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BREAST CANCER DIAGNOSIS

DATA ANALYSIS

DATA ANALYSIS

IN:

```
df = pd.read_csv('https://archive.ics.uci.edu/ml/machine-learning-databases/breast-cancer-wisconsin/wdbc.data',names=column_names)
df.info()
```

OUT:

```
<class 'pandas.core.frame.DataFrame'>
RangeIndex: 569 entries, 0 to 568
Data columns (total 32 columns):
id                       569 non-null int64
diagnosis                569 non-null object
radius_mean              569 non-null float64
texture_mean             569 non-null float64
perimeter_mean           569 non-null float64
area_mean                569 non-null float64
smoothness_mean          569 non-null float64
compactness_mean         569 non-null float64
concavity_mean           569 non-null float64
concave points_mean      569 non-null float64
symmetry_mean            569 non-null float64
fractal_dimension_mean   569 non-null float64
radius_se                569 non-null float64
```

. . . (TOTAL 32 ATTRIBUTE)

DTYPES: FLOAT64(30), INT64(1), OBJECT(1)

DATA ANALYSIS

- 属性信息:
- 1 身份证号码
- 2 诊断（M =恶性，B =良性）
- 3-32 为每个细胞核计算十个实值特征：
  - a）半径（从中心到周边点的距离的平均值）
  - b）纹理（灰度值的标准偏差）
  - c）周界
  - d）区域
  - e）光滑度（半径长度的局部变化）
  - f）紧凑性（周长^ 2 /面积 - 1.0）
  - g）凹度（轮廓凹部的严重程度）
  - h）凹点（轮廓的凹入部分的数量）
  - i）对称
  - j）分形维数（“海岸线近似” - 1）
- 对每个数据分别求平均值，标准误差，“最差”或最大，产生30个特征
- 所有功能值都用四位有效数字重新编码

IN:

```
df.head(10)
```

OUT:

id	diagnosis	radius_mean	texture_mean
842302	M	17.99	10.38
842517	M	20.57	17.77
84300903	M	19.69	21.25
84348301	M	11.42	20.38

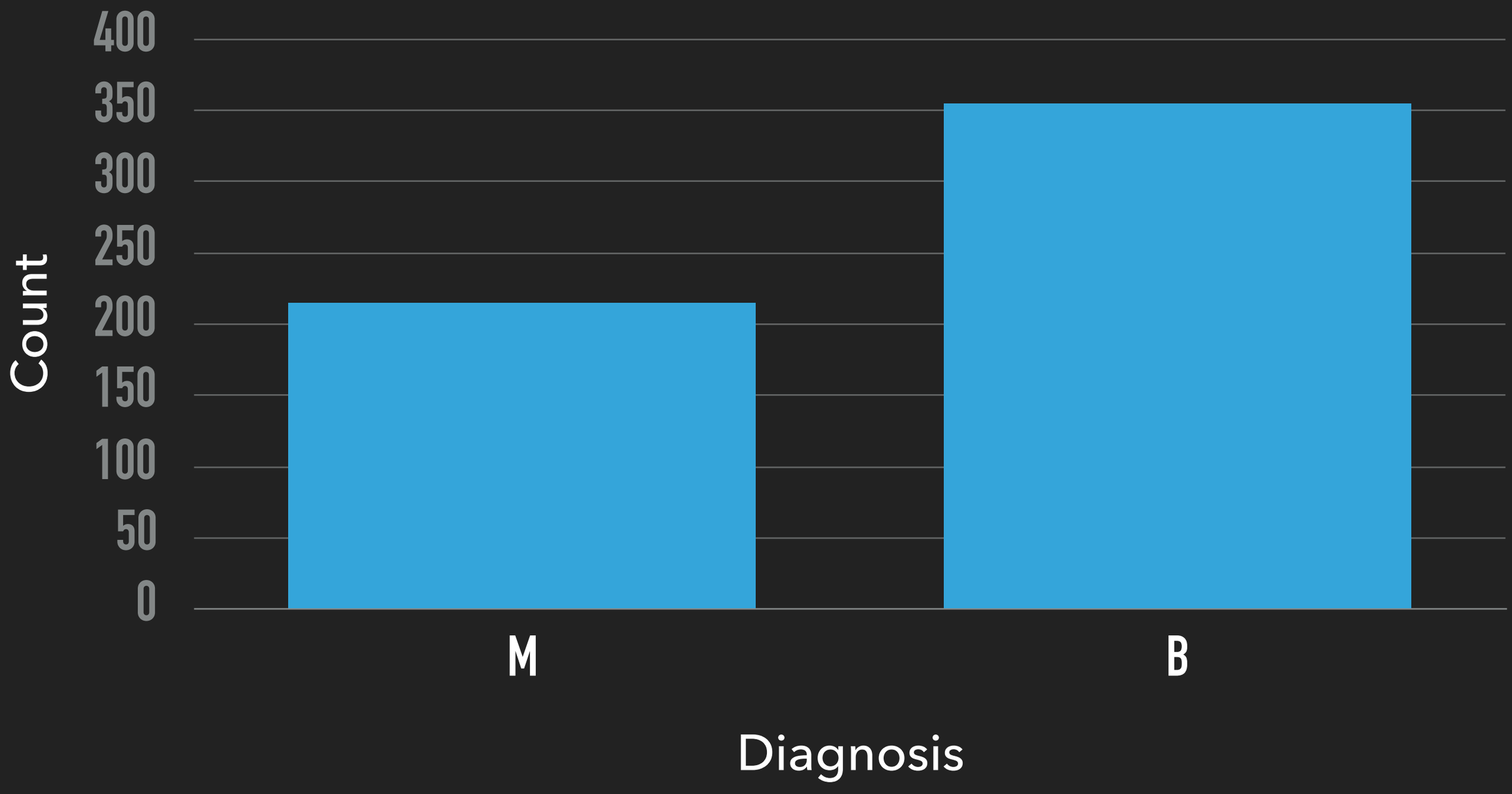
...(TOTAL 10 ROWS * 32 COLUMNS)

IN:

```
sn.countplot(df["diagnosis"],label='count')
```

OUT:

```
<matplotlib.axes._subplots.AxesSubplot at 0x18697281cc0>
```



IN:

```
dia = df['diagnosis']

df.drop('id', axis=1,inplace=True)

df.drop('diagnosis',axis=1,inplace=True)
```

```
# id 不用于classification，删去，diagnosis为分类标准

## feature 的名字并不需要了解
```

DATA VISUALIZATION

IN: # 相似相关性热力图

```
plt.subplots(figsize=(20, 20))
```

```
sn.heatmap(data.corr(), annot=True, linewidths=.5, fmt= '.2f', cmap='coolwarm')
```

OUT:

```
<matplotlib.axes._subplots.AxesSubplot at 0x1d3a9ce3a58>
```

~~### correlation features

~~- Compactness_mean, concavity_mean, concave points_mean

radius_se, perimeter_se, area_se

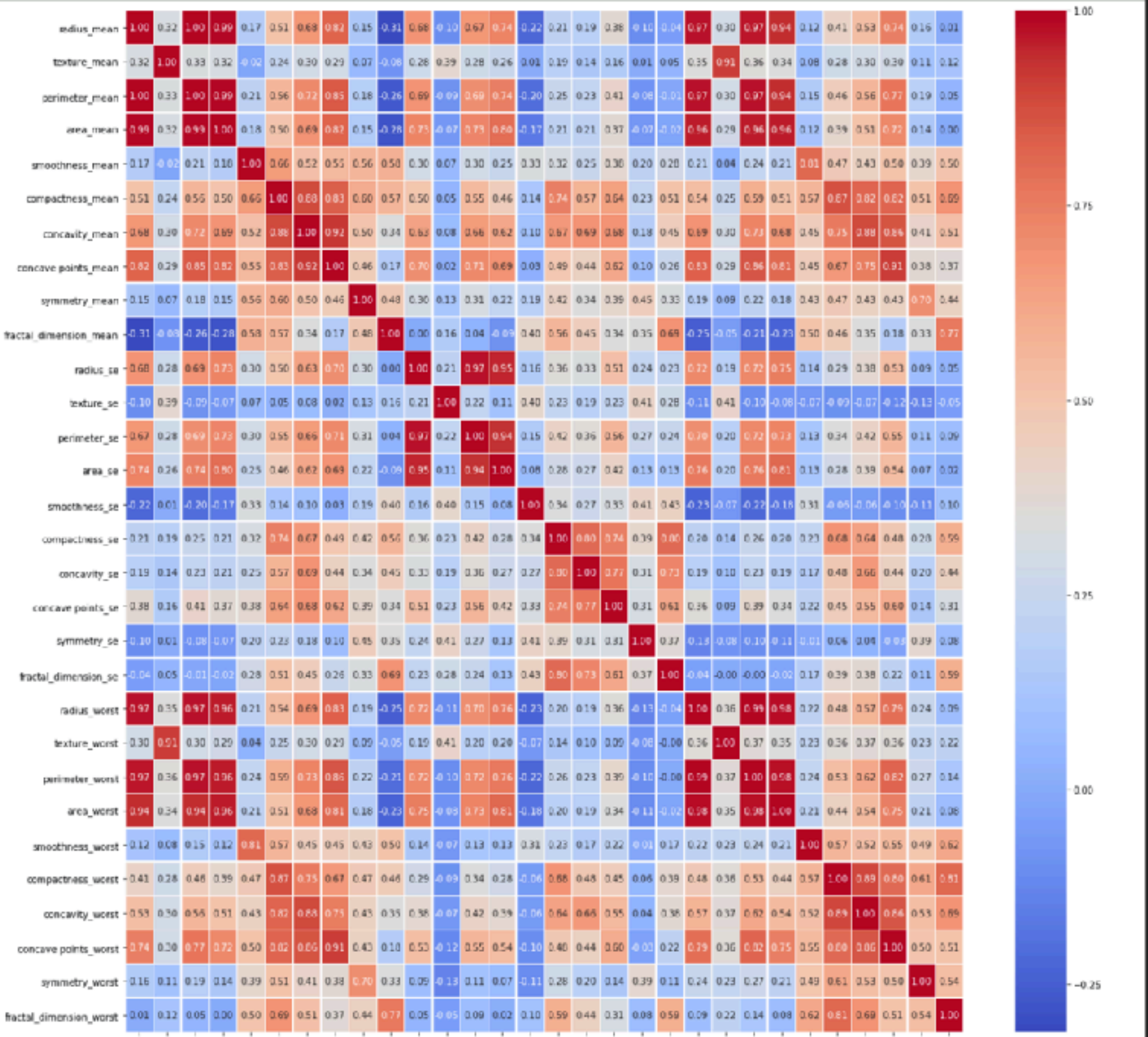
radius_worst, perimeter_worst, area_worst

Compactness_worst, concavity_worst, concave points_worst

Compactness_se, concavity_se, concave points_se

texture_mean, texture_worst

area_worst, area_mean

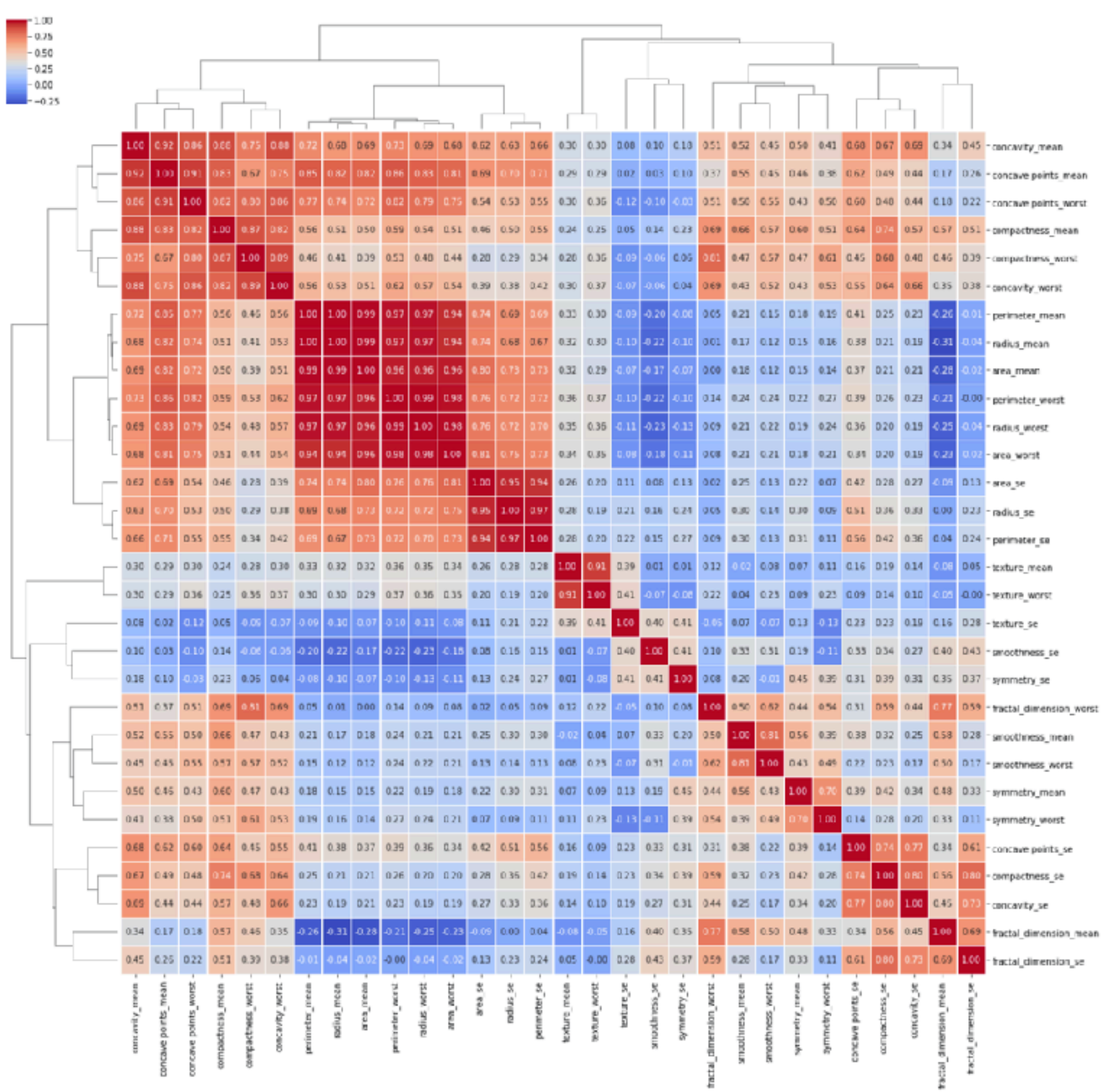

radius_mean
texture_mean
perimeter_mean
area_mean
smoothness_mean
compactness_mean
concavity_mean
concave points_mean
symmetry_mean
fractal_dimension_mean
radius_se
texture_se
perimeter_se
area_se
smoothness_se
compactness_se
concavity_se
concave points_se
symmetry_se
fractal_dimension_se
radius_worst
texture_worst
perimeter_worst
area_worst
smoothness_worst
compactness_worst
concavity_worst
concave points_worst
symmetry_worst
fractal_dimension_worst
1.00
0.75
0.50
0.25
0.00
−0.25

IN: # 加入分类的相关性热力图

```
sn.clustermap(data.corr(), annot=True, linewidths=.5, fmt= '.2f', cmap='coolwarm',figsize=(20,20))
```

OUT:

- <matplotlib.axes._subplots.AxesSubplot at 0x1d3a9ce3a58>
  - new correlation features¶
  - 32 to 16 dimension
  - concavity_mean, concave points_mean, concave points_worst
  - compactness_mean, compactness_worst, concavity_worst
  - perimeter_mean, radius_mean, area_mean, perimeter_worst, radius_worst, area_worst
  - area_se, radius_se, perimeter_se
  - texture_mean, texture_worst
  - texture_se, smoothness_se, symmetry_se
  - fractal_dimesion_worst
  - smoothness_mean
  - smoothness_worst
  - symmetry_mean
  - symmetry_worst
  - concave points_se
  - compactness_se
  - concavity_se
  - fractal_dimession_mean


1.00
0.75
0.50
0.25
0.00
−0.25
concavity_mean
concave points_mean
concave points_worst
compactness_mean
compactness_worst
concavity_worst
perimeter_mean
radius_mean
area_mean
perimeter_worst
radius_worst
area_worst
area_se
radius_se
perimeter_se
texture_mean
texture_worst
texture_se
smoothness_se
symmetry_se
fractal_dimension_worst
smoothness_mean
smoothness_worst
symmetry_mean
symmetry_worst
concave points_se
compactness_se
concavity_se
fractal_dimension_mean
fractal_dimension_se

CLASSIFICATION ALGORITHM

IN 32 FEATURES

LOGISTIC REGRESSION

IN:

- `LR = LogisticRegression()`
- `LR.fit(X_train, y_train)`
- `LR_pred = LR.predict(X_test)`
- `print(metrics.classification_report(y_test,LR_pred, digits = 5))`
- `LR_cm=metrics.confusion_matrix(y_test,LR_pred)`

OUT:

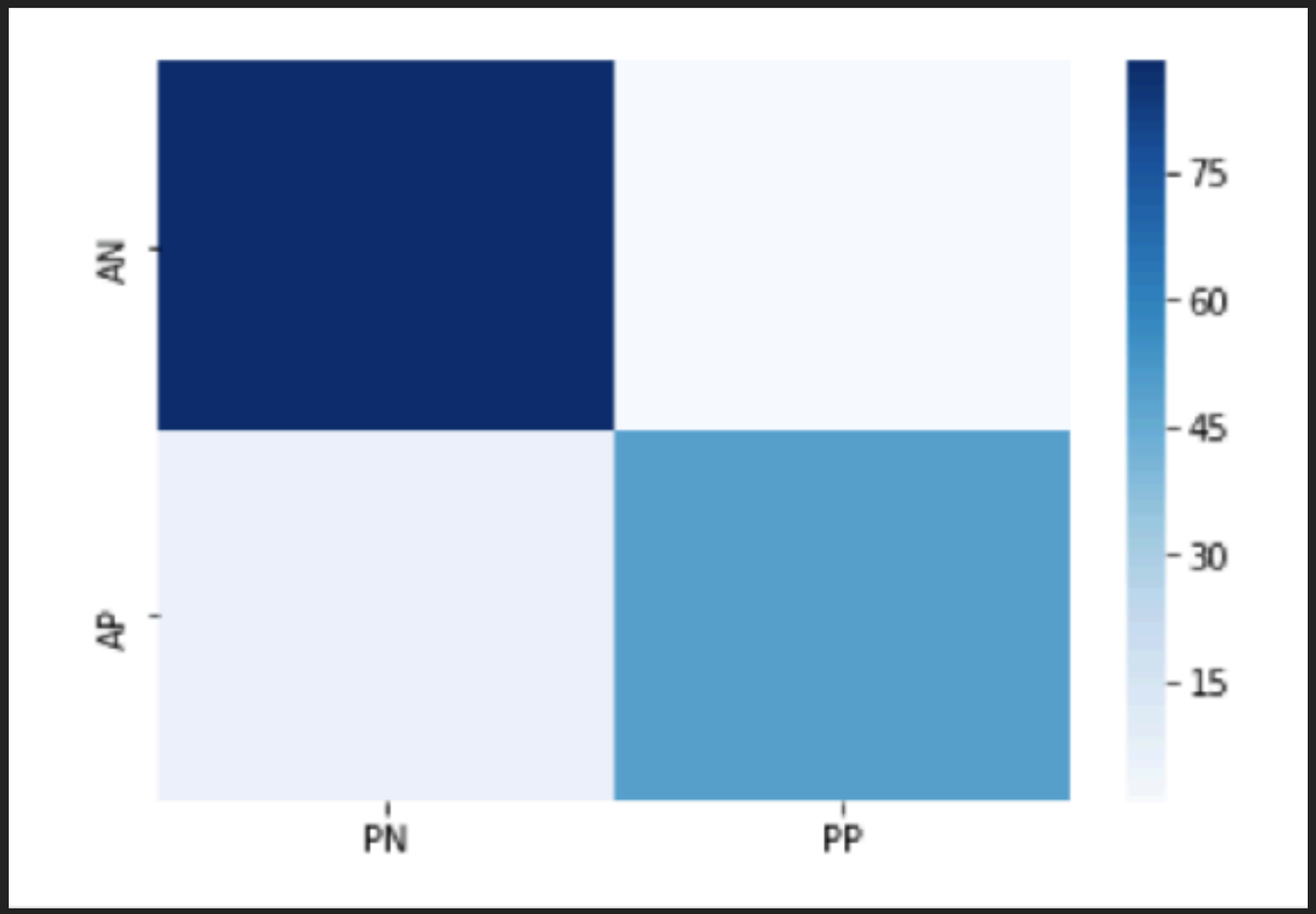
	Precision	Recall	f1-Score	Support
B	0.94624	0.98876	0.96703	89
M	0.98000	0.90741	0.94231	54
Avg/Total	0.95899	0.95804	0.94231	143

IN: # 计算混淆矩阵

```
print(LR_cm)
df_cm = pd.DataFrame(LR_cm,index = ['AN','AP'],columns=['PN','PP'])
sn.heatmap(df_cm,cbar = True,cmap = 'Blues')
```

OUT:

```
<matplotlib.axes._subplots.AxesSubplot at 0x186b5dde198>
```

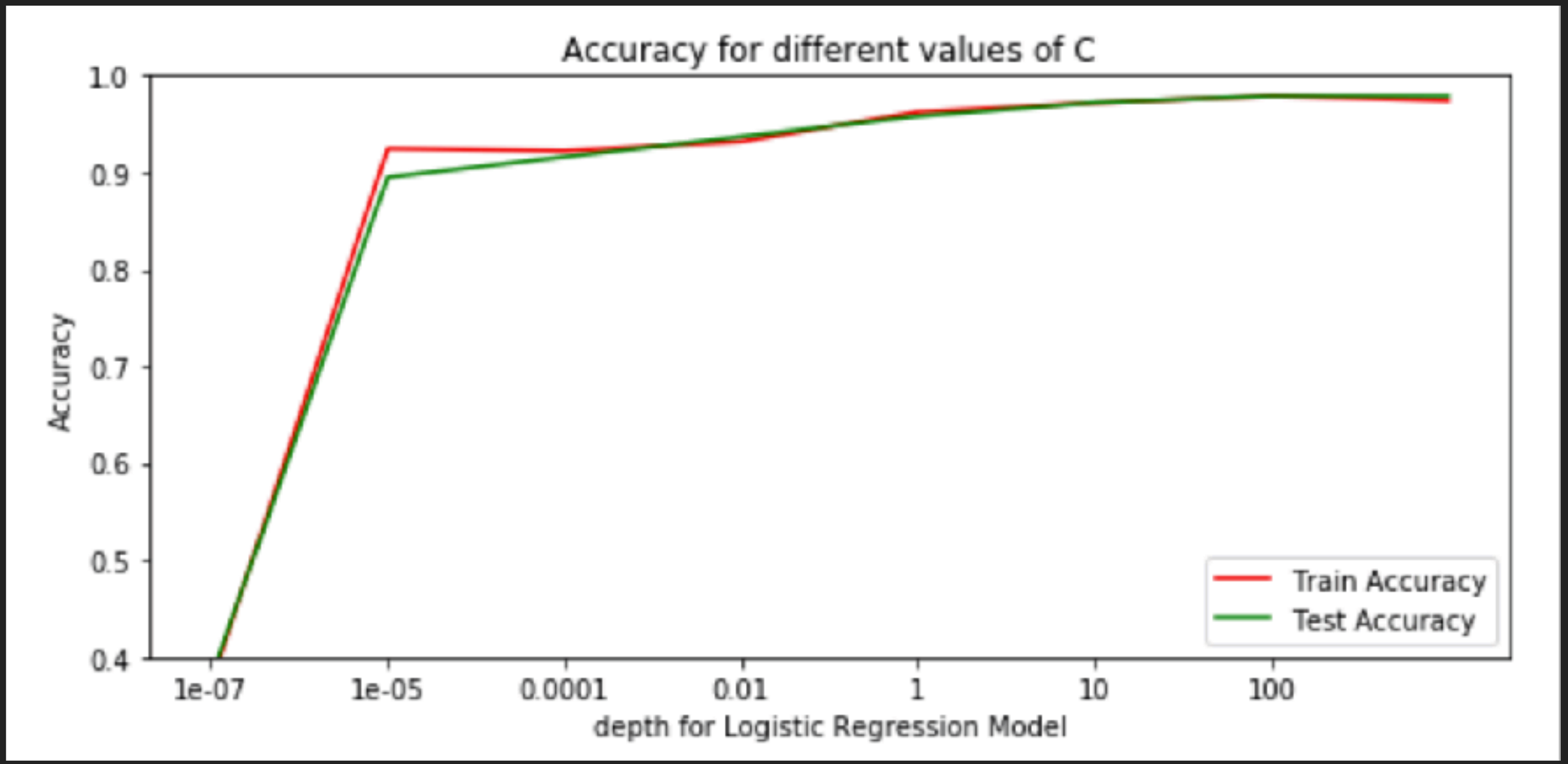


IN: # Change Depth

- `depth = [0.0000001,0.00001,0.0001,0.01, 1, 10, 100, 1000]`

OUT:

- `Accuracy is maximum at depth 100 and accuracy 0.979`



LOGISTIC REGRESSION+

IN:

```
LR_pro = LogisticRegression(C=100)
LR_pro.fit(X_train, y_train)
LR_pred_pro = LR_pro.predict(X_test)
print(metrics.classification_report(y_test,LR_pred_pro,digits = 5))
```

```
LR_cm_pro=metrics.confusion_matrix(y_test,LR_pred_pro)
```

OUT:

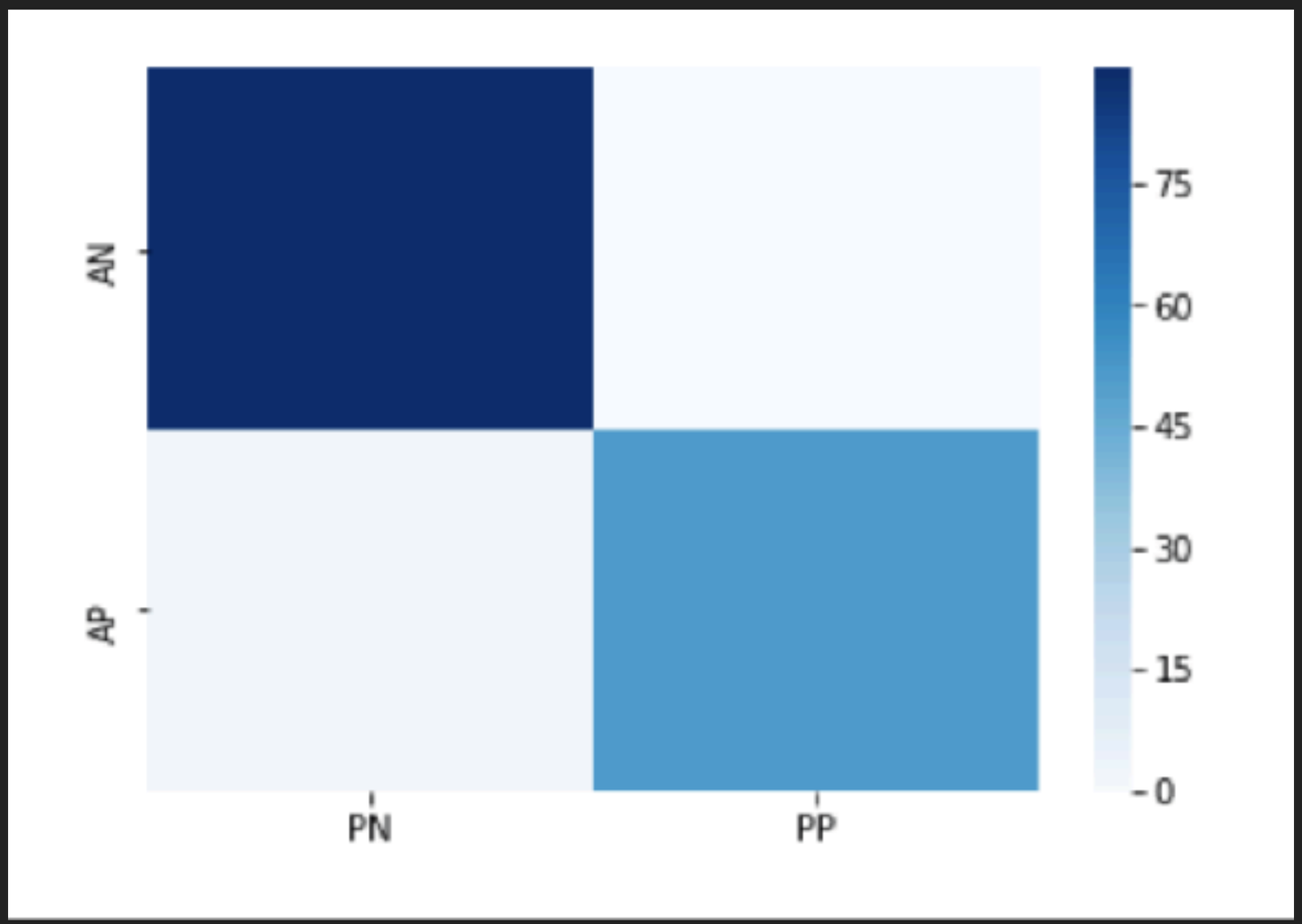
	Precision	Recall	f1-Score	Support
B	0.96739	1.00000	0.98343	89
M	1.00000	0.94444	0.97143	54
Avg/Total	0.97971	0.97902	0.97890	143

IN: # 计算混淆矩阵

```
print(LR_cm_pro)
df_cm_pro = pd.DataFrame(LR_cm_pro,index = ['AN','AP'],columns=['PN','PP'])
sn.heatmap(df_cm_pro,cbar = True,cmap = 'Blues')
```

OUT:

```
<matplotlib.axes._subplots.AxesSubplot at 0x186ad715860>
```



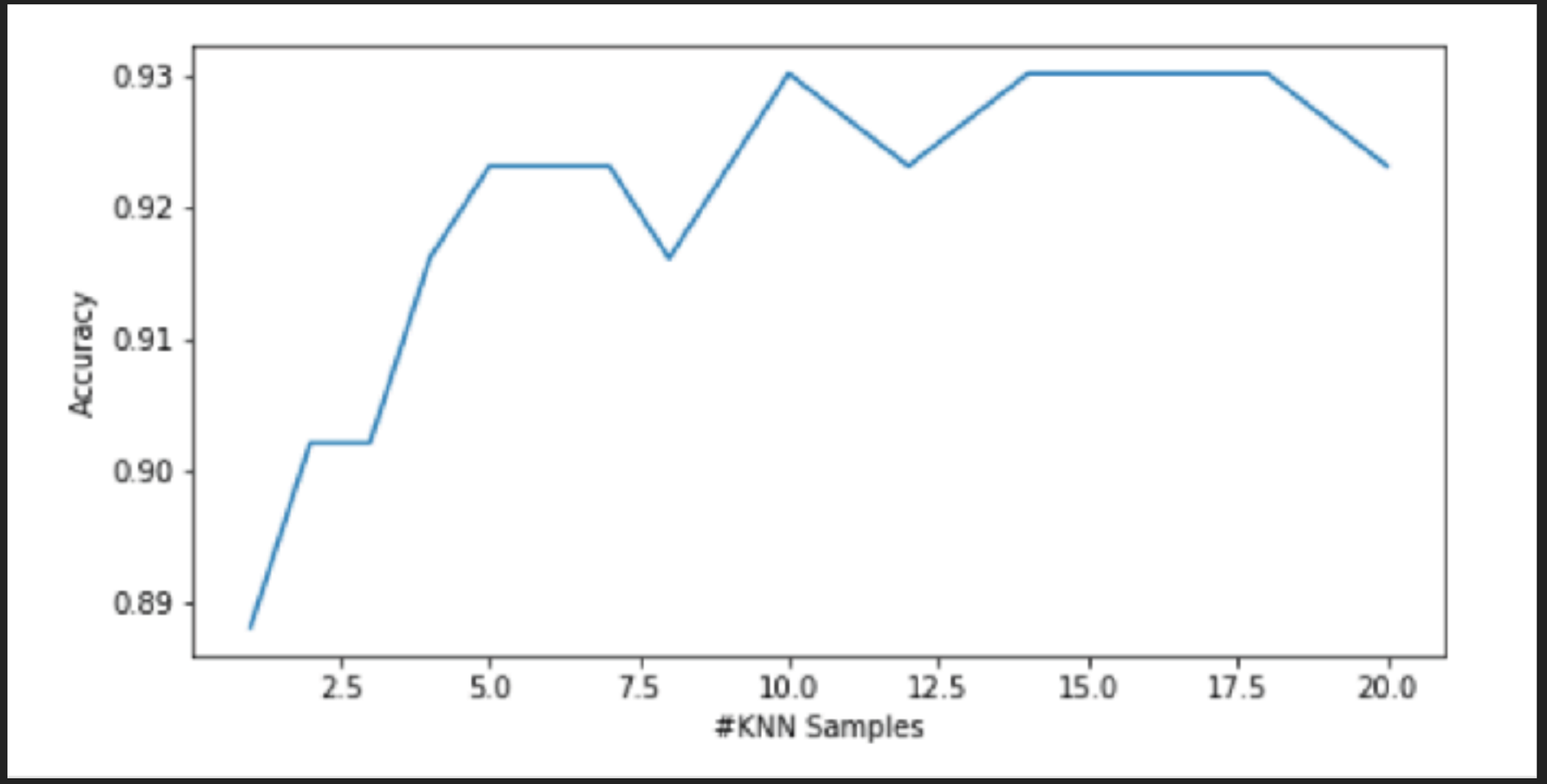
KNN

IN: # Change Number N of Nearest-Neighbor(s)

- `N = [1,2,3,4,5,6,7,8,10,12,14,16,18,20]`

OUT:

- `Accuracy is max in Sample 10 and accuracy 0.9301`



IN:

```
KNN = KNeighborsClassifier(n_neighbors=10)
```

```
print(metrics.classification_report(y_test,KNN_pred, digits = 5))
```

OUT:

	Precision	Recall	f1-Score	Support
B	0.92473	0.96629	0.94505	89
M	0.94000	0.87037	0.90385	54
Avg/Total	0.93050	0.93007	0.92949	143

GAUSSIAN NAIVE BAYES

IN:

```
GNB = GaussianNB(priors=None)
GNB.fit(X_train,y_train)
GNB_pred = GNB.predict(X_test)
GNB_cm=metrics.confusion_matrix(y_test,GNB_pred)
print(metrics.classification_report(y_test,GNB_pred, digits = 5))
```

OUT:

	Precision	Recall	f1-Score	Support
B	0.92632	0.98876	0.95652	89
M	0.97917	0.87037	0.92157	54
Avg/Total	0.94627	0.94406	0.94332	143

IN 16 FEATURES

DROP ATTRIBUTES

IN:

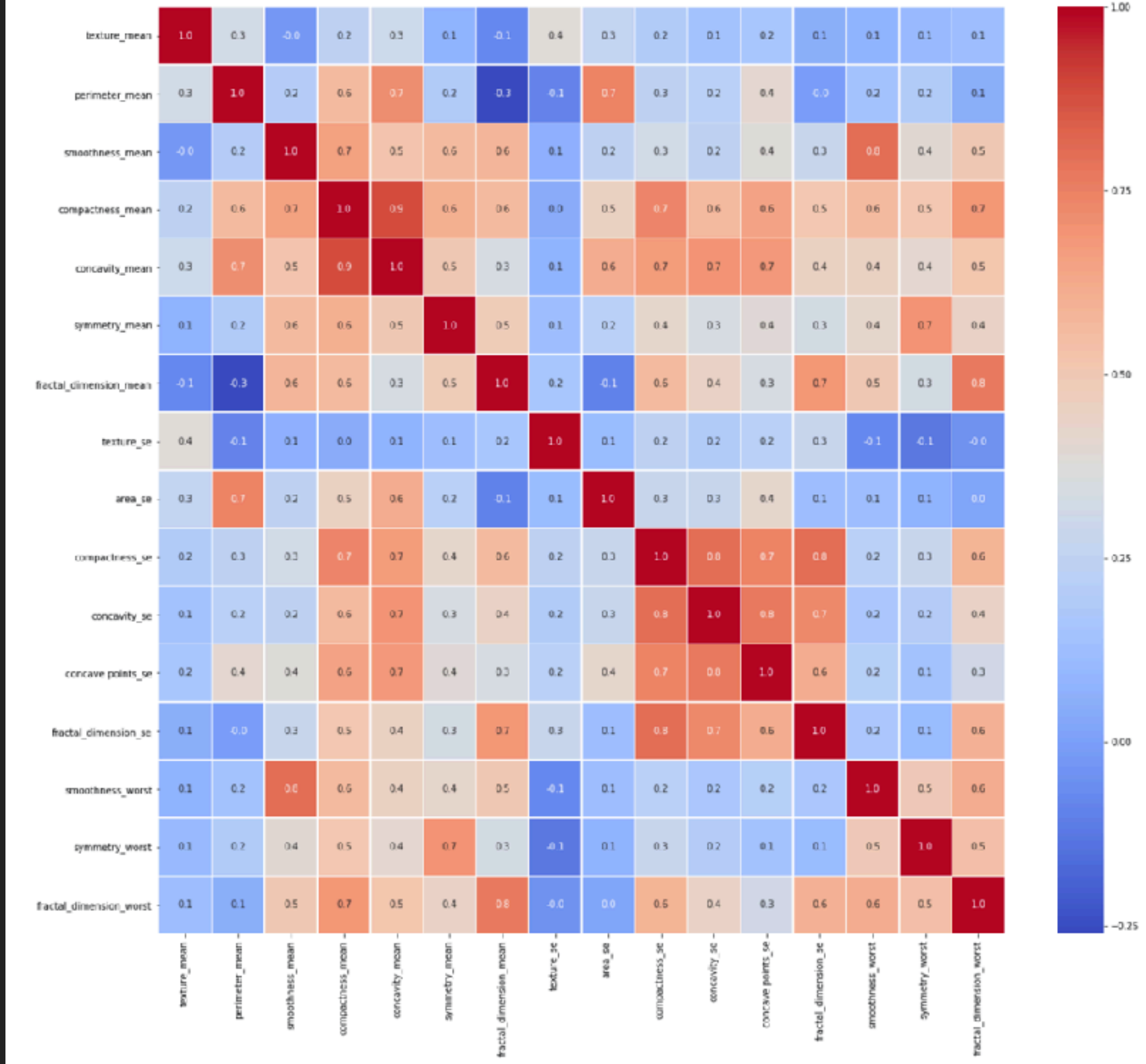
```
drop_list = ['concave points_mean', 'concave points_worst',
'compactness_worst', 'concavity_worst', 'radius_mean',
'area_mean', 'perimeter_worst', 'radius_worst', 'area_worst',
'radius_se', 'perimeter_se', 'texture_worst', 'smoothness_se',
'symmetry_se']
```

```
data_d = data.drop(drop_list,axis=1)
```

```
data_d.shape
```

OUT:

```
<matplotlib.axes._subplots.AxesSubplot at 0x186b4e82ba8>
```


texture_mean
perimeter_mean
smoothness_mean
compactness_mean
concavity_mean
symmetry_mean
fractal_dimension_mean
texture_se
area_se
compactness_se
concavity_se
concave points_se
fractal_dimension_se
smoothness_worst
symmetry_worst
fractal_dimension_worst
1.00
0.75
0.50
0.25
0.00
−0.25

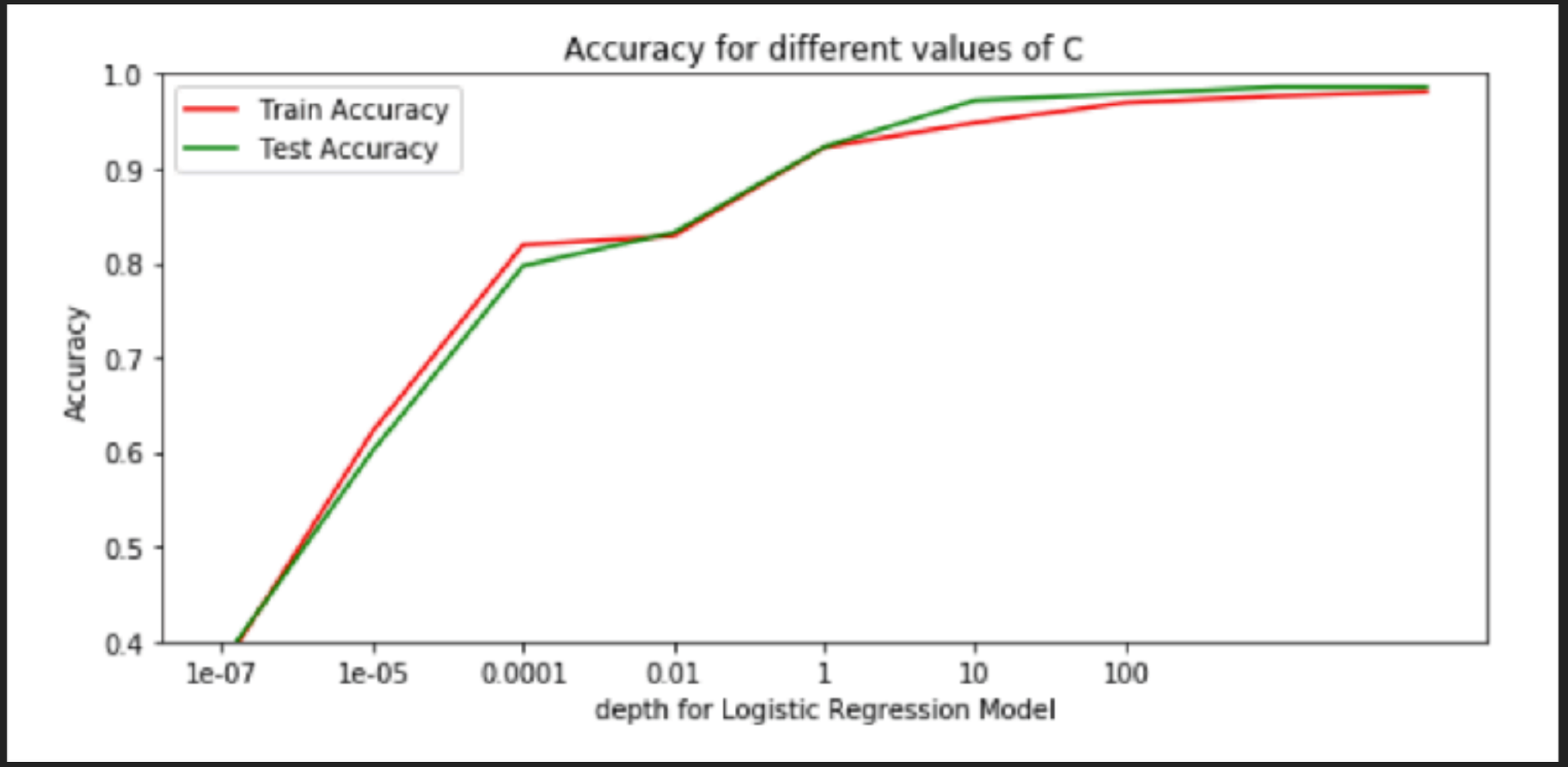
LOGISTIC REGRESSION

IN:

- `depth = [0.0000001,0.00001,0.0001,0.01, 1, 10, 100, 1000, 10000]`

OUT:

- `Accuracy is maximum at depth 1000 and accuracy 0.986`



IN:

```
LR_pro_d = LogisticRegression(C=1000)
```

OUT:

	Precision	Recall	f1-Score	Support
B	0.97802	1.00000	0.98889	89
M	1.00000	0.96296	0.98113	54
Avg/Total	0.98632	0.98601	0.98596	143

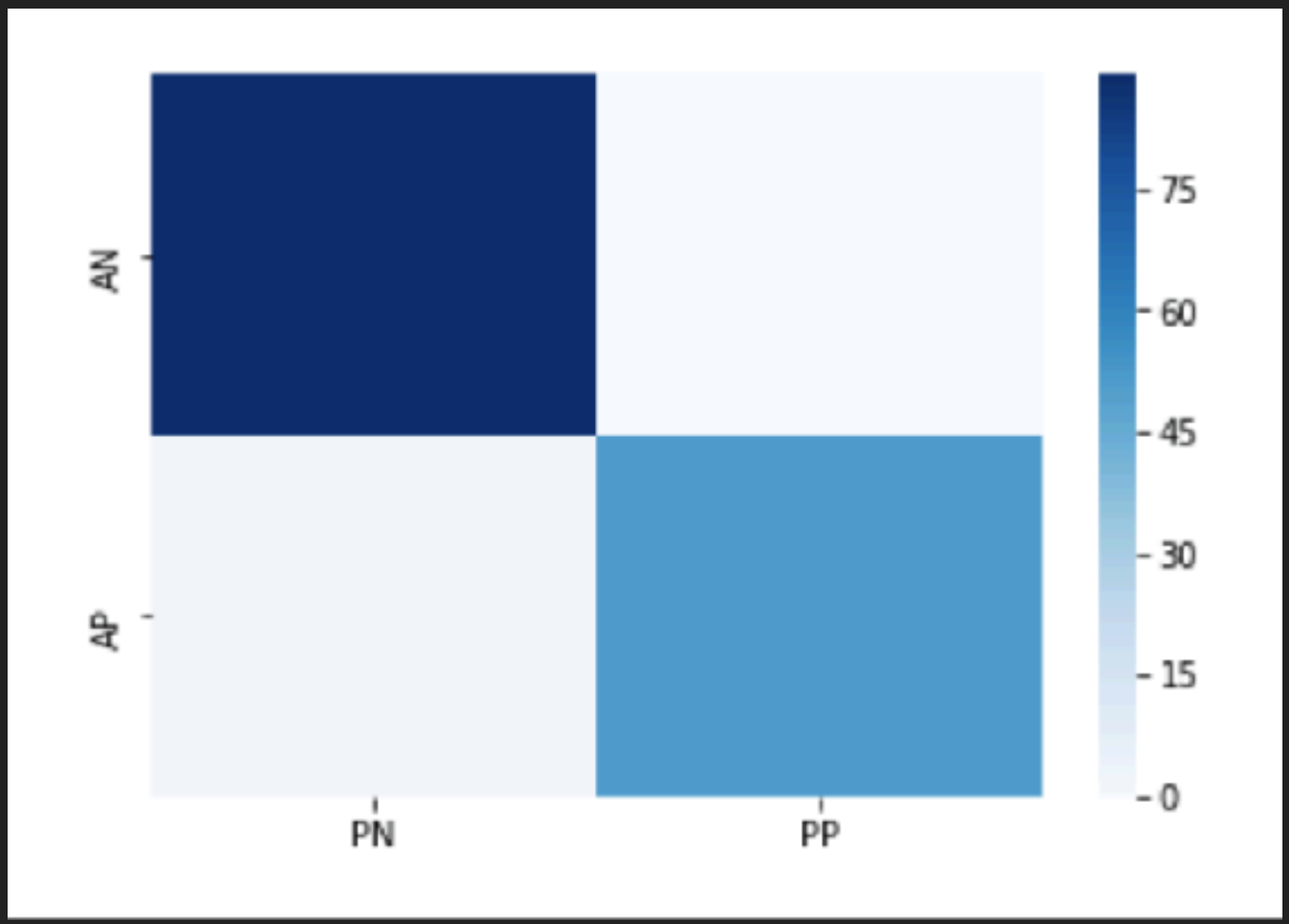
CLASSIFICATION ALGORITHM - LOGISTIC REGRESSION

IN:

```
print(LR_cm_pro_d)
df_cm_pro_d = pd.DataFrame(LR_cm_pro_d,index = ['AN','AP'],columns=['PN','PP'])
sn.heatmap(df_cm_pro_d,cbar = True,cmap = 'Blues')
```

OUT:

```
<matplotlib.axes._subplots.AxesSubplot at 0x186b5ec8b70>
```



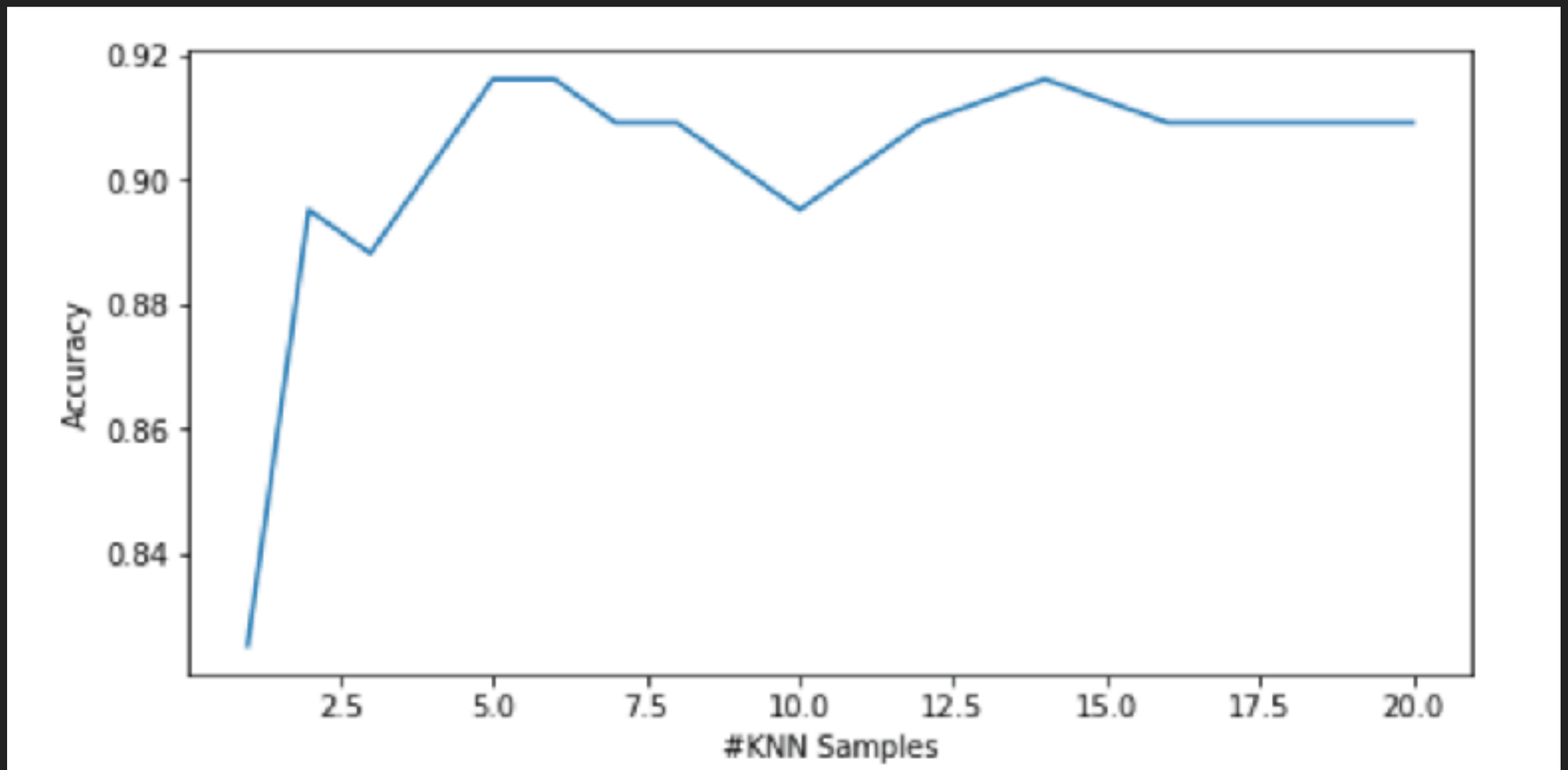
KNN

IN:

- N = [1,2,3,4,5,6,7,8,10,12,14,16,18,20]

OUT:

- Accuracy is max in Sample 5 and accuracy 0.9161



IN:

```
KNN_pro_d = KNeighborsClassifier(n_neighbors=5)
```

OUT:

	Precision	Recall	f1-Score	Support
B	0.91398	0.95506	0.93407	89
M	0.92000	0.85185	0.88462	54
Avg/Total	0.91625	0.91608	0.91539	143

RANDOM FOREST

IN:

```
RF_d = RandomForestClassifier()
```

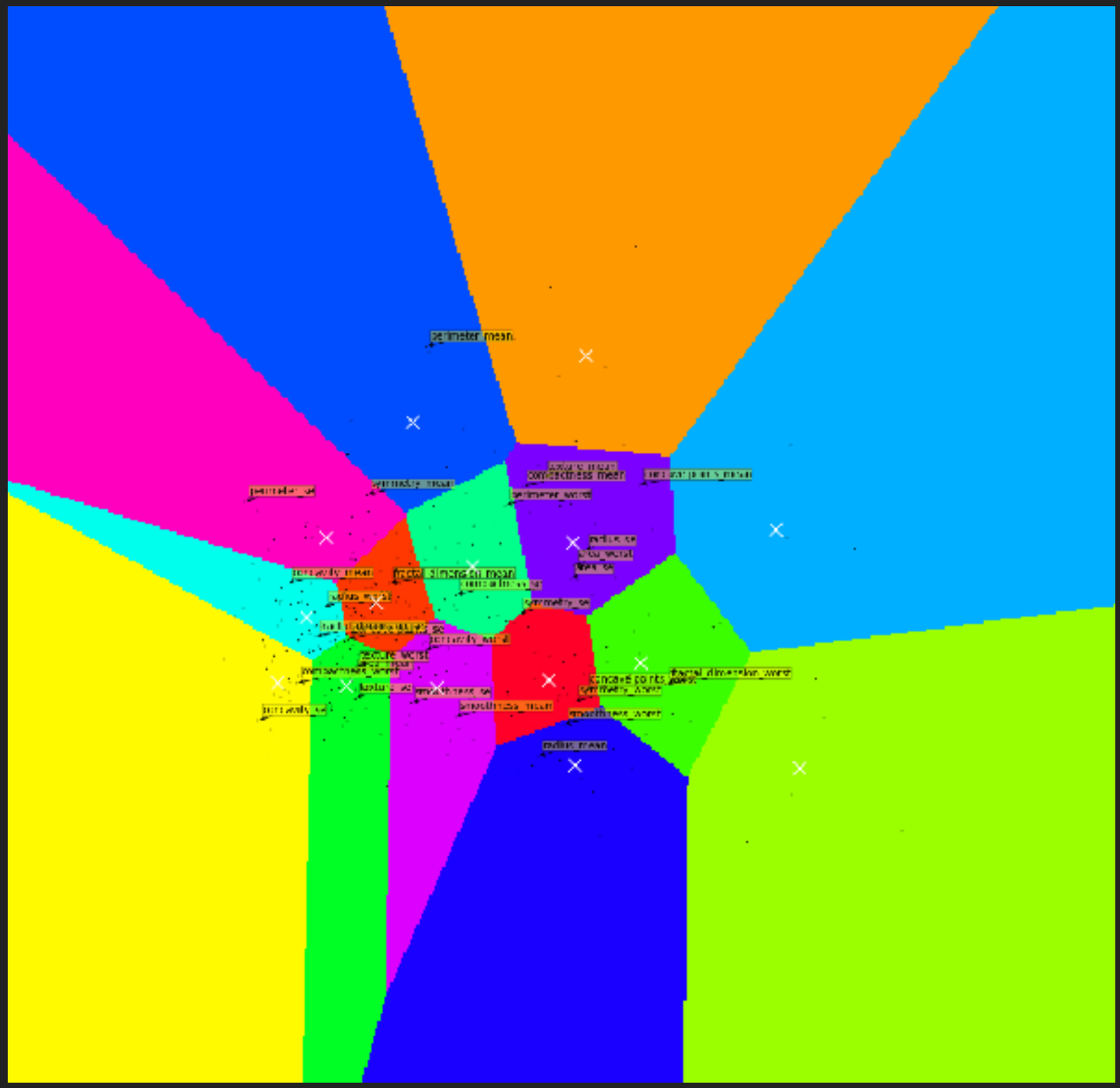
OUT:

	Precision	Recall	f1-Score	Support
B	0.94624	0.98876	0.96703	89
M	0.98000	0.90741	0.94231	54
Avg/Total	0.95899	0.95804	0.95770	143

DIMENSION REDUCTION*

K-means clustering on the digits dataset (PCA-reduced)

PCA*



END