In [1]:

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import pandas as pd
import numpy as np
import seaborn as sns
import matplotlib.pyplot as plt
from numpy import hstack
from sklearn.datasets import make_classification
from sklearn.model_selection import train_test_split
from sklearn.metrics import accuracy_score
from sklearn.metrics import roc_auc_score
from sklearn.linear_model import LogisticRegression
from sklearn.neighbors import KNeighborsClassifier
from sklearn.tree import DecisionTreeClassifier
from sklearn.svm import SVC
from sklearn.naive_bayes import GaussianNB
from sklearn.gaussian_process import GaussianProcessClassifier
from xgboost import XGBClassifier

# get the dataset
def get_dataset():
        data_set= pd.read_csv('https://raw.githubusercontent.com/sharmaroshan/Breast-Ca
        data_set = data_set.reset_index()
        #Extracting Independent and dependent Variable
        data_set['diagnosis'] = data_set['diagnosis'].map({'M':1, 'B':0})
        y= data_set.iloc[:, 2].values
        X= data_set.iloc[:, 3:33].values
        #print(X.T)
        #print(y.T)
        return X, y

# get a list of base models
def get_models():
        models = list()
        models.append(('lr', LogisticRegression()))
        models.append(('knn', KNeighborsClassifier()))
        models.append(('cart', DecisionTreeClassifier()))
        models.append(('svm', SVC()))
        models.append(('bayes', GaussianNB()))
        return models

# fit the blending ensemble
def fit_ensemble(models, X_train, X_val, y_train, y_val):
        # fit all models on the training set and predict on hold out set
        meta_X = list()
        for name, model in models:
                # fit in training set
                model.fit(X_train, y_train)
                # predict on hold out set
                yhat = model.predict(X_val)
                # reshape predictions into a matrix with one column
                yhat = yhat.reshape(len(yhat), 1)
                #print(yhat)
                #print(len(yhat))
                #exponential noise
                mn=yhat.mean()
                v=yhat.std()
                s=1/0.01 #epsilon=0.001
                n=np.random.normal(mn,v,(len(yhat), 1))
                #print(n)
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                yhat = yhat.reshape(len(yhat), 1) + n
                #yhat = yhat.reshape(len(yhat), 1)
                #print(yhat)
                # store predictions as input for blending
                meta_X.append(yhat)
        # create 2d array from predictions, each set is an input feature
        meta_X = hstack(meta_X)
        # define blending model
        blender = LogisticRegression()
        # fit on predictions from base models
        blender.fit(meta_X, y_val)
        return blender

# make a prediction with the blending ensemble
def predict_ensemble(models, blender, X_test):
        # make predictions with base models
        meta_X = list()
        for name, model in models:
                # predict with base model
                yhat = model.predict(X_test)
                # reshape predictions into a matrix with one column
                yhat = yhat.reshape(len(yhat), 1)
                # store prediction
                meta_X.append(yhat)
        # create 2d array from predictions, each set is an input feature
        meta_X = hstack(meta_X)
        # predict
        return blender.predict(meta_X)

# define dataset
X, y = get_dataset()
# split dataset into train and test sets
X_train_full, X_test, y_train_full, y_test = train_test_split(X, y, test_size=0.20, ran
#feature Scaling
from sklearn.preprocessing import StandardScaler
st_x= StandardScaler()
X_train_full= st_x.fit_transform(X_train_full)
X_test= st_x.transform(X_test)
# split training set into train and validation sets
X_train, X_val, y_train, y_val = train_test_split(X_train_full, y_train_full, test_size
X_train= st_x.fit_transform(X_train)
X_val= st_x.transform(X_val)
# summarize data split
print('Train: %s, Val: %s, Test: %s' % (X_train.shape, X_val.shape, X_test.shape))
# create the base models
models = get_models()
# train the blending ensemble
blender = fit_ensemble(models, X_train, X_val, y_train, y_val)
# make predictions on test set
yhat = predict_ensemble(models, blender, X_test)
# evaluate predictions
score = accuracy_score(y_test, yhat)
print('Blending Accuracy: %.3f' % (score*100))
print(roc_auc_score(y_test, yhat))
#Creating the Confusion matrix
from sklearn.metrics import confusion_matrix
cm= confusion_matrix(y_test, yhat)
print(cm)
# visualize Confusion Matrix
fig = sns.heatmap(cm, annot=True, fmt="d")
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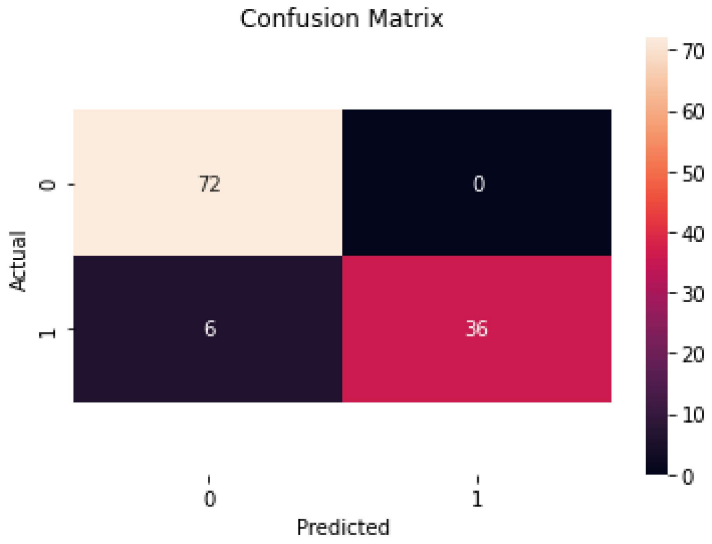
```
bottom, top = fig.get_ylim()
fig.set_ylim(bottom + 0.5, top - 0.5)
plt.title('Confusion Matrix')
plt.xlabel('Predicted')
plt.ylabel('Actual')
plt.show()
```

```
Train: (364, 30), Val: (91, 30), Test: (114, 30)
Blending Accuracy: 94.737
0.9285714285714286
[[72  0]
 [ 6 36]]
```



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