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Self Learning

1. Import semua library yang diperlukan

```
#Library
import pandas as pd
import numpy as np
from scipy import stats
from sklearn.preprocessing import MinMaxScaler
from sklearn.preprocessing import StandardScaler
from sklearn.feature_selection import SelectKBest, f_classif
from sklearn.model_selection import train_test_split
import time
from sklearn.neighbors import KNeighborsClassifier
from sklearn import metrics
from sklearn.decomposition import PCA
from sklearn.discriminant_analysis import LinearDiscriminantAnalysis
import matplotlib.pyplot as plt
%matplotlib inline
```

2. Membuka dataset **skor_toefl.csv**

```
toefl = pd.read_csv('skor_toefl.csv')
toefl
```

	Sebelum	Sesudah
0	429	569
1	443	599
2	408	612
3	459	536
4	401	572
...	...	...
94	496	552
95	413	544
96	400	531
97	471	561
98	443	588

99 rows × 2 columns

3. Menghitung **uji t**

```
#Melakukan uji t
uji_t = stats.ttest_rel(toefl['Sesudah'], toefl['Sebelum']) #hasilnya: (statistik hitungnya (t-hitung), pvalue)
print('nilai t-hitung = ', uji_t[0])
print('nilai p-value = ', uji_t[1])
```

```
nilai t-hitung =  30.255038012916643
nilai p-value =  1.638101871655264e-51
```

4. Membaca dataset music_genre, membuat copynya, dan menghapus **artist name** dan **track name**

```
music = pd.read_csv('music_genre.csv')
music2 = music.copy()
music2.dropna(inplace=True)
del music2['Artist Name']
del music2['Track Name']
music2
```

	Popularity	danceability	energy	key	loudness	mode	speechiness	acousticness	instrumentalness	liveness	valence	tempo	duration_in min/ms
1	54.0	0.382	0.814	3.0	-7.230	1	0.0406	0.001100	0.004010	0.1010	0.5690	116.454	251733.(
2	35.0	0.434	0.614	6.0	-8.334	1	0.0525	0.486000	0.000196	0.3940	0.7870	147.681	109667.(
4	53.0	0.167	0.975	2.0	-4.279	1	0.2160	0.000169	0.016100	0.1720	0.0918	199.060	229960.(
5	53.0	0.235	0.977	6.0	0.878	1	0.1070	0.003530	0.006040	0.1720	0.2410	152.952	208133.(
6	48.0	0.674	0.658	5.0	-9.647	0	0.1040	0.404000	0.000001	0.0981	0.6770	143.292	329387.(
...	...	...	...	...	...	...	...	...	...	...	...	...	..
17991	35.0	0.166	0.109	7.0	-17.100	0	0.0413	0.993000	0.824000	0.0984	0.1770	171.587	193450.(
17992	27.0	0.638	0.223	11.0	-10.174	0	0.0329	0.858000	0.000016	0.0705	0.3350	73.016	257067.(
17993	34.0	0.558	0.981	4.0	-4.683	0	0.0712	0.000030	0.000136	0.6660	0.2620	105.000	216222.(
17994	29.0	0.215	0.805	6.0	-12.757	0	0.1340	0.001290	0.916000	0.2560	0.3550	131.363	219693.(
17995	43.0	0.400	0.853	4.0	-5.320	0	0.0591	0.006040	0.212000	0.3340	0.3770	138.102	182227.(

11813 rows × 15 columns

5. Memisahkan **feature** dan **label**

```
#Memisahkan Feature dan Label
#Feature
X = music2.iloc[:,:14].values
Y = music2.iloc[:, 14].values
```

6. Melakukan **transform data**

```
scaler = StandardScaler()

# transform data
X_scaled = scaler.fit_transform(X)
print(X_scaled)
```

```
[[ 0.6578634  -0.86108     0.59301271 ... -0.22000411  0.33481231
   0.22582345]
 [-0.48893955 -0.54783734 -0.2323635  ...  0.8410691  -0.89146753
   0.22582345]
 [ 0.59750535 -2.15621793  1.25744056 ...  2.5868942   0.14687296
   0.22582345]
 ...
 [-0.5492976   0.19912594  1.28220184 ... -0.6092036   0.02828982
   0.22582345]
 [-0.85108785 -1.86707086  0.55587078 ...  0.28659404  0.05825067
   0.22582345]
 [-0.00607515 -0.75264985  0.75396107 ...  0.51558089 -0.26514691
   0.22582345]]
```

7. Memilih **k feature** yang akan digunakan, k = 8

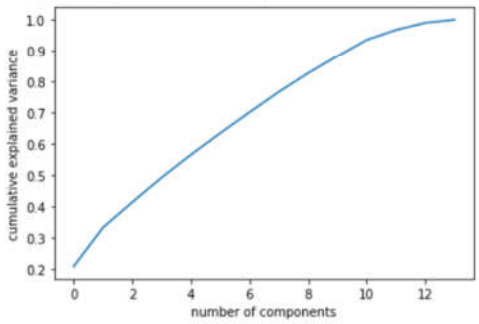
```
#Ketik kodingannya disini, silahkan memilih berapa k feature yang mau digunakan
selector = SelectKBest(f_classif, k=8)
selector.fit(X_scaled, Y)
X_new_a = selector.fit_transform(X_scaled, Y)
print("nilai statistik hitung tiap feature : ", selector.scores_)
print('\n', "nilai p value : ", selector.pvalues_)
```

```
nilai statistik hitung tiap feature :  [139.88066056 327.57607032 607.05627169   3.44940318 533.23015937
  17.36126483 240.43782283 702.69800751 307.34168538  25.06319532
 208.2249501   28.89657946 931.21961423  25.14183356]

 nilai p value :  [5.67588919e-278 0.00000000e+000 0.00000000e+000 1.54594261e-004
 0.00000000e+000 8.80419429e-032 0.00000000e+000 0.00000000e+000
 0.00000000e+000 1.36713016e-047 0.00000000e+000 1.72827268e-055
 0.00000000e+000 9.41651367e-048]
```

8. Membuat visualisasi **cumulative explained ratio**

```
#Ketik kodingan disini
pca = PCA()
pca_data = pca.fit_transform(X_scaled)

plt.plot(np.cumsum(pca.explained_variance_ratio_))
plt.xlabel("number of components")
plt.ylabel("cumulative explained variance")
```

```
Text(0, 0.5, 'cumulative explained variance')
```



9. Untuk **Cumulative explained variance** minimal 75% maka disini dimasukkan n = 9.

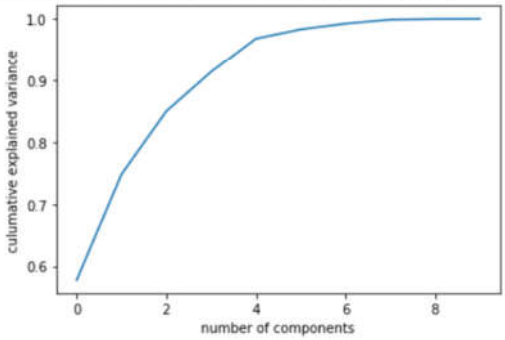
```
# Ketik kodingannya disini
n = 9
pca = PCA(n_components = n)
X_new_pca = pca.fit_transform(X_scaled)
total_var = pca.explained_variance_ratio_.sum() * 100
print(total_var, '% of total variance is explained by',n, 'principal components')
```

```
82.70526081543656 % of total variance is explained by 9 principal components
```

10. Berikut adalah visualisasi dari model **LDA**

```
#Ketik kodingannya disini
lda = LinearDiscriminantAnalysis()
lda_data = lda.fit_transform(X_scaled, Y)

plt.plot(np.cumsum(lda.explained_variance_ratio_))
plt.xlabel("number of components")
plt.ylabel("culumative explained variance")
```

```
Text(0, 0.5, 'culumative explained variance')
```



11. Untuk mendapatkan **cumulative explained variance** minimal 75%, maka dimasukkan l = 3

```
#Ketik kodingannya disini
l = 3
lda = LinearDiscriminantAnalysis(n_components=l)
X_new_lda = lda.fit_transform(X_scaled, Y)
total_var = lda.explained_variance_ratio_.sum() * 100
print(total_var, '% of total variance is expalained by', l, 'features')
```

```
84.99124363053903 % of total variance is expalained by 3 features
```

12. Pada code dibawah ini, adalah code untuk **train model dan predict menggunakan data asli**

```
#Train Model and Predict menggunakan data asli
Xmusix = X_scaled
Ymusix = Y
Xmusix_train, Xmusix_test, Ymusix_train, Ymusix_test = train_test_split(Xmusix, Ymusix, test_size = 0.2, random_state = 22, stratify = Ymusix)

start = time.time()
knn = KNeighborsClassifier(n_neighbors = 9).fit(Xmusix_train, Ymusix_train)
Ypred = knn.predict(Xmusix_test)
end = time.time()
print("Akurasi  : ", metrics.accuracy_score(Ymusix_test, Ypred))
print("waktu    : ", end-start)
```

```
Akurasi  :  0.4265763859500635
waktu    :  0.5650367736816406
```

13. Selanjutnya, pada code ini adalah code untuk **train model dan predict menggunakan data dengan feature selection**

```
#Train Model and Predict menggunakan data dengan feature selection
Xmusix = X_scaled
Ymusix = Y
Xmusix_train, Xmusix_test, Ymusix_train, Ymusix_test = train_test_split(Xmusix, Ymusix, test_size = 0.2, random_state = 22, stratify = Ymusix)

start = time.time()
select = SelectKBest(f_classif, k=8)
select.fit(X_scaled, Y)
Xnew = select.fit_transform(X_scaled, Y)
print("nilai statistik hitung tiap feature  : ", select.scores_)
print('\n',"nilai pvalue : ", select.pvalues_)
end = time.time()
print("Akurasi  : ", metrics.accuracy_score(Ymusix_test, Ypred))
print("waktu    : ", end-start)
```

```
nilai statistik hitung tiap feature  :  [139.88066056 327.57607032 607.05627169   3.44940318 533.23015937
  17.36126483 240.43782283 702.69800751 307.34168538  25.06319532
 208.2249501   28.89657946 931.21961423  25.14183356]

 nilai pvalue :  [5.67588919e-278 0.00000000e+000 0.00000000e+000 1.54594261e-004
 0.00000000e+000 8.80419429e-032 0.00000000e+000 0.00000000e+000
 0.00000000e+000 1.36713016e-047 0.00000000e+000 1.72827268e-055
 0.00000000e+000 9.41651367e-048]
Akurasi  :  0.4265763859500635
waktu    :  0.03121042251586914
```

14. Pada code ini juga, adalah kode **untuk train model dan predict menggunakan data dengan PCA**

```
[14] #Train Model and Predict menggunakan data dengan PCA
     Xmusix = X_scaled
     Ymusix = Y
     Xmusix_train, Xmusix_test, Ymusix_train, Ymusix_test = train_test_split(Xmusix, Ymusix, test_size = 0.2, random_state = 22, stratify = Ymusix)

     start = time.time()
     n = 8
     pca = PCA(n_components = n)
     X_new_pca = pca.fit_transform(X_scaled)
     total_var = pca.explained_variance_ratio_.sum() * 100
     print(total_var, '% of total variance is explained by',n, 'principal components')
     end = time.time()
     print("Akurasi  : ", metrics.accuracy_score(Ymusix_test, Ypred))
     print("waktu    : ", end-start)

     76.68715479081389 % of total variance is explained by 8 principal components
     Akurasi  :  0.4265763859500635
     waktu    :  0.03221845626831055
```

15. Kemudian untuk code dibawah ini adalah code untuk **train model dan predict menggunakan data dengan LDA**

```
#Train Model and Predict menggunakan data dengan LDA
Xmusix = X_scaled
Ymusix = Y
Xmusix_train, Xmusix_test, Ymusix_train, Ymusix_test = train_test_split(Xmusix, Ymusix, test_size = 0.2, random_state = 22, stratify = Ymusix)

start = time.time()
l = 4
lda = LinearDiscriminantAnalysis(n_components=l)
X_new_lda = lda.fit_transform(X_scaled, Y)
total_var = lda.explained_variance_ratio_.sum() * 100
print(total_var, '% of total variance is expalained by', l, 'features')
end = time.time()
print("Akurasi  : ", metrics.accuracy_score(Ymusix_test, Ypred))
print("waktu    : ", end-start)

91.36003363150662 % of total variance is expalained by 4 features
Akurasi  :  0.4265763859500635
waktu    :  0.058984994888305664
```

Kesimpulannya adalah **akurasi yang dihasilkan tetaplah sama, namun pada lama waktu setiap model berbeda – beda**

Untuk source code, bisa di lihat pada link berikut :
https://github.com/Muhamad-naufal/Project-MSIB-3/blob/main/Exercise_19.ipynb