TUGAS LAB IF540 MACHINE LEARNING

WEEK 04 : Linear Discriminant Analysis

Semester Ganjil 2022/2023

In [1]:
```
import datetime
import uuid

# Fill in your name and NIM
myName = "Christopher Darren"
myNIM = "00000054804"
```

In [2]:
```
myDate = datetime.datetime.now()
myDevice = str(uuid.uuid1())

# Header
print("Name: \t\t{}".format(myName))
print("NIM: \t\t{}".format(myNIM))
print("Start: \t\t{}".format(myDate))
print("Device ID: \t{}".format(myDevice))
```

```
Name:           Christopher Darren
NIM:            00000054804
Start:          2023-03-02 10:06:53.092746
Device ID:      48551295-b8a7-11ed-9cd4-f02f74a116e8
```

Dataset yang dipakai:

1. Drug – sumber : https://www.kaggle.com/datasets/prathamtripathi/drug-classification
2. Glass – sumber :https://www.kaggle.com/datasets/prashant111/glass-identification-dataset?select=glass_data.csv

Hasil kerja

Part 1.Data Preprocessing

1.1 import libraries

In [2]:
```
import numpy as np
import pandas as pd
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn import utils
```

1.2 Import the dataset

In [3]:
```
dataset = pd.read_csv(r'D:\SEMESTER 4\IF540 Machine Learning\LAB\week4\glass_data.csv')
X = dataset.iloc[:, :10].values
Y = dataset.iloc[:, 10].values
```

In [4]:
```
dataset.head(5)
```

Out[4]:

	column_a	column_b	column_c	column_d	column_e	column_f	column_g	column_h	column_i	column_j	column_k
0	1	1.52101	13.64	4.49	1.10	71.78	0.06	8.75	0.0	0.0	1
1	2	1.51761	13.89	3.60	1.36	72.73	0.48	7.83	0.0	0.0	1
2	3	1.51618	13.53	3.55	1.54	72.99	0.39	7.78	0.0	0.0	1
3	4	1.51766	13.21	3.69	1.29	72.61	0.57	8.22	0.0	0.0	1
4	5	1.51742	13.27	3.62	1.24	73.08	0.55	8.07	0.0	0.0	1

In [5]:
```
dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 214 entries, 0 to 213
Data columns (total 11 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   column_a  214 non-null    int64
 1   column_b  214 non-null    float64
 2   column_c  214 non-null    float64
 3   column_d  214 non-null    float64
 4   column_e  214 non-null    float64
 5   column_f  214 non-null    float64
 6   column_g  214 non-null    float64
 7   column_h  214 non-null    float64
 8   column_i  214 non-null    float64
 9   column_j  214 non-null    float64
 10  column_k  214 non-null    int64
dtypes: float64(9), int64(2)
memory usage: 18.5 KB
```

In [6]:
```
dataset.describe()
```

Out[6]:

	column_a	column_b	column_c	column_d	column_e	column_f	column_g	column_h	column_i	column_j	column_k
count	214.000000	214.000000	214.000000	214.000000	214.000000	214.000000	214.000000	214.000000	214.000000	214.000000	214.000000
mean	107.500000	1.518365	13.407850	2.684533	1.444907	72.650935	0.497056	8.956963	0.175047	0.057009	2.780374
std	61.920648	0.003037	0.816604	1.442408	0.499270	0.774546	0.652192	1.423153	0.497219	0.097439	2.103739
min	1.000000	1.511150	10.730000	0.000000	0.290000	69.810000	0.000000	5.430000	0.000000	0.000000	1.000000
25%	54.250000	1.516522	12.907500	2.115000	1.190000	72.280000	0.122500	8.240000	0.000000	0.000000	1.000000
50%	107.500000	1.517680	13.300000	3.480000	1.360000	72.790000	0.555000	8.600000	0.000000	0.000000	2.000000
75%	160.750000	1.519157	13.825000	3.600000	1.630000	73.087500	0.610000	9.172500	0.000000	0.100000	3.000000
max	214.000000	1.533930	17.380000	4.490000	3.500000	75.410000	6.210000	16.190000	3.150000	0.510000	7.000000

In [7]:
```
dataset.shape
```

Out[7]:
```
(214, 11)
```

In [8]:
```
#checking null

dataset.isnull().sum()
```

Out[8]:
```
column_a    0
column_b    0
column_c    0
column_d    0
column_e    0
column_f    0
column_g    0
column_h    0
column_i    0
column_j    0
column_k    0
dtype: int64
```

In [9]:
```
def clean_dataset(dataset):
    assert isinstance(dataset, pd.DataFrame), "dataset needs to be a pd.DataFrame"
    dataset.dropna(inplace=True)
    indices_to_keep = ~dataset.isin([np.nan, np.inf, -np.inf]).any(axis=1)
    return dataset[indices_to_keep].astype(np.float64)
```

In [10]:
```
#get rid of infinite values.
dataset.replace([np.inf, -np.inf], np.nan, inplace=True)
```

In [11]:
```
#fill missing values
dataset.fillna(0, inplace=True)
```

In [12]:
```
dataset.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 214 entries, 0 to 213
Data columns (total 11 columns):
 #   Column    Non-Null Count  Dtype
---  ------    --------------  -----
 0   column_a  214 non-null    int64
 1   column_b  214 non-null    float64
 2   column_c  214 non-null    float64
 3   column_d  214 non-null    float64
 4   column_e  214 non-null    float64
 5   column_f  214 non-null    float64
 6   column_g  214 non-null    float64
 7   column_h  214 non-null    float64
 8   column_i  214 non-null    float64
 9   column_j  214 non-null    float64
 10  column_k  214 non-null    int64
dtypes: float64(9), int64(2)
memory usage: 18.5 KB
```

In [13]:
```
#converting
#dataset['age'] = dataset['age'].astype(int)


#dataset["age"] = [float(str(i).replace("-", "+", "a+b")) for i in dataset["age"]]


#dataset['age'] = pd.to_numeric(dataset['age'])
```

In [14]:
```
#dataset_new = dataset.drop('age', axis=1)
#dataset_new.head(2)
```

In [15]:
```
#del dataset['age']
```

In [16]:
```
#X_ = dataset.iloc[:, :13].values
#Y_ = dataset.iloc[:, 13].values
```

1.3 Split the dataset for test and train

In [17]:
```
# splitting the dataset into train set and test set
from sklearn.model_selection import train_test_split
X_train, X_test, y_train, y_test = train_test_split(X,Y, test_size=0.2, random_state=0)
```

In [18]:
```
#feature Feature Scaling is the most important part of data preprocessing. If we see our
#dataset then some attribute contains information in Numeric value some value very high andsome
#are very low if we see the age and estimated salary.

from sklearn.preprocessing import StandardScaler
sc_X = StandardScaler()
X_train = sc_X.fit_transform(X_train)

X_test = sc_X.transform(X_test)
```

Part 2. Building a Linear Discriminant analysis for Dimensionality Reduction

2.1 Import the Libraries

In [19]:
```
# import LDA model
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis as LDA
```

2.2 Initialize our model

In [20]:
```
# initialize the LDA
lda = LDA(n_components = 2)
```

2.3 Fitting the Model

In [21]:
```
# fitting the LDA model
X_test = lda.fit_transform(X_test, y_test)
X_train = lda.transform(X_train)
```

3.1 Import the Libraries

In [22]:
```
# import the Logistic Regression model from sklearn using the 2 variances with
#,!the help of LDA

from sklearn.linear_model import LogisticRegression
```

3.2 Initialize our Logistic Regression model

In [23]:
```
LG=LogisticRegression(random_state=0)
```

3.3 Fitting the Model

In [24]:
```
# fit the Logistic Regression model
LG.fit(X_train,y_train)
```

Out[24]:
```
LogisticRegression(random_state=0)
```

Part 4. Making a Prediction and Visualize the result

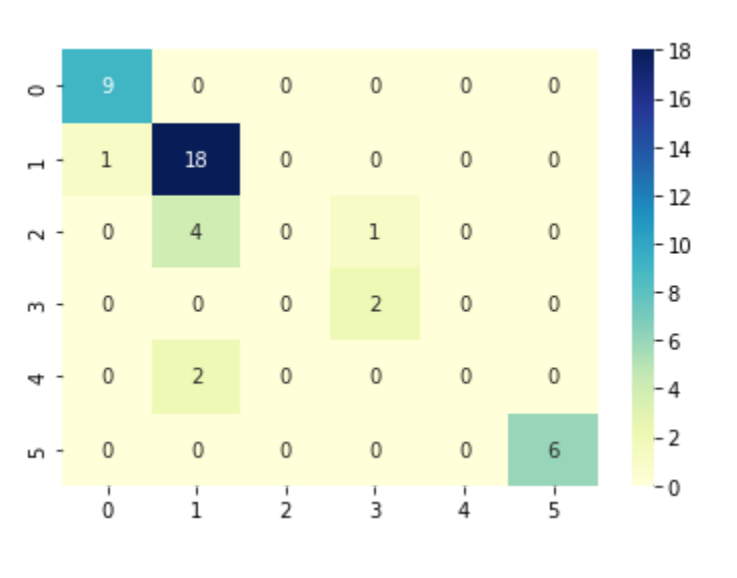
4.1 Predict the test set Result

In [25]:
```
# predict the Logistic regression model
y_pred=LG.predict(X_test)
```

4.2 Confusion Matrix

In [26]:
```
# making a confusion metrics
from sklearn.metrics import confusion_matrix
confusion_matrix=confusion_matrix(y_test,y_pred)
sns.heatmap(confusion_matrix, annot=True, cmap="YlGnBu")
```

Out[26]:
```
<AxesSubplot:>
```



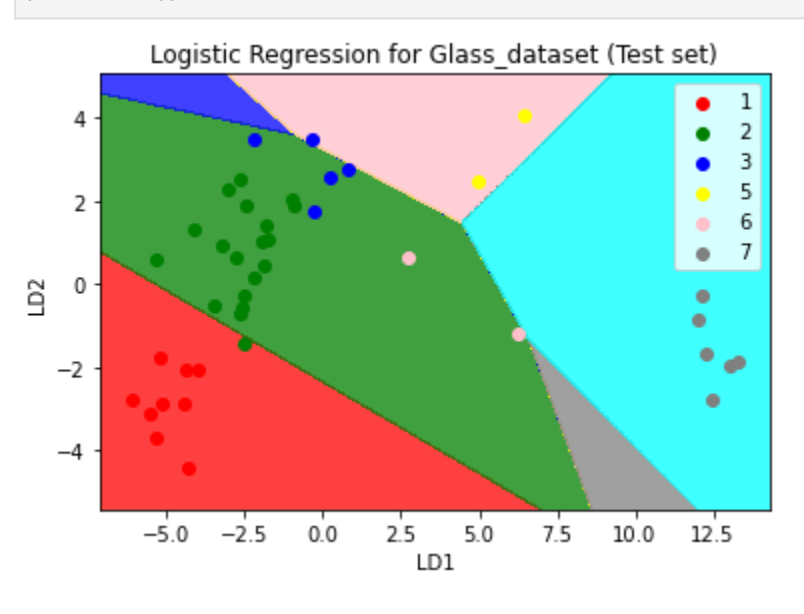
4.3 Visualize our Test Set Result

In [27]:
```
#Visualising the Test set results

from matplotlib.colors import ListedColormap
X_set, y_set = X_test, y_test

X1, X2 = np.meshgrid(np.arange(start = X_set[:, 0].min() - 1, stop = X_set[:, 0].
                              max() + 1, step = 0.01),
                    np.arange(start = X_set[:, 1].min() - 1, stop = X_set[:, 1].
                              max() + 1, step = 0.01))

plt.contourf(X1, X2, LG.predict(np.array([X1.ravel(), X2.ravel()]).T).reshape(X1.shape),
            alpha = 0.75, cmap = ListedColormap(('red','green','blue','yellow','pink','grey','cyan')))
plt.xlim(X1.min(), X1.max())
plt.ylim(X2.min(), X2.max())
for i, j in enumerate(np.unique(y_set)):
    plt.scatter(X_set[y_set == j, 0], X_set[y_set == j, 1],
               color = ListedColormap(('red','green','blue','yellow','pink','grey','cyan'))(i), label = j)
plt.title('Logistic Regression for Glass_dataset (Test set)')
plt.xlabel('LD1')
plt.ylabel('LD2')
plt.legend()
plt.show()
```



Dataset 2 TUGAS MANDIRI

1.2.1 Import the dataset

In [28]:
```
dataset2 = pd.read_csv(r'D:\SEMESTER 4\IF540 Machine Learning\LAB\week4\drug200.csv')
Xnew = dataset2.iloc[:, :5].values
Ynew = dataset2.iloc[:, 5].values
dataset2.head(5)
```

Out[28]:

	Age	Sex	BP	Cholesterol	Na_to_K	Drug
0	23	F	HIGH	HIGH	25.355	DrugY
1	47	M	LOW	HIGH	13.093	drugC
2	47	M	LOW	HIGH	10.114	drugC
3	28	F	NORMAL	HIGH	7.798	drugX
4	61	F	LOW	HIGH	18.043	DrugY

In [29]:
```
dataset2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 6 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   Age          200 non-null    int64
 1   Sex          200 non-null    object
 2   BP           200 non-null    object
 3   Cholesterol  200 non-null    object
 4   Na_to_K      200 non-null    float64
 5   Drug         200 non-null    object
dtypes: float64(1), int64(1), object(4)
memory usage: 9.5+ KB
```

In [30]:
```
dataset2.shape
```

Out[30]:
```
(200, 6)
```

In [31]:
```
dataset2.describe()
```

Out[31]:

	Age	Na_to_K
count	200.000000	200.000000
mean	44.315000	16.084485
std	16.544315	7.223956
min	15.000000	6.269000
25%	31.000000	10.445500
50%	45.000000	13.936500
75%	58.000000	19.380000
max	74.000000	38.247000

In [32]:
```
#checking null

dataset2.isnull().sum()
```

Out[32]:
```
Age            0
Sex            0
BP             0
Cholesterol    0
Na_to_K        0
Drug           0
dtype: int64
```

In [33]:
```
# displaying the datatypes
display(dataset2.dtypes)

# converting 'Weight' and 'Salary' from float to int
dataset2['Na_to_K'] = dataset2['Na_to_K'].astype(str)

# displaying the datatypes
display(dataset2.dtypes)
```

```
Age              int64
Sex             object
BP              object
Cholesterol     object
Na_to_K        float64
Drug            object
dtype: object
Age             int64
Sex            object
BP             object
Cholesterol    object
Na_to_K        object
Drug           object
dtype: object
```

In [34]:
```
#encoding

def encode_data(feature_name):
    '''
    This function takes feature name as a parameter and returns mapping dictionary to replace(or map) categorical data with
    '''
    mapping_dict = {}

    unique_values = list(dataset2[feature_name].unique())


    for idx in range(len(unique_values)):

        mapping_dict[unique_values[idx]] = idx

    return mapping_dict

dataset2['Sex'].replace(encode_data('Sex'), inplace = True)

dataset2['BP'].replace(encode_data('BP'), inplace = True)

dataset2['Cholesterol'].replace(encode_data('Cholesterol'), inplace = True)

dataset2['Drug'].replace(encode_data('Drug'), inplace = True)
```

In [35]:
```
dataset2.info()
```

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 200 entries, 0 to 199
Data columns (total 6 columns):
 #   Column       Non-Null Count  Dtype
---  ------       --------------  -----
 0   Age          200 non-null    int64
 1   Sex          200 non-null    int64
 2   BP           200 non-null    int64
 3   Cholesterol  200 non-null    int64
 4   Na_to_K      200 non-null    object
 5   Drug         200 non-null    int64
dtypes: int64(5), object(1)
memory usage: 9.5+ KB
```

In [36]:
```
Xnew1 = dataset2.iloc[:, :5].values
Ynew1 = dataset2.iloc[:, 5].values
dataset2.head(3)
```

Out[36]:

	Age	Sex	BP	Cholesterol	Na_to_K	Drug
0	23	0	0	0	25.355	0
1	47	1	1	0	13.093	1
2	47	1	1	0	10.114	1

1.3.1 Split the dataset for test and train for drug test

In [37]:
```
# splitting the dataset into train set and test set
from sklearn.model_selection import train_test_split
X_train1, X_test1, y_train1, y_test1 = train_test_split(Xnew1,Ynew1, test_size=0.2, random_state=0)
```

In [38]:
```
#feature Feature Scaling is the most important part of data preprocessing. If we see our
#dataset then some attribute contains information in Numeric value some value very high andsome
#are very low if we see the age and estimated salary.

from sklearn.preprocessing import StandardScaler
sc_X = StandardScaler()
X_train1 = sc_X.fit_transform(X_train1)

X_test1 = sc_X.transform(X_test1)
```

2.1.1 Import the Libraries

In [39]:
```
# import LDA model
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis as LDA
```

2.2.1 Initialize our model

In [40]:
```
# initialize the LDA
lda2 = LDA(n_components = 2)
```

2.3.1 Fitting the Model

In [41]:
```
# fitting the LDA model
X_test1 = lda2.fit_transform(X_test1, y_test1)
X_train1 = lda2.transform(X_train1)
```

3.1.1 Import the Libraries

In [42]:
```
# import the Logistic Regression model from sklearn using the 2 variances with
#,!the help of LDA

from sklearn.linear_model import LogisticRegression
```

3.2.1 Initialize our Logistic Regression model

In [43]:
```
LG1=LogisticRegression(random_state=0)
```

3.3.1 Fitting the Model

In [44]:
```
# fit the Logistic Regression model
LG1.fit(X_train1,y_train1)
```

Out[44]:
```
LogisticRegression(random_state=0)
```

4.1.1 Predict the test set Result

In [45]:
```
# predict the Logistic regression model
y_pred1=LG1.predict(X_test1)
```

4.2.1 Confusion Matrix

In [46]:
```
y_pred1.shape
```

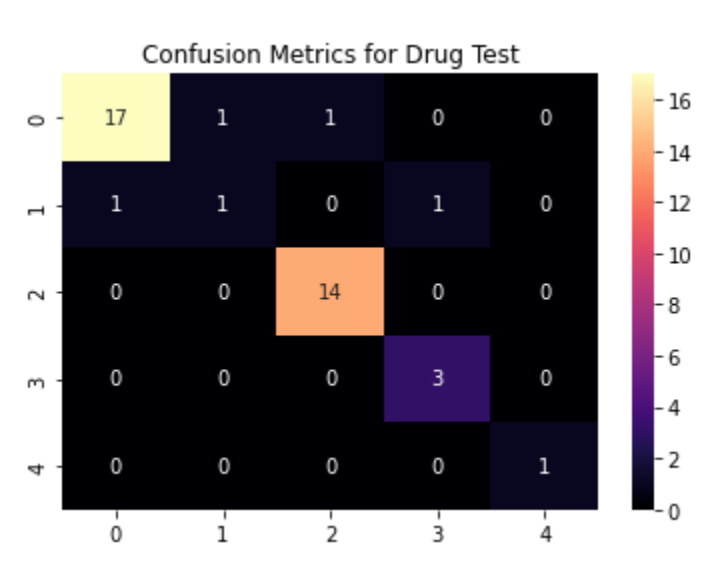
Out[46]:
```
(40,)
```

In [47]:
```
y_test1.shape
```

Out[47]:
```
(40,)
```

In [48]:
```
# making a confusion metrics
from sklearn.metrics import confusion_matrix
confusion_matrix1=confusion_matrix(y_test1,y_pred1)
sns.heatmap(confusion_matrix1, annot=True, cmap="magma").set(title='Confusion Metrics for Drug Test')
```

Out[48]:
```
[Text(0.5, 1.0, 'Confusion Metrics for Drug Test')]
```



4.3 Visualize our Test Set Result

In [49]:
```
#Visualising the Test set results

from matplotlib.colors import ListedColormap
X_set1, y_set1 = X_test1, y_test1

X1drug, X2drug = np.meshgrid(np.arange(start = X_set1[:, 0].min() - 1, stop = X_set1[:, 0].
                              max() + 1, step = 0.01),
                    np.arange(start = X_set1[:, 1].min() - 1, stop = X_set1[:, 1].
                              max() + 1, step = 0.01))

plt.contourf(X1drug, X2drug, LG1.predict(np.array([X1drug.ravel(), X2drug.ravel()]).T).reshape(X1drug.shape),
            alpha = 0.75, cmap = ListedColormap(('red','green','blue','orange','purple')))
plt.xlim(X1drug.min(), X1drug.max())
plt.ylim(X2drug.min(), X2drug.max())
for i, j in enumerate(np.unique(y_set1)):
    plt.scatter(X_set1[y_set1 == j, 0], X_set1[y_set1 == j, 1],
               color = ListedColormap(('red','green','blue','orange','purple'))(i), label = j)
plt.title('Logistic Regression for drug test (Test set)')
plt.xlabel('LD1')
plt.ylabel('LD2')
plt.legend()
plt.show()
```

Kesimpulan

Berikan simpulan yang dilakukan dari hasil kerja menggunakan algoritma dan 2 dataset yang dipilih. Simpulan bisa berkisar antara (bisa di modifikasi):

```
- Hasil perbandingan akurasi antara algoritma menurut saya berbeda karena class dataset antara glass dan Drug berbeda.
- Pada week ini saya belajar tentang LDA. LDA merupakan sebuah teknik analisis statistik multivariat yang digunakan untuk memisahkan atau mengklasifikasikan
data menjadi dua atau lebih kelompok yang telah ditentukan sebelumnya berdasarkan variabel prediktor yang diukur. di dalam modul ini saya mencoba dataset
antara glass dan drug. Selain LDA, saya juga menggunakan Logistic regression, training data supaya bisa melihat hasil dari LDA yang saya sudah buat. Pada
akhir dari praktikum ini semua hasilnya dibuat menjadi visualisasi menggunakan scatter plot dengan batas batas class yang sudah diinput pada proses predict
serta train_model.
```

In [50]:
```
# Footer
myDate = datetime.datetime.now()
print("I certify that this is my own work.")
print("Signed by:")
print("Name: \t{}".format(myName))
print("NIM: \t{}".format(myNIM))
print("Time-stamp:\t{}".format(myDate))
```

```
I certify that this is my own work.
Signed by:
Name:   Christopher Darren
NIM:    00000054804
Time-stamp:     2023-03-05 21:36:55.981883
```

Save the notebook, then convert the notebook to html (by running the next code).

In [52]:
```
!jupyter nbconvert --to html "./IF540_Kelas EL_00000054804_Christopher Darren_Week04.ipynb" --output-dir="./"
```

```
[NbConvertApp] Converting notebook ./IF540_Kelas EL_00000054804_Christopher Darren_Week04.ipynb to html
[NbConvertApp] Writing 736214 bytes to IF540_Kelas EL_00000054804_Christopher Darren_Week04.html
```

Next step:

- convert the generated html file to PDF using the online tool: https://www.sejda.com/html-to-pdf
- choose the following settings:
  - Page size: One long page
  - Page Orientation: auto
  - Use print stylesheet
- Submit your ipython notebook and PDF files

Markdown basics https://markdown-guide.readthedocs.io/en/latest/basics.html#