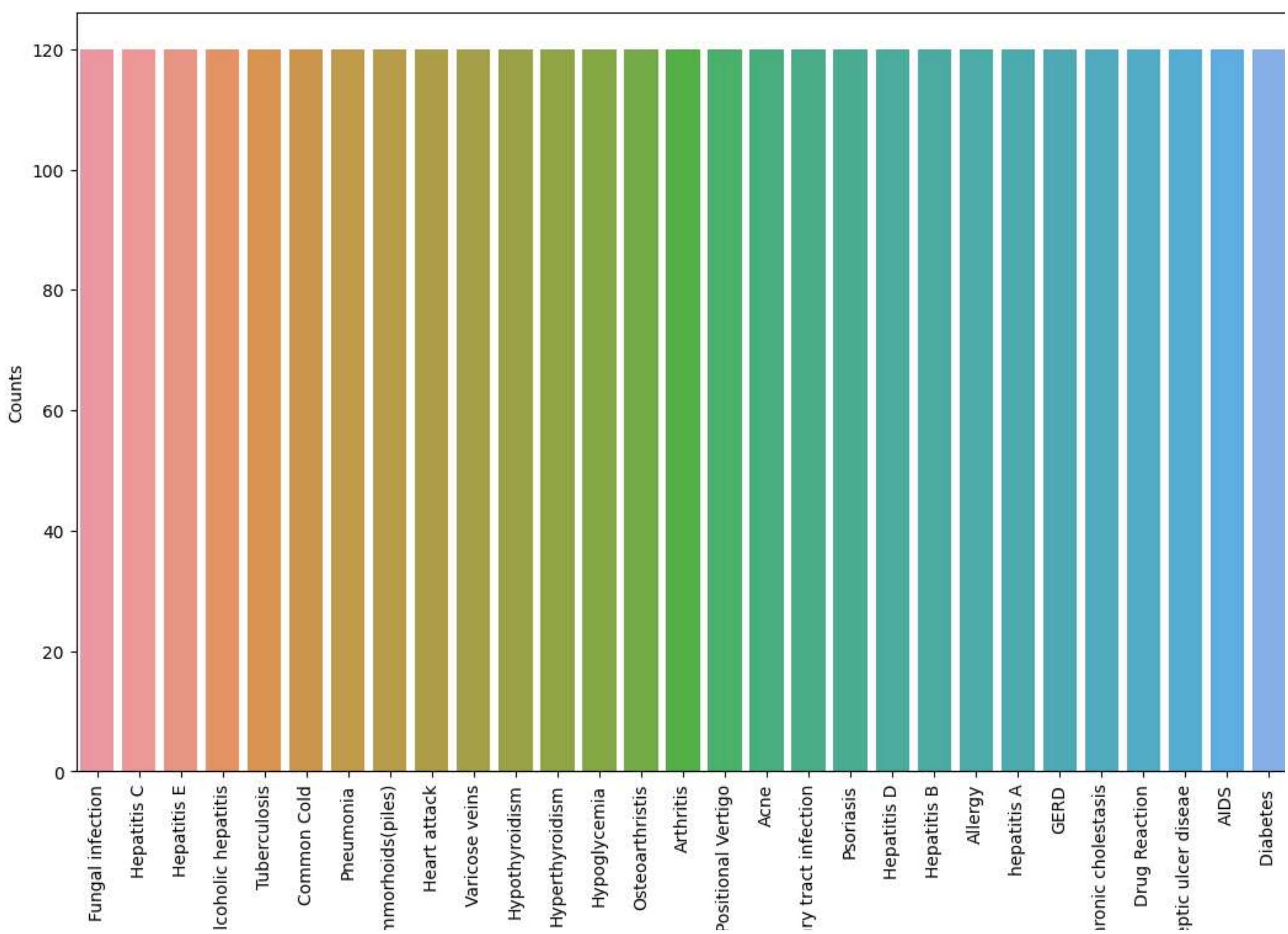
```
# Importing libraries
import numpy as np
import pandas as pd
from scipy.stats import mode
import matplotlib.pyplot as plt
import seaborn as sns
from sklearn.preprocessing import LabelEncoder
from sklearn.model_selection import train_test_split, cross_val_score
from sklearn.svm import SVC
from sklearn.naive_bayes import GaussianNB
from sklearn.ensemble import RandomForestClassifier
from sklearn.metrics import accuracy_score, confusion_matrix

%matplotlib inline
```

```
# Reading the train.csv by removing the
# last column since it's an empty column
DATA_PATH = "/content/Training.csv"
data = pd.read_csv(DATA_PATH).dropna(axis = 1)

# Checking whether the dataset is balanced or not
disease_counts = data["prognosis"].value_counts()
temp_df = pd.DataFrame({
  "Disease": disease_counts.index,
  "Counts": disease_counts.values
})

plt.figure(figsize = (18,8))
sns.barplot(x = "Disease", y = "Counts", data = temp_df)
plt.xticks(rotation=90)
plt.show()
```



```
# Encoding the target value into numerical
# value using LabelEncoder
encoder = LabelEncoder()
data["prognosis"] = encoder.fit_transform(data["prognosis"])



X = data.iloc[:,:-1]
y = data.iloc[:, -1]
X_train, X_test, y_train, y_test =train_test_split(
X, y, test_size = 0.2, random_state = 24)

print(f"Train: {X_train.shape}, {y_train.shape}")
print(f"Test: {X_test.shape}, {y_test.shape}")
```

```
Train: (3936, 132), (3936,)
Test: (984, 132), (984,)
```

```
# Defining scoring metric for k-fold cross validation
def cv_scoring(estimator, X, y):
    return accuracy_score(y, estimator.predict(X))

# Initializing Models
models = {
    "SVC":SVC(),
    "Gaussian NB":GaussianNB(),
    "Random Forest":RandomForestClassifier(random_state=18)
}

# Producing cross validation score for the models
for model_name in models:
    model = models[model_name]
    scores = cross_val_score(model, X, y, cv = 2,
                             n_jobs = -1,
                             scoring = cv_scoring)
    print("=="*30)
    print(model_name)
    print(f"Scores: {scores}")
    print(f"Mean Score: {np.mean(scores)}")
```

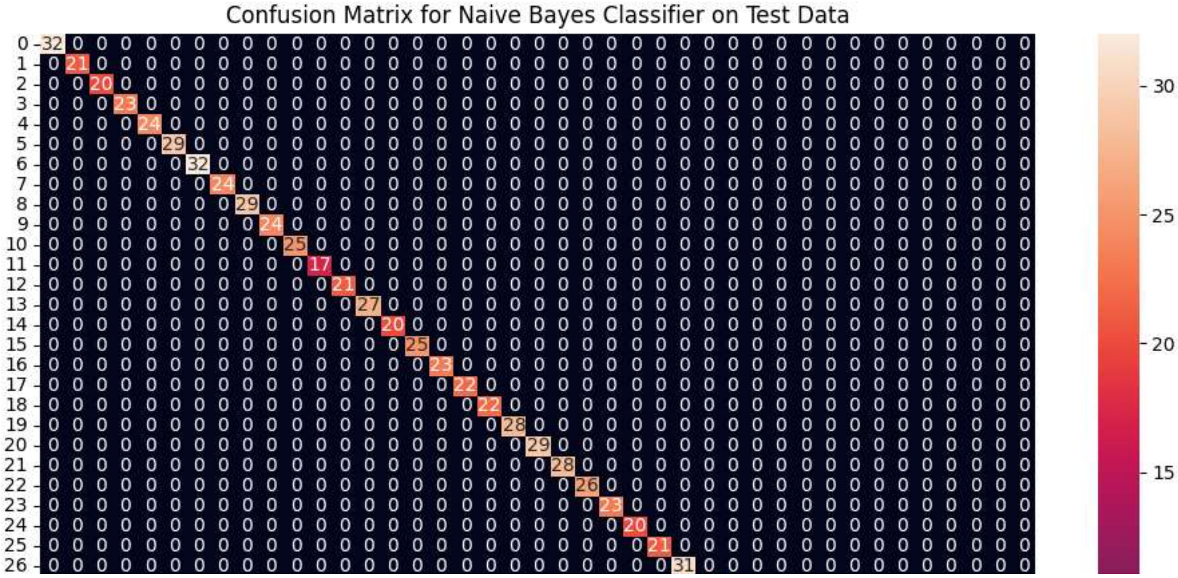
```
============================================================
SVC
Scores: [1. 1.]
Mean Score: 1.0
============================================================
Gaussian NB
Scores: [1. 1.]
Mean Score: 1.0
============================================================
Random Forest
Scores: [1. 1.]
Mean Score: 1.0
```

```
# Training and testing SVM Classifier
svm_model = SVC()
svm_model.fit(X_train, y_train)
preds = svm_model.predict(X_test)

print(f"Accuracy on train data by SVM Classifier\
: {accuracy_score(y_train, svm_model.predict(X_train))*100}")

print(f"Accuracy on test data by SVM Classifier\
: {accuracy_score(y_test, preds)*100}")
cf_matrix = confusion_matrix(y_test, preds)
plt.figure(figsize=(12,8))
sns.heatmap(cf_matrix, annot=True)
plt.title("Confusion Matrix for SVM Classifier on Test Data")
plt.show()

# Training and testing Naive Bayes Classifier
nb_model = GaussianNB()
nb_model.fit(X_train, y_train)
preds = nb_model.predict(X_test)
print(f"Accuracy on train data by Naive Bayes Classifier\
: {accuracy_score(y_train, nb_model.predict(X_train))*100}")
```

```
print(f"Accuracy on test data by Naive Bayes Classifier\
: {accuracy_score(y_test, preds)*100}")
cf_matrix = confusion_matrix(y_test, preds)
plt.figure(figsize=(12,8))
sns.heatmap(cf_matrix, annot=True)
plt.title("Confusion Matrix for Naive Bayes Classifier on Test Data")
plt.show()

# Training and testing Random Forest Classifier
rf_model = RandomForestClassifier(random_state=18)
rf_model.fit(X_train, y_train)
preds = rf_model.predict(X_test)
print(f"Accuracy on train data by Random Forest Classifier\
: {accuracy_score(y_train, rf_model.predict(X_train))*100}")

print(f"Accuracy on test data by Random Forest Classifier\
: {accuracy_score(y_test, preds)*100}")

cf_matrix = confusion_matrix(y_test, preds)
plt.figure(figsize=(12,8))
sns.heatmap(cf_matrix, annot=True)
plt.title("Confusion Matrix for Random Forest Classifier on Test Data")
plt.show()
```

```
Accuracy on train data by Naive Bayes Classifier: 100.0
Accuracy on test data by Naive Bayes Classifier: 100.0
```

Confusion Matrix for Naive Bayes Classifier on Test Data



```
# Training the models on whole data
final_svm_model = SVC()
final_nb_model = GaussianNB()
final_rf_model = RandomForestClassifier(random_state=18)
final_svm_model.fit(X, y)
final_nb_model.fit(X, y)
final_rf_model.fit(X, y)

# Reading the test data
test_data = pd.read_csv("/content/Testing.csv").dropna(axis=1)

test_X = test_data.iloc[:, :-1]
test_Y = encoder.transform(test_data.iloc[:, -1])
```

```
# Making prediction by take mode of predictions
# made by all the classifiers
svm_preds = final_svm_model.predict(test_X)
nb_preds = final_nb_model.predict(test_X)
rf_preds = final_rf_model.predict(test_X)

final_preds = [[mode([i,j,k])[0][0] for i,j,k in zip(svm_preds, nb_preds, rf_preds)]]

print(f"Accuracy on Test dataset by the combined model\
: {accuracy_score(test_Y, final_preds)*100}")

cf_matrix = confusion_matrix(test_Y, final_preds)
plt.figure(figsize=(12,8))

sns.heatmap(cf_matrix, annot = True)
plt.title("Confusion Matrix for Combined Model on Test Dataset")
plt.show()
```

```
---------------------------------------------------------------------------
IndexError                                Traceback (most recent call last)
<ipython-input-25-71e3c90373d6> in <cell line: 21>()
     19 rf_preds = final_rf_model.predict(test_X)
     20 
---> 21 final_preds = [[mode([i,j,k])[0][0] for i,j,k in zip(svm_preds, nb_preds, rf_preds)]]
     22 
     23 print(f"Accuracy on Test dataset by the combined model\

<ipython-input-25-71e3c90373d6> in <listcomp>(.0)
     19 rf_preds = final_rf_model.predict(test_X)
     20 
---> 21 final_preds = [[mode([i,j,k])[0][0] for i,j,k in zip(svm_preds, nb_preds, rf_preds)]]
     22 
     23 print(f"Accuracy on Test dataset by the combined model\

IndexError: invalid index to scalar variable.
```

SEARCH STACK OVERFLOW

```
symptoms = X.columns.values

# Creating a symptom index dictionary to encode the
# input symptoms into numerical form
symptom_index = {}
for index, value in enumerate(symptoms):
  symptom = " ".join([i.capitalize() for i in value.split("_")])
  symptom_index[symptom] = index

data_dict = {
  "symptom_index":symptom_index,
  "predictions_classes":encoder.classes_
}

# Defining the Function
# Input: string containing symptoms separated by commas
# Output: Generated predictions by models
def predictDisease(symptoms):
  symptoms = symptoms.split(",")

  # creating input data for the models
  input_data = [0] * len(data_dict["symptom_index"])
  for symptom in symptoms:
    index = data_dict["symptom_index"][symptom]
    input_data[index] = 1

  # reshaping the input data and converting it
  # into suitable format for model predictions
  input_data = np.array(input_data).reshape(1,-1)

  # generating individual outputs
  rf_prediction = data_dict["predictions_classes"][final_rf_model.predict(input_data)[0]]
  nb_prediction = data_dict["predictions_classes"][final_nb_model.predict(input_data)[0]]
  svm_prediction = data_dict["predictions_classes"][final_svm_model.predict(input_data)[0]]

  # making final prediction by taking mode of all predictions
  final_prediction = mode([rf_prediction, nb_prediction, svm_prediction])[0][0]
  predictions = {
```