

# Neural Networks and Deep Learning

## Assignment 1

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1. Implement Naïve Bayes method using scikit-learn library Use dataset available with name glass Use train\_test\_split to create training and testing part Evaluate the model on test part using score and Classification Report

In this question,

- The related modules has been imported and reading csv file.
- After that data has been divided into features and target set.
- Later, the data is divided into train and test data sets.
- The data is trained with the model GaussianNB.
- After training the data, need to predict using test data and calculated classification report using y test and y pred.
- Here are the screenshots after running the code

The screenshot displays a Jupyter Notebook window titled 'SAITEJAGOUKASALA700741728\_Q1'. The interface includes a top toolbar with options like File, Edit, View, Insert, Cell, Kernel, Widgets, and Help. The notebook content shows four input cells with Python code and one output cell displaying a data preview.

```
In [1]: #Question1
#Imported necessary libraries and modules required
import pandas as pd
from sklearn.model_selection import train_test_split
from sklearn.naive_bayes import GaussianNB
from sklearn import metrics

In [2]: #read the csv data download and assigned it to a variable df
df=pd.read_csv('Downloads/HWIDL_Code and Data/glass.csv')

In [3]: #checking what data is present
df

Out[3]:
```

	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe	Type
0	1.52101	13.64	4.49	1.10	71.78	0.06	8.75	0.00	0.0	1
1	1.51761	13.89	3.60	1.36	72.73	0.48	7.83	0.00	0.0	1
2	1.51618	13.53	3.55	1.54	72.99	0.39	7.78	0.00	0.0	1
3	1.51766	13.21	3.69	1.29	72.61	0.57	8.22	0.00	0.0	1
4	1.51742	13.27	3.62	1.24	73.08	0.55	8.07	0.00	0.0	1
...	...	...	...	...	...	...	...	...	...	...
209	1.51623	14.14	0.00	2.88	72.61	0.08	9.18	1.06	0.0	7
210	1.51685	14.92	0.00	1.99	73.06	0.00	8.40	1.59	0.0	7
211	1.52065	14.36	0.00	2.02	73.42	0.00	8.44	1.64	0.0	7
212	1.51651	14.38	0.00	1.94	73.61	0.00	8.48	1.57	0.0	7
213	1.51711	14.23	0.00	2.08	73.36	0.00	8.62	1.67	0.0	7

214 rows x 10 columns

```
In [4]: #splitting data into features and target variable
X = df.drop('Type',axis=1)
print(X)
```

	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe
0	1.52101	13.64	4.49	1.10	71.78	0.06	8.75	0.00	0.0
1	1.51761	13.89	3.60	1.36	72.73	0.48	7.83	0.00	0.0
2	1.51618	13.53	3.55	1.54	72.99	0.39	7.78	0.00	0.0
3	1.51766	13.21	3.69	1.29	72.61	0.57	8.22	0.00	0.0
4	1.51742	13.27	3.62	1.24	73.08	0.55	8.07	0.00	0.0

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212 1.51601 14.38 0.00 1.94 73.61 0.00 8.48 1.67 0.0 /  
213 1.51711 14.23 0.00 2.08 73.36 0.00 8.62 1.67 0.0 7  
214 rows x 10 columns

In [4]: #splitting data into features and target variable  
X = df.drop("Type",axis=1)  
print(X)

```
   RI      Na      Mg      Al      Si      K      Ca      Ba      Fe  
0  1.52101 13.64  4.49  1.10  71.78  0.06  8.75  0.00  0.0  
1  1.51761 13.89  3.60  1.36  72.73  0.48  7.83  0.00  0.0  
2  1.51618 13.53  3.55  1.54  72.99  0.39  7.78  0.00  0.0  
3  1.51766 13.21  3.69  1.29  72.61  0.57  8.22  0.00  0.0  
4  1.51742 13.27  3.62  1.24  73.08  0.55  8.07  0.00  0.0  
..      ..      ..      ..      ..      ..      ..      ..      ..  
209 1.51623 14.14  0.00  2.88  72.61  0.00  9.18  1.06  0.0  
210 1.51685 14.92  0.00  1.99  73.06  0.00  8.40  1.59  0.0  
211 1.52065 14.36  0.00  2.02  73.42  0.00  8.44  1.64  0.0  
212 1.51651 14.38  0.00  1.94  73.61  0.00  8.48  1.57  0.0  
213 1.51711 14.23  0.00  2.08  73.36  0.00  8.62  1.67  0.0  
[214 rows x 9 columns]
```

In [5]: #splitting data into features and target variable  
y = df["Type"]  
print(y)

```
0    1  
1    1  
2    1  
3    1  
4    1  
..  
209  7  
210  7  
211  7  
212  7  
213  7  
Name: Type, Length: 214, dtype: int64
```

In [6]: #splitting data into train and test sets  
X\_train, X\_test, y\_train, y\_test = train\_test\_split(X, y, test\_size=0.4, random\_state=1)

In [7]: #training the model on training set  
model = GaussianNB()  
model.fit(X\_train, y\_train)

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In [7]: #training the model on training set  
model = GaussianNB()  
model.fit(X\_train, y\_train)

Out[7]: GaussianNB  
GaussianNB()

In [8]: #predicting based on test set  
y\_pred = model.predict(X\_test)

In [9]: #measuring accuracy using test data and predicted data  
accuracy = metrics.accuracy\_score(y\_test, y\_pred)  
print("Score:", accuracy)

Score: 0.27906976744186046

In [10]: #printing classification report  
print("Classification Report:\n", metrics.classification\_report(y\_test, y\_pred))

```
Classification Report:  
              precision    recall  f1-score   support  
  
     1               0.00        0.00        0.00         33  
     2               0.44        0.15        0.23         26  
     3               0.11        0.75        0.19          8  
     5               0.25        0.50        0.33          4  
     6               0.50        0.50        0.50          2  
     7               1.00        0.85        0.92         13  
  
   accuracy                   0.28         86  
  macro avg                   0.38         86  
 weighted avg                   0.32         86
```

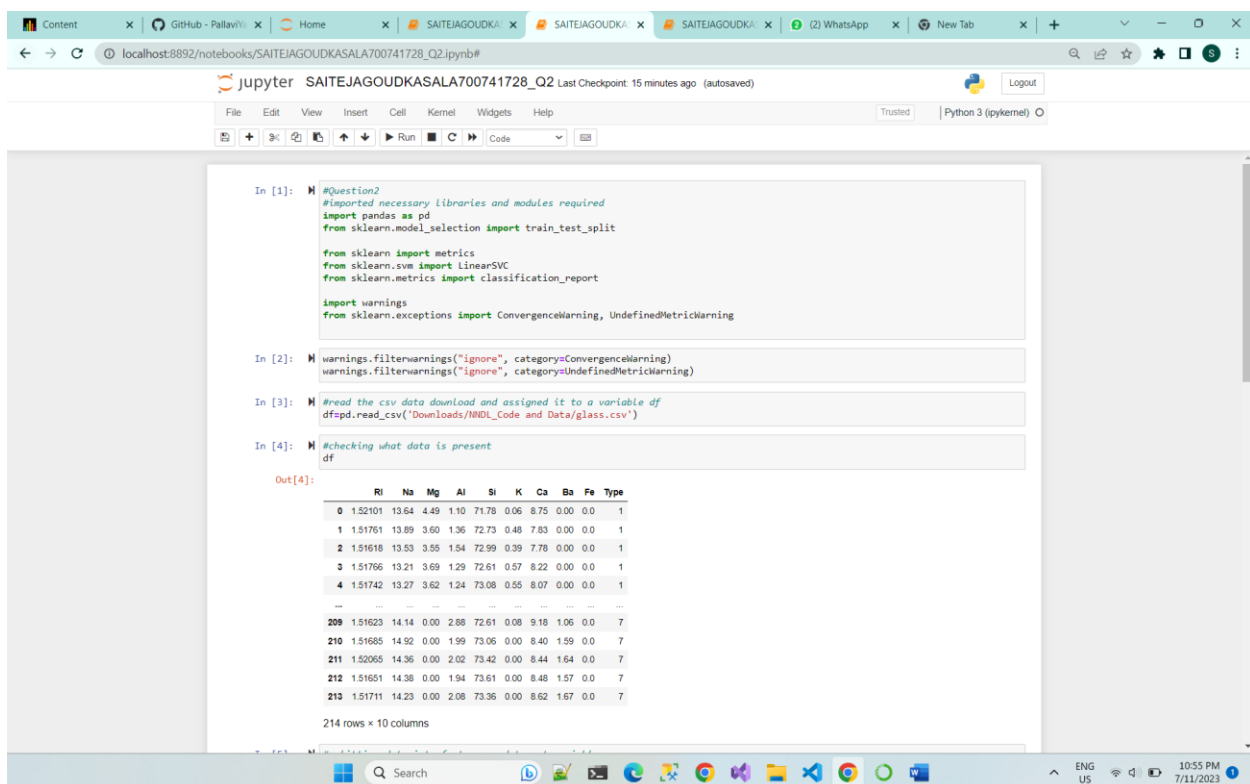
In [ ]:

2. Implement linear SVM method using scikit-learn Use the same dataset above Use train\_test\_split to create training and testing part Evaluate the model on test part using score and Which algorithm you got better accuracy? Can you justify why?

In this question,

- The related modules has been imported and read csv file.
- After that data has been divided into features and target set.
- Later, the data is divided into train and test data sets. The data is trained with the model Linear SVM.
- After training the data, need to predict using test data. And, calculated classification report using y test and y pred.
- It is observed that this has better accuracy score compared to Naïve Bayes method.

Here are the screenshots below running the code.



```
In [1]: #Question2
#Imported necessary libraries and modules required
import pandas as pd
from sklearn.model_selection import train_test_split

from sklearn import metrics
from sklearn.svm import LinearSVC
from sklearn.metrics import classification_report

import warnings
from sklearn.exceptions import ConvergenceWarning, UndefinedMetricWarning

In [2]: warnings.filterwarnings("ignore", category=ConvergenceWarning)
warnings.filterwarnings("ignore", category=UndefinedMetricWarning)

In [3]: #read the csv data download and assigned it to a variable df
df=pd.read_csv('Downloads/NDL Code and Data/glass.csv')

In [4]: #checking what data is present
df

Out[4]:
```

	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe	Type
0	1.52101	13.64	4.49	1.10	71.78	0.06	8.75	0.00	0.0	1
1	1.51761	13.89	3.60	1.36	72.73	0.48	7.83	0.00	0.0	1
2	1.51618	13.53	3.55	1.54	72.99	0.39	7.78	0.00	0.0	1
3	1.51766	13.21	3.69	1.29	72.61	0.57	8.22	0.00	0.0	1
4	1.51742	13.27	3.62	1.24	73.08	0.55	8.07	0.00	0.0	1
...	...	...	...	...	...	...	...	...	...	...
209	1.51623	14.14	0.00	2.88	72.61	0.08	9.18	1.06	0.0	7
210	1.51685	14.92	0.00	1.99	73.06	0.00	8.40	1.59	0.0	7
211	1.52065	14.36	0.00	2.02	73.42	0.00	8.44	1.64	0.0	7
212	1.51651	14.38	0.00	1.94	73.61	0.00	8.48	1.57	0.0	7
213	1.51711	14.23	0.00	2.08	73.36	0.00	8.62	1.67	0.0	7

214 rows x 10 columns

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214 rows x 10 columns

```
In [5]: #splitting data into features and target variable
X = df.drop('Type',axis=1)
print(X)
```

	RI	Na	Mg	Al	Si	K	Ca	Ba	Fe
0	1.52101	13.64	4.49	1.10	71.78	0.06	8.75	0.00	0.0
1	1.51761	13.89	3.60	1.36	72.73	0.48	7.83	0.00	0.0
2	1.51618	13.53	3.55	1.54	72.99	0.39	7.78	0.00	0.0
3	1.51766	13.21	3.69	1.29	72.61	0.57	8.22	0.00	0.0
4	1.51742	13.27	3.62	1.24	73.08	0.55	8.07	0.00	0.0
...	...	...	...	...	...	...	...	...	...
209	1.51623	14.14	0.00	2.88	72.61	0.08	9.18	1.06	0.0
210	1.51685	14.52	0.00	1.99	73.06	0.00	8.40	1.59	0.0
211	1.52065	14.36	0.00	2.02	73.42	0.00	8.44	1.64	0.0
212	1.51651	14.38	0.00	1.94	73.61	0.00	8.48	1.57	0.0
213	1.51711	14.23	0.00	2.08	73.36	0.00	8.62	1.67	0.0

[214 rows x 9 columns]

```
In [6]: #splitting data into features and target variable
y = df['Type']
print(y)
```

	Type
0	1
1	1
2	1
3	1
4	1
...	...
209	7
210	7
211	7
212	7
213	7

Name: Type, Length: 214, dtype: int64

```
In [7]: #splitting data into train and test sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.4, random_state=1)
```

```
In [8]: svm = LinearSVC(random_state=38)
svm.fit(X_train, y_train)
```

```
Out[8]:
```

	LinearSVC
1	LinearSVC(random_state=38)

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localhost:8892/notebooks/SAITEJAGOUDKASALA700741728\_Q2.ipynb#

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```
213 7
212 7
213 7
Name: Type, Length: 214, dtype: int64
```

```
In [7]: #splitting data into train and test sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=0.4, random_state=1)
```

```
In [8]: svm = LinearSVC(random_state=38)
svm.fit(X_train, y_train)
```

```
Out[8]:
```

	LinearSVC
1	LinearSVC(random_state=38)

```
In [9]: score = svm.score(X_test, y_test)
y_pred = svm.predict(X_test)
report = classification_report(y_test, y_pred)
```

```
In [10]: print(f"Accuracy score: ", score)
print(f"Classification report:\n", report)
```

Accuracy score: 0.5

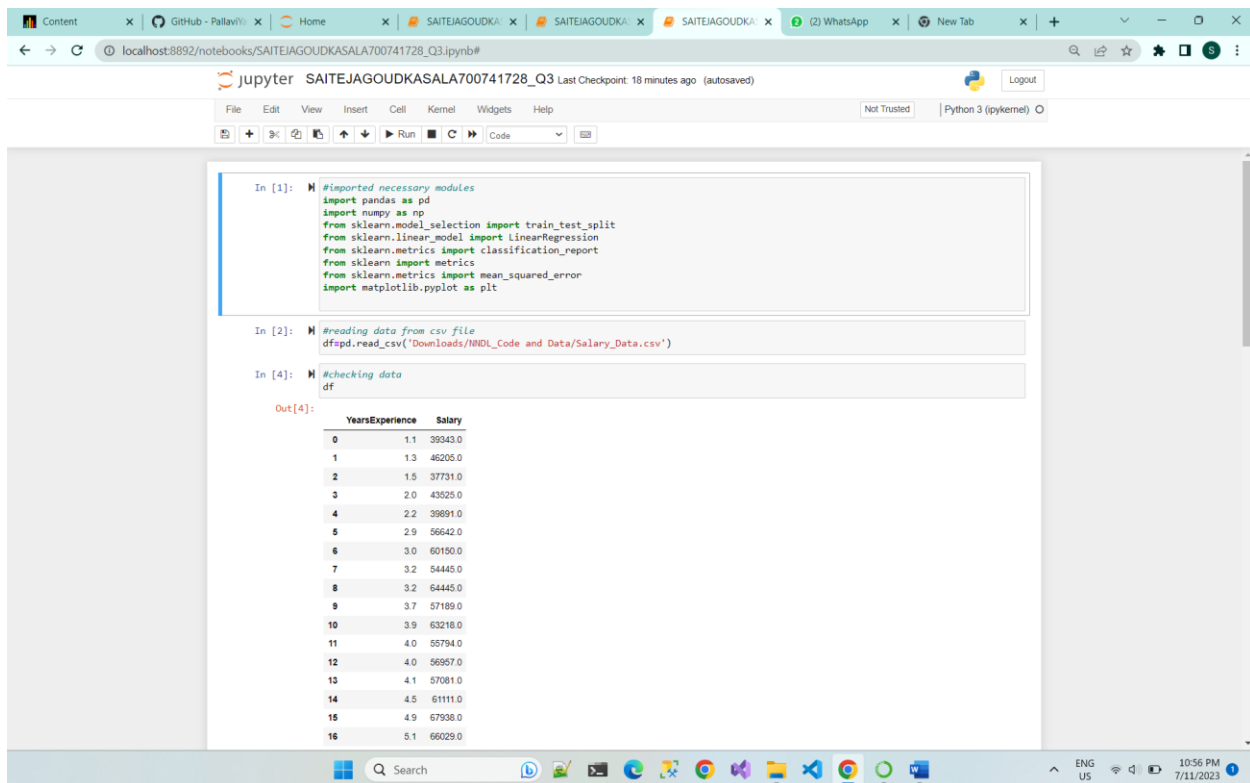
Classification report:

	precision	recall	f1-score	support
1	0.79	0.33	0.47	33
2	0.38	0.65	0.48	26
3	0.00	0.00	0.00	8
5	0.43	0.75	0.55	4
6	0.00	0.00	0.00	2
7	0.63	0.92	0.75	13
accuracy			0.50	86
macro avg	0.37	0.44	0.37	86
weighted avg	0.53	0.50	0.46	86

3. Implement Linear Regression using scikit-learn a) Import the given “Salary\_Data.csv” b) Split the data in train\_test partitions, such that 1/3 of the data is reserved as test subset. c) Train and predict the model. d) Calculate the mean\_squared error. e) Visualize both train and test data using scatter plot.

- Here salary data has been used.
- In the first step imported all necessary modules and splitted data according to the test partition given.
- After that using Linear Regression trained the model and calculated mean squared error.
- For visualization used matplotlib module and through scatter plot the visualization displayed.

Here are the screenshots below



The screenshot shows a Jupyter Notebook interface with the following code and output:

```
In [1]: #imported necessary modules
import pandas as pd
import numpy as np
from sklearn.model_selection import train_test_split
from sklearn.linear_model import LinearRegression
from sklearn.metrics import classification_report
from sklearn.metrics import mean_squared_error
import matplotlib.pyplot as plt
```

```
In [2]: #reading data from csv file
df=pd.read_csv("Downloads/NINDL_Code and Data/Salary_Data.csv")
```

```
In [4]: #checking data
df
```

Out[4]:

	YearsExperience	Salary
0	1.1	39343.0
1	1.3	46205.0
2	1.5	37731.0
3	2.0	43525.0
4	2.2	39891.0
5	2.9	56642.0
6	3.0	60150.0
7	3.2	54445.0
8	3.2	64445.0
9	3.7	57189.0
10	3.9	63218.0
11	4.0	55794.0
12	4.0	56957.0
13	4.1	57081.0
14	4.5	61111.0
15	4.9	67938.0
16	5.1	66029.0

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```
In [6]: #splitting data into feature and target set
X=df[['YearsExperience']];

In [7]: #splitting data into feature and target set
y=df[['Salary']];

In [8]: #splitting data into train and test sets
X_train, X_test, y_train, y_test = train_test_split(X, y, test_size=1/3, random_state=1)

In [9]: #using Linear Regression model on training set
from sklearn.linear_model import LinearRegression
r=LinearRegression()
r.fit(X_train,y_train)

Out[9]: r: LinearRegression
LinearRegression()

In [10]: #predicting based on test data
y_pred=r.predict(X_test)

In [11]: #calculating mean_squared_error
mean_squared_errors=metrics.mean_squared_error(y_test,y_pred)

In [12]: #printing mean_squared_error
print(mean_squared_error)

37496296.6187984

In [13]: #plt.scatter(X_train, y_train, colors='Blue')
plt.scatter(X_test, y_test, colors='Green')
plt.plot(X_train, r.predict(X_train), colors='Red')
plt.title('Salary vs Experience')
plt.xlabel('Years of Experience')
plt.ylabel('Salary')
plt.show()
```

Salary vs Experience

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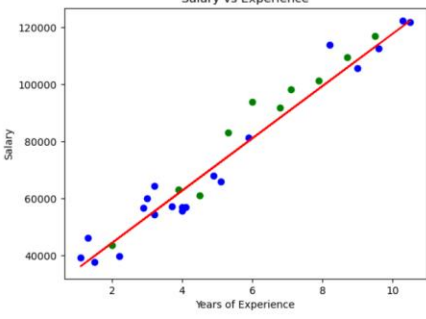
```
In [11]: #calculating mean_squared_error
mean_squared_errors=metrics.mean_squared_error(y_test,y_pred)

In [12]: #printing mean_squared_error
print(mean_squared_error)

37496296.6187984

In [13]: #plt.scatter(X_train, y_train, colors='Blue')
plt.scatter(X_test, y_test, colors='Green')
plt.plot(X_train, r.predict(X_train), colors='Red')
plt.title('Salary vs Experience')
plt.xlabel('Years of Experience')
plt.ylabel('Salary')
plt.show()
```

Salary vs Experience



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Github link:

<https://github.com/sxk17280/NeuralAssignment1>

Video Link:

[https://github.com/sxk17280/NeuralAssignment1/blob/main/SAITEJAGLOUD\\_KASALA\\_700741728.mp4](https://github.com/sxk17280/NeuralAssignment1/blob/main/SAITEJAGLOUD_KASALA_700741728.mp4)