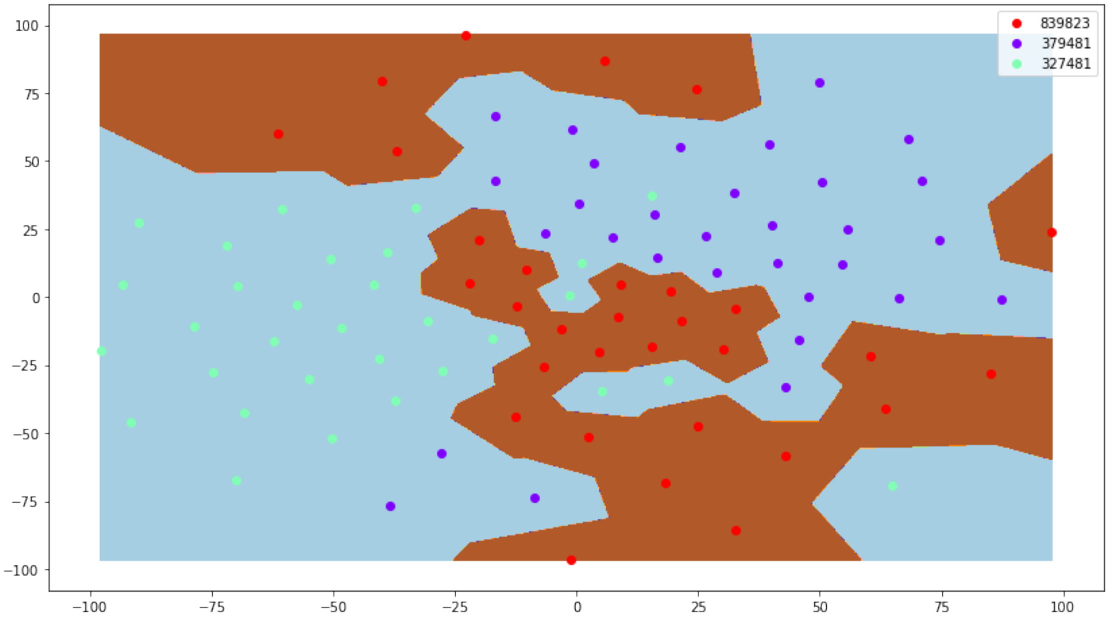


```
           precision    recall  f1-score   support

362204          0.88      0.88      0.88         8
362292          1.00      0.88      0.93         8
362293          0.89      1.00      0.94         8
```

```
avg / total       0.92      0.92      0.92        24


Accuracy:0.916666666667
```

```
In [208]: #839823 "379481"

          df_839823 = getDeweyAndAllSubdeweys("839823", articles)
          mask = (df_839823['dewey'].str.len() == 6)
          df_839823 = df_839823.loc[mask]


          df_379481 = getDeweyAndAllSubdeweys("379481", articles)
          mask = (df_379481['dewey'].str.len() == 6)
          df_379481= df_379481.loc[mask]

          df_327481  = getDeweyAndAllSubdeweys("327481", articles)
          mask = (df_327481 ['dewey'].str.len() == 6)
          df_327481 = df_327481 .loc[mask]


          joinedDF = pd.concat([df_839823, df_379481, df_327481])

          test = dewey_test(joinedDF)
          test.preprocessing(numArticlesPerDewey=39, strict = True)
          test.splitToTrainingAndTest(stratified = True)
          test.fit()
          test.train()
          test.predict()
          test.tsne()
          test.plotDecisionSurface()
          test.printResults()
```



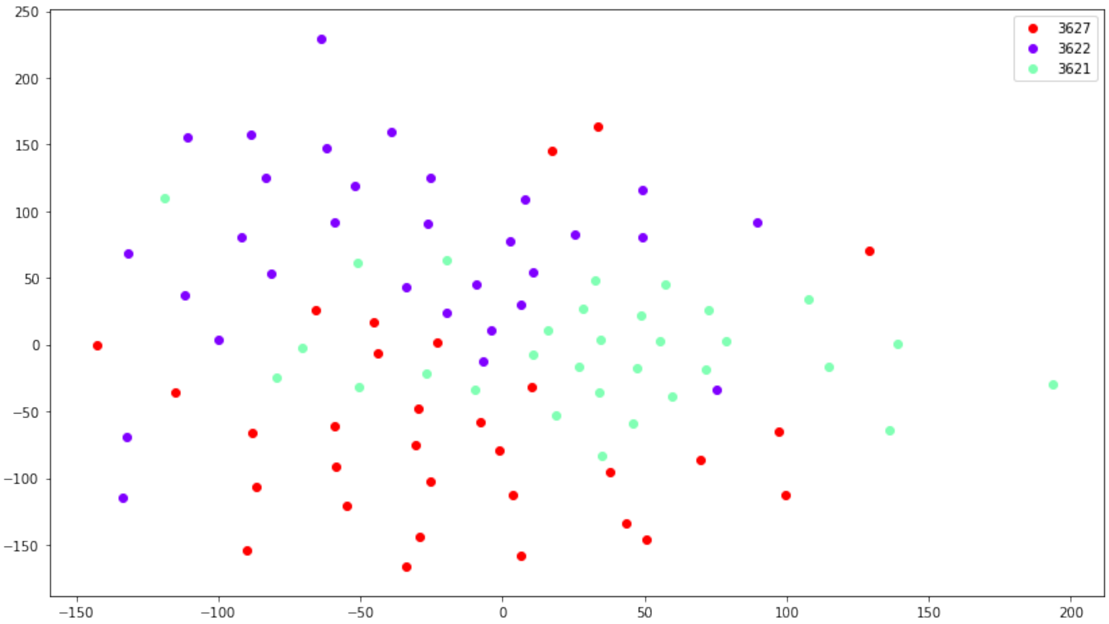


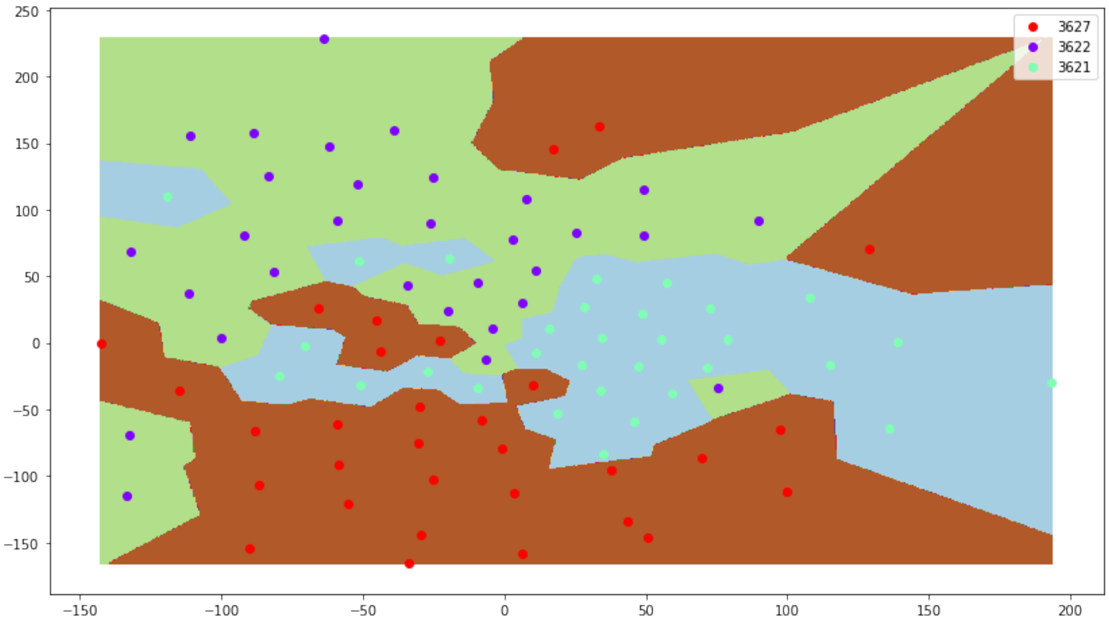
```
          precision    recall  f1-score   support

327481       1.00      1.00      1.00         8
379481       1.00      1.00      1.00         8
839823       1.00      1.00      1.00         8
```

```
avg / total       1.00      1.00      1.00        24


Accuracy:1.0
```

2.1.1 Test med 4 siffer:

```
In [211]: dewey4 = ["3621", "3622", "3627"] #"9072"]
          dewey4_df = articles.loc[articles['dewey'].isin(dewey4)].copy()

          test = dewey_test(dewey4_df)
          test.preprocessing(numArticlesPerDewey = 39, strict = True)
          test.splitToTrainingAndTest(stratified = True)
          test.fit()
          test.train()
          test.predict()
          test.tsne()
          test.plotDecisionSurface()
          test.printResults()
```

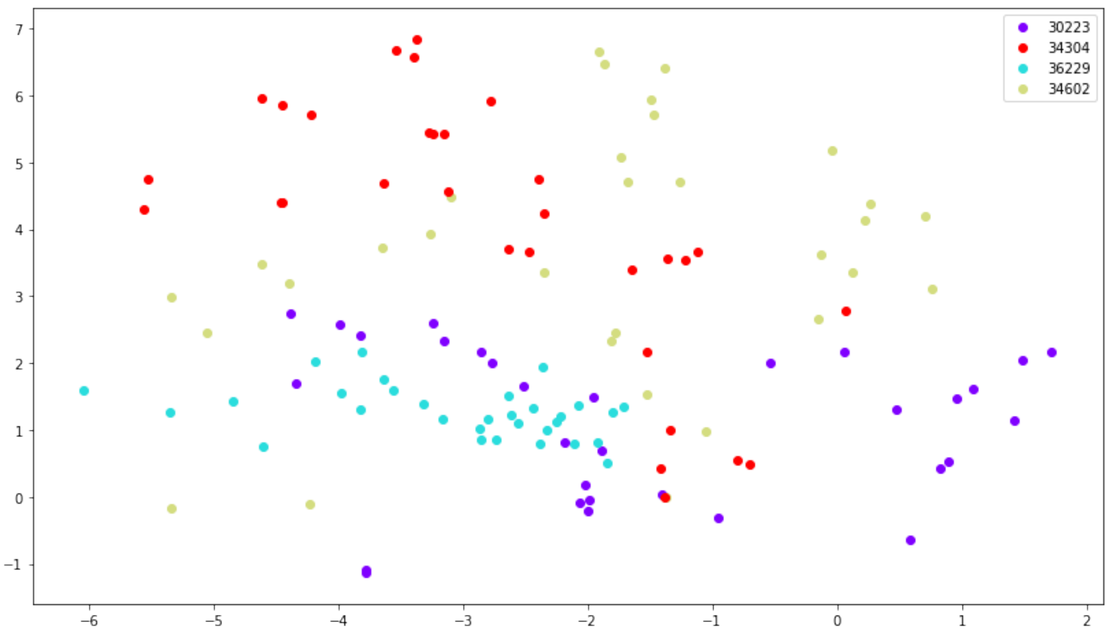


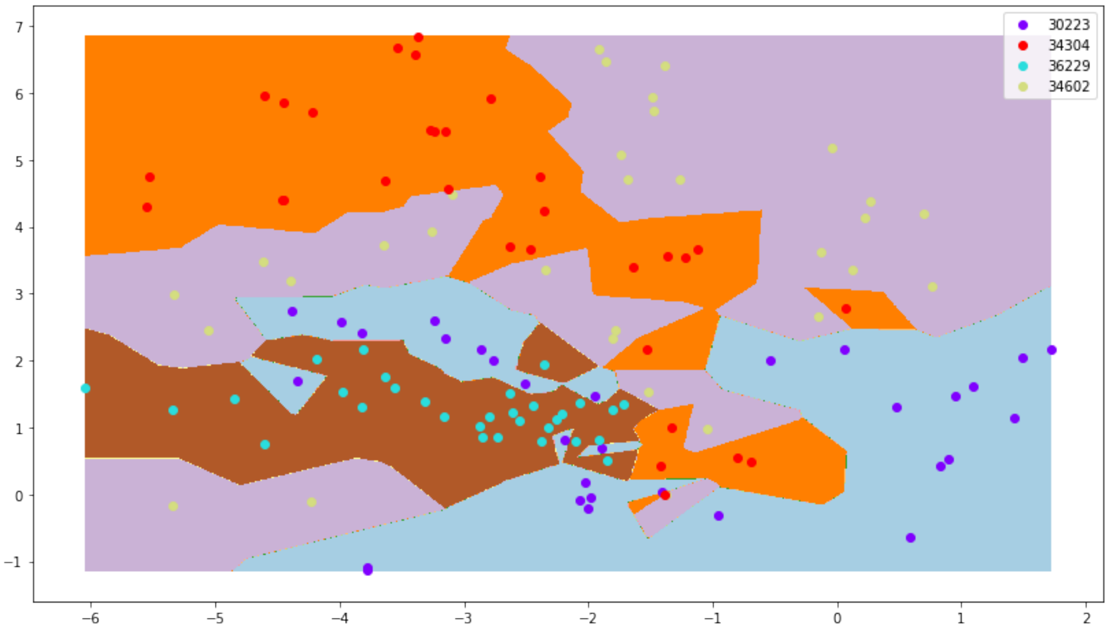


```
             precision    recall  f1-score   support

       3621       0.80      1.00      0.89         8
       3622       1.00      0.75      0.86         8
       3627       0.88      0.88      0.88         8

avg / total       0.89      0.88      0.87        24


Accuracy:0.875
```

2.1.2 Test med 5 siffer

```
In [213]: dewey5 = ["36229", "34304", "30223", "34602"]
          dewey5_df = articles.loc[articles['dewey'].isin(dewey5)].copy()

          test = dewey_test(dewey5_df)
          test.preprocessing(numArticlesPerDewey = 39, strict = True)
          test.splitToTrainingAndTest(stratified = True)
          test.fit()
          test.train()
          test.predict()
          test.tsne()
          test.plotDecisionSurface()
          test.printResults()
```



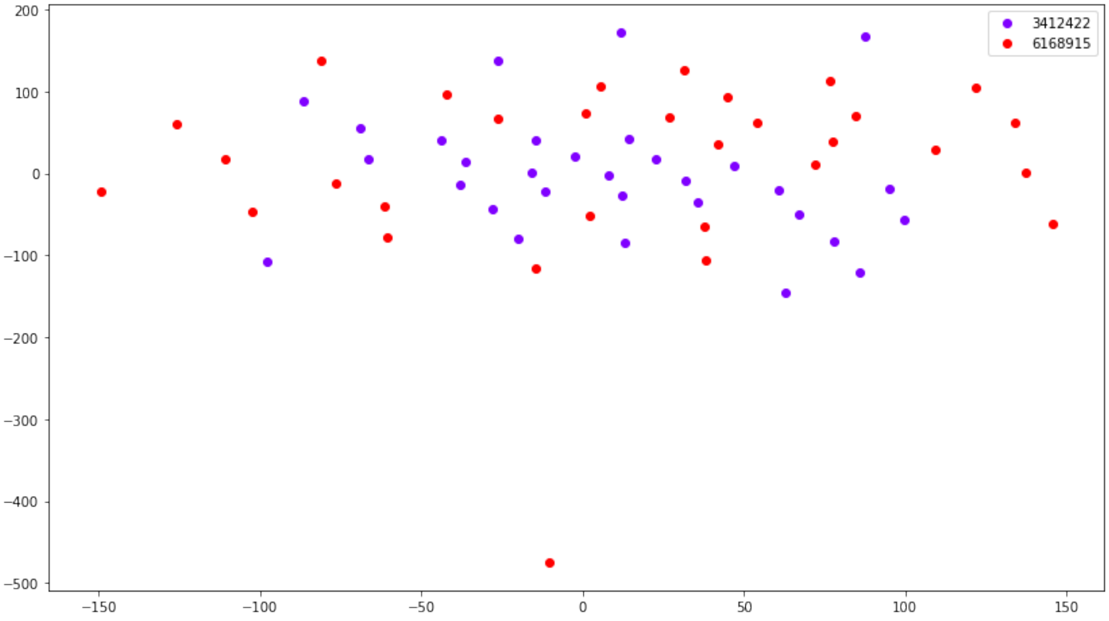


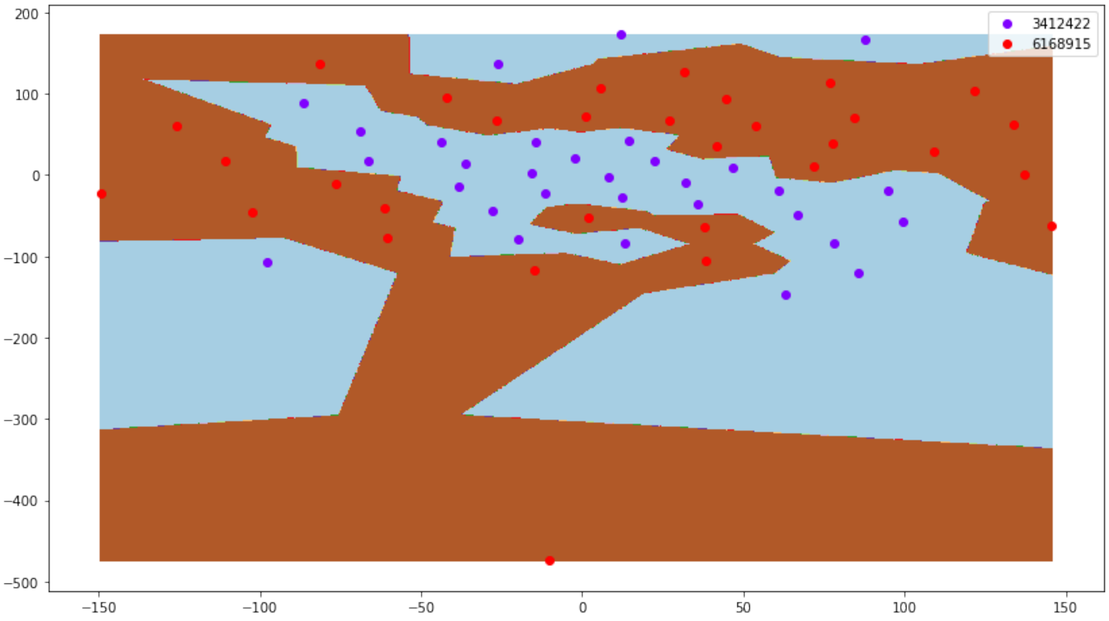
```
        precision    recall  f1-score   support

30223        0.89      1.00      0.94         8
34304        1.00      0.88      0.93         8
34602        1.00      0.88      0.93         8
```

```
      36229       0.89      1.00      0.94         8

avg / total       0.94      0.94      0.94        32


Accuracy:0.9375
```

2.1.3 Test med 7 siffer

```
In [215]: dewey7 = ["6168915", "3412422"]
          dewey7_df = articles.loc[articles['dewey'].isin(dewey7)].copy()

          test = dewey_test(dewey7_df)
          test.preprocessing(numArticlesPerDewey = 39, strict = True)
          test.splitToTrainingAndTest(stratified = True)
          test.fit()
          test.train()
          test.predict()
          test.tsne()
          test.plotDecisionSurface()
          test.printResults()
```





```
             precision    recall  f1-score   support

    3412422       1.00      1.00      1.00         8
    6168915       1.00      1.00      1.00         8

avg / total       1.00      1.00      1.00        16


Accuracy:1.0
```

```
In [ ]: dewey7_df["num_words"] = dewey7_df["text"].str.split().str.len()
```