model

April 14, 2019

In [1]:
```
import pandas as pd
import xgboost as xgb
import matplotlib.pyplot as plt
from sklearn.metrics import accuracy_score
import heapq
```

In [2]:
```
#Preprocessing
col_to_drop = ['fin_neg','fin_neu','fin_pos', 'fin_subheading', 'fin_title','news_kids
       'news_pos', 'news_score', 'news_title', 'news_url','reddit_domain', 'reddit_neg
       'reddit_num_comments', 'reddit_pos', 'reddit_score', 'reddit_title',
       'symbol', 'tweet_favorites', 'tweet_hashtags',
       'tweet_neg', 'tweet_neu', 'tweet_pos', 'tweet_retweets', 'tweet_text','asset_nar

col_to_drop_crypto = ['fin_neg','fin_neu','fin_pos', 'fin_subheading', 'fin_title','neu
       'news_pos', 'news_score', 'news_title', 'news_url','reddit_domain', 'reddit_neg
       'reddit_num_comments', 'reddit_pos', 'reddit_score', 'reddit_title',
       'symbol', 'tweet_favorites', 'tweet_hashtags',
       'tweet_neg', 'tweet_neu', 'tweet_pos', 'tweet_retweets', 'tweet_text','asset_nar


def preprocessing(stock_pair):
    df = stock_pair["data"].drop(columns = col_to_drop,axis=1)
    df = df.astype(float)
    for col in df.columns:
        df[col] = df[col].fillna(df[col].mean())
    return df

def preprocessing_crypto(crypto_pair):
    df = crypto_pair["data"].drop(columns = col_to_drop_crypto,axis=1)
    df = df.astype(float)
    for col in df.columns:
        df[col] = df[col].fillna(df[col].mean())
    return df
```

In [3]:
```
def create_predictors(df):
    predictors = pd.DataFrame({"sma20":df.open.rolling(window=20).mean()})
    predictors["sma40"] = df.open.rolling(window=40).mean()
    predictors["sma20_1"] = predictors.sma20.shift(1)
```

```
    predictors["sma20_increment"] = predictors.sma20.diff()
    predictors["sma20_1_increment"] = predictors.sma20_1.diff()
    predictors["sma40_increment"] = predictors.sma40.diff()
    predictors["vol_increment"] = df.volume.diff()
    predictors["vol_rel_increment"] = df.volume.diff() / df.volume
    predictors["open_1"] = df.open.shift(1)
    predictors["open_incr"] = df.open - df.open.shift(1)
    predictors["open"] = df.open
    predictors['ema20'] = df.open.ewm(span=20,adjust=False).mean()
    predictors["ema20_1"] = predictors.ema20.shift(1)
    predictors["ema20_increment"] = predictors.ema20.diff()
    predictors['ema40'] = df.open.ewm(span=40,adjust=False).mean()
    predictors["ema40_1"] = predictors.ema40.shift(1)
    predictors["ema40_increment"] = predictors.ema40.diff()
    predictors["ema40_1_increment"] = predictors.ema40_1.diff()
    predictors["high"] = df.high
    predictors["low"] = df.low
    predictors["close"] = df.close
    predictors['fin_compound'] = df.fin_compound
    predictors['news_compound'] = df.news_compound
    predictors['reddit_compound'] = df.reddit_compound
    predictors['tweet_compound'] = df.tweet_compound
    return predictors.dropna()


def create_predictors_crypto(df):
    predictors = pd.DataFrame({"sma20":df.open.rolling(window=20).mean()})
    predictors["sma40"] = df.open.rolling(window=40).mean()
    predictors["sma20_1"] = predictors.sma20.shift(1)
    predictors["sma20_increment"] = predictors.sma20.diff()
    predictors["sma40_increment"] = predictors.sma40.diff()
    predictors["sma20_1_increment"] = predictors.sma20_1.diff()
    predictors["vol_increment"] = df.volumefrom.diff()
    predictors["vol_rel_increment"] = df.volumefrom.diff() / df.volumefrom
    predictors["open_1"] = df.open.shift(1)
    predictors["open_incr"] = df.open - df.open.shift(1)
    predictors["open"] = df.open
    predictors['ema20'] = df.open.ewm(span=20,adjust=False).mean()
    predictors['ema40'] = df.open.ewm(span=40,adjust=False).mean()
    predictors["ema20_increment"] = predictors.ema20.diff()
    predictors["ema40_1"] = predictors.ema40.shift(1)
    predictors["ema40_increment"] = predictors.ema40.diff()
    predictors["ema40_1_increment"] = predictors.ema40_1.diff()
    predictors["high"] = df.high
    predictors["low"] = df.low
    predictors["close"] = df.close
    predictors['fin_compound'] = df.fin_compound
    predictors['news_compound'] = df.news_compound
```

```
        predictors['reddit_compound'] = df.reddit_compound
        predictors['tweet_compound'] = df.tweet_compound
        return predictors.dropna()

In [4]: #Create target test and training
    def create_test_target(Predictors):
        target = pd.DataFrame({"value":Predictors.sma20.shift(-1) - Predictors.sma20}).dro
        X = pd.merge(Predictors, target,left_index=True,right_index=True)[Predictors.colum
        y = pd.merge(Predictors, target,left_index=True,right_index=True)[target.columns]
        train_samples = int(X.shape[0] * 0.65)
        X_train = X.iloc[:train_samples]
        X_test = X.iloc[train_samples:]

        y_train = y.iloc[:train_samples]
        y_test = y.iloc[train_samples:]

        return target,X_train,X_test,y_train,y_test

In [5]: #Creating the model

    n_estimators = [150, 200, 250, 450, 500, 550, 1000]
    max_depth = [1,2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]

    def model(target,X_train,X_test,y_train,y_test):
        def getBinary(val):
            if val>0:
                return 1
            else:
                return 0

        y_test_binary = pd.DataFrame(y_test["value"].apply(getBinary))

        best_depth = 0
        best_estimator = 0
        max_score = 0

        for n in n_estimators:
            for md in max_depth:
                model = xgb.XGBRegressor(gamma=0.0,n_estimators=n,base_score=0.7,colsample
                xgbModel = model.fit(X_train,y_train.value.apply(getBinary))
                y_predicted = model.predict(X_test)
                y_predicted_binary = [1 if yp >=0.5 else 0 for yp in y_predicted]
                score = accuracy_score(y_test_binary, y_predicted_binary)
                if score > max_score:
                    max_score = score
                    best_depth = md
                    best_estimator = n
                    best_y_predicted_binary = y_predicted_binary
```

```
                    best_model = xgbModel
        #    print("Best score is " + str(max_score) + " at depth of " + str(best_depth) + " a
            return y_test_binary,best_y_predicted_binary,max_score,best_model
```

In [6]:
```
#To merge the predicted values with the original dataframe
def merge_original(y_test_binary,y_predicted_binary,stock_pair):
    y_test_binary['predicted'] = y_predicted_binary
    merged = pd.merge(stock_pair['data'], y_test_binary,left_index=True,right_index=Tru
    return merged
```

In [7]:
```
#Reading the data files
df_stock = pd.read_json("C:\\Users\\rishb\\tradespade\\Code\\Data_Collection\\Hourly-Pr
df_crypto = pd.read_json("C:\\Users\\rishb//tradespade\\Code\\Data_Collection\\Hourly-D
```

In [8]:
```
#For stocks
stock_sybmol_list=['WMT', 'US1.MSFT', 'US1.HD', 'US2.GOOG', 'US2.AAPL', 'US1.WFC',
       'US1.CVX', 'US1.KO', 'US1.XOM']
stock_name_list = ['Walmart', 'Microsoft', 'Home_Depot',
       'Alphabet', 'Apple', 'Wells_Fargo',
       'Chevron', 'Coca-Cola',
       'Exxon_Mobil']

mylist = list()

for stock,stock_name in zip(stock_sybmol_list,stock_name_list):
    stock = {"stock_name":stock_name, "data": df_stock[df_stock['symbol']==stock]}
    stock["data"]=stock["data"].set_index("created_utc")
    mylist.append(stock)


total_acc = 0
for dict1 in mylist:
    df = preprocessing(dict1)
    Predictors = create_predictors(df)
    target,X_train,X_test,y_train,y_test = create_test_target(Predictors)
    y_test_binary,y_predicted_binary,acc,xgbModel = model(target,X_train,X_test,y_train
    fig = plt.figure(figsize=(6,6))
    plt.xticks(rotation='vertical')
    plt.bar([i for i in range(len(xgbModel.feature_importances_))], xgbModel.feature_im
    plt.show()
    print(dict1['stock_name'],acc)
    merged = merge_original(y_test_binary,y_predicted_binary,dict1)
    merged['accuracy'] = acc
    total_acc+=acc
    dict1['acc']=acc
    dict1['feature_importance']=xgbModel.feature_importances_.tolist()
    dict1['merged'] = merged
    dict1['stock_name'] = dict1['stock_name']+"_with_predicted"
```

```
#    dict1["merged"].reset_index().to_json(save_path+dict1['stock_name']+'.json',orien


print("The average accuracy for stocks is: {}".format(total_acc/9))
```

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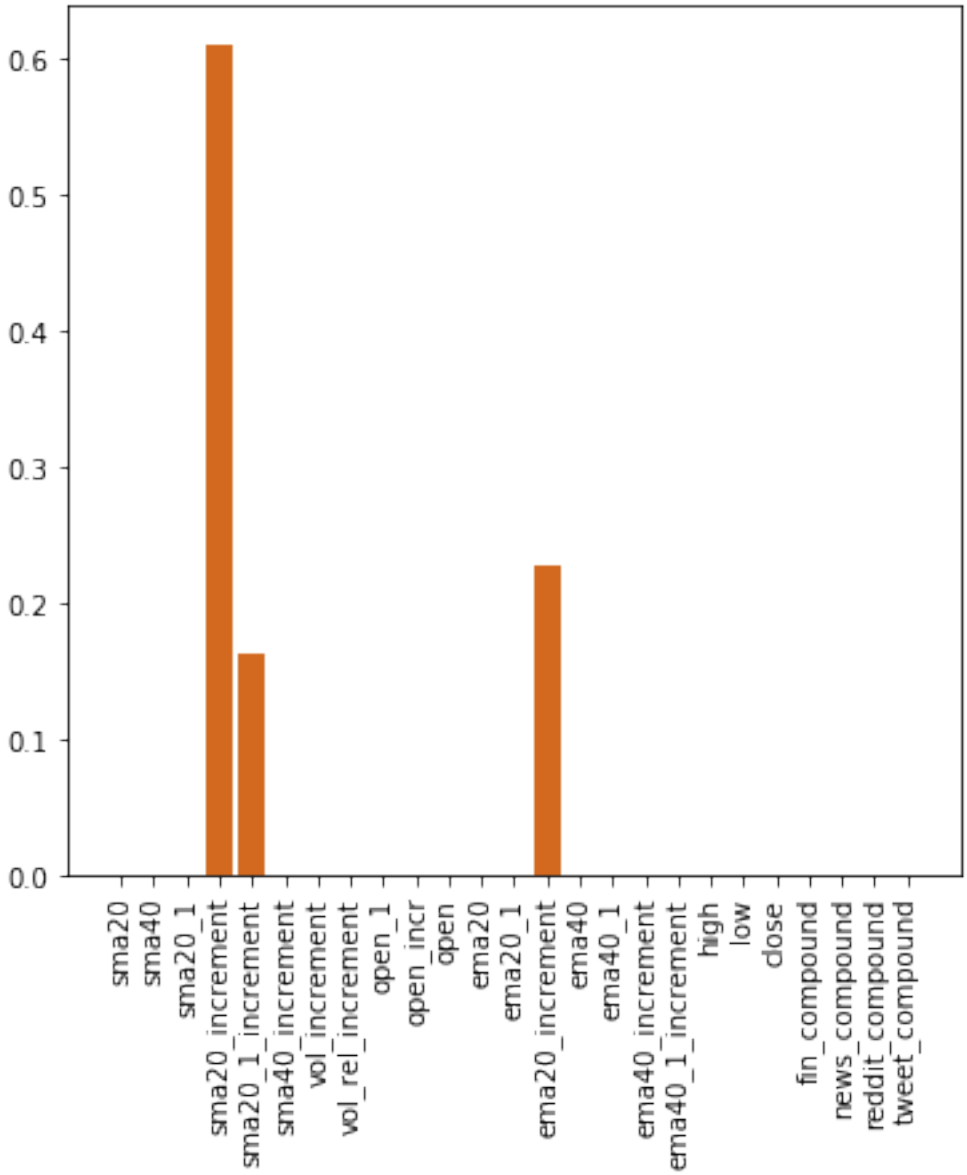


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Walmart 0.9343971631205674
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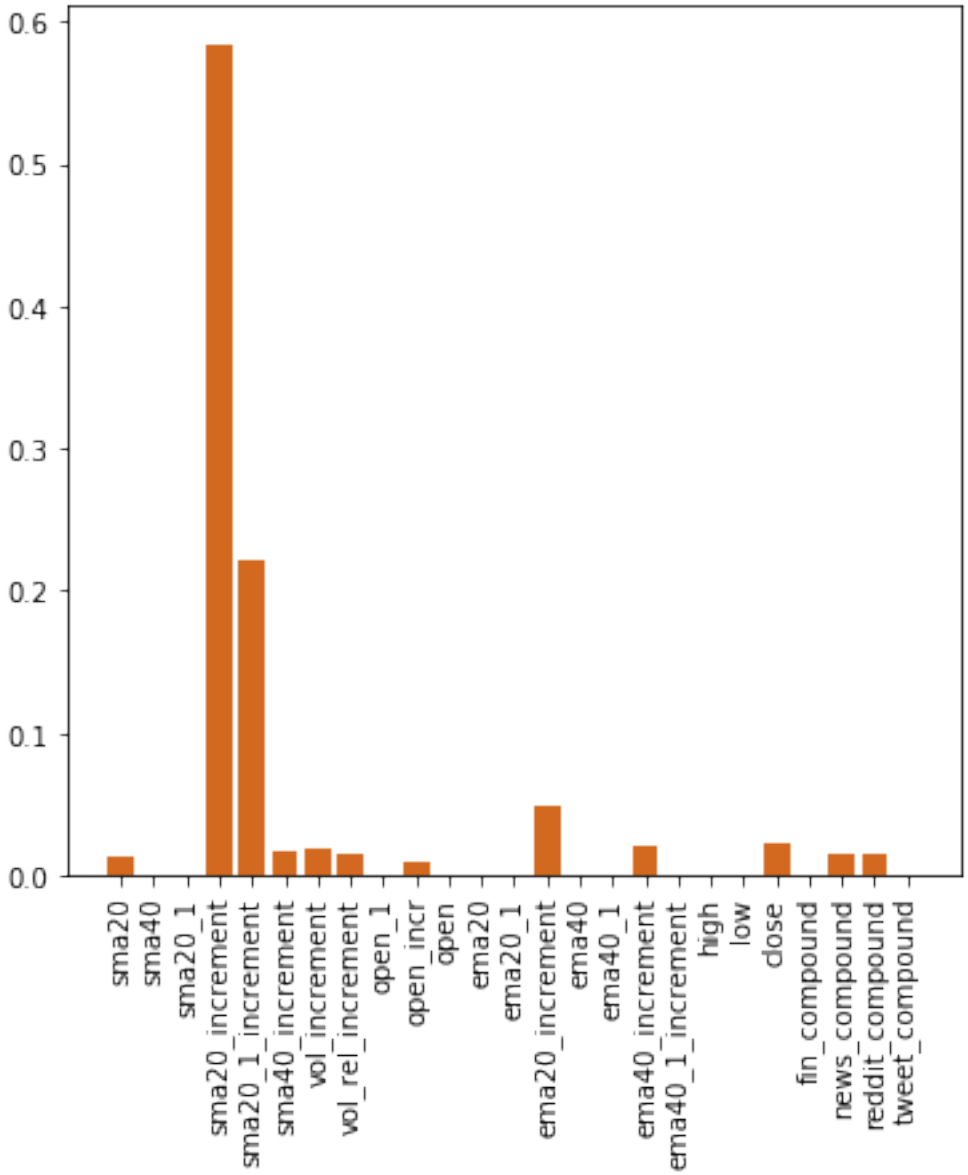


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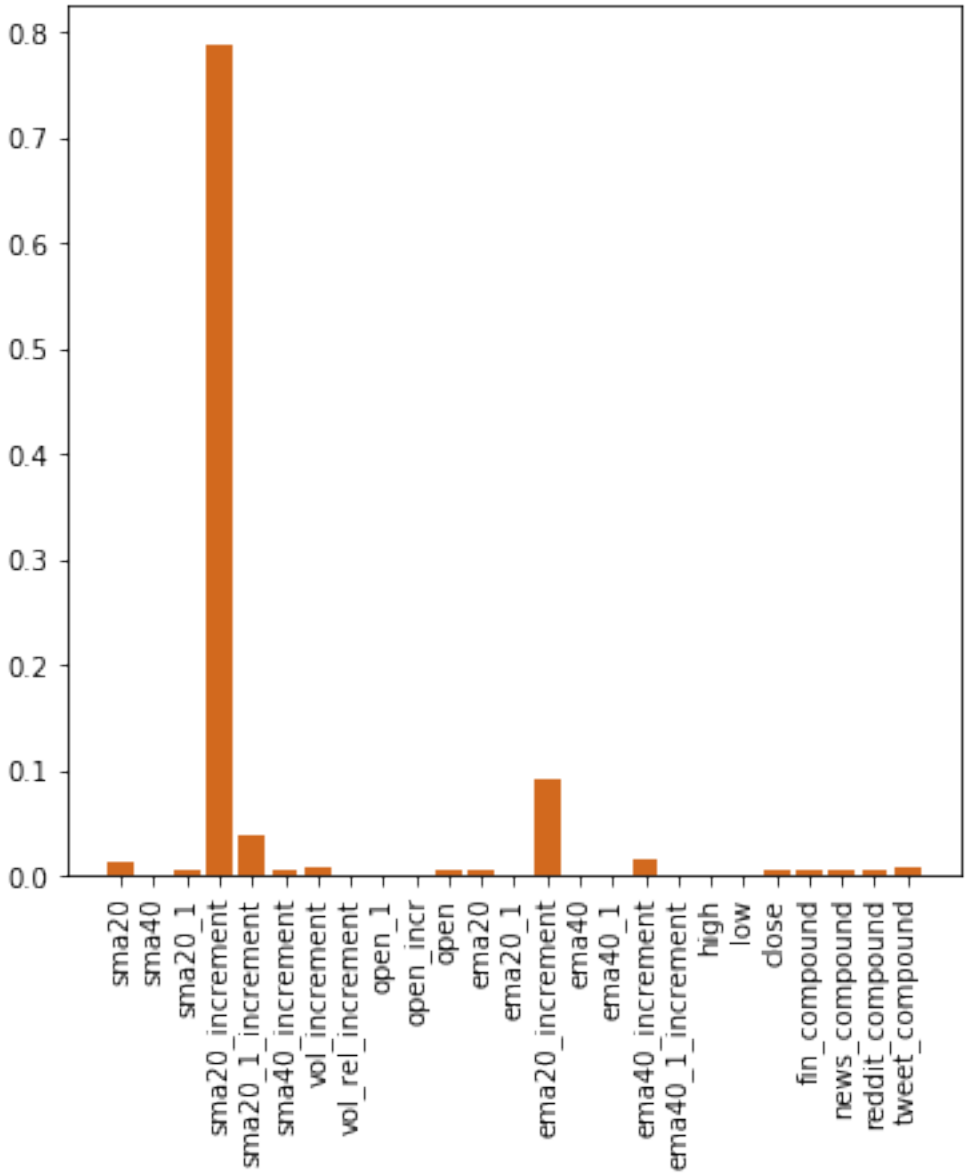


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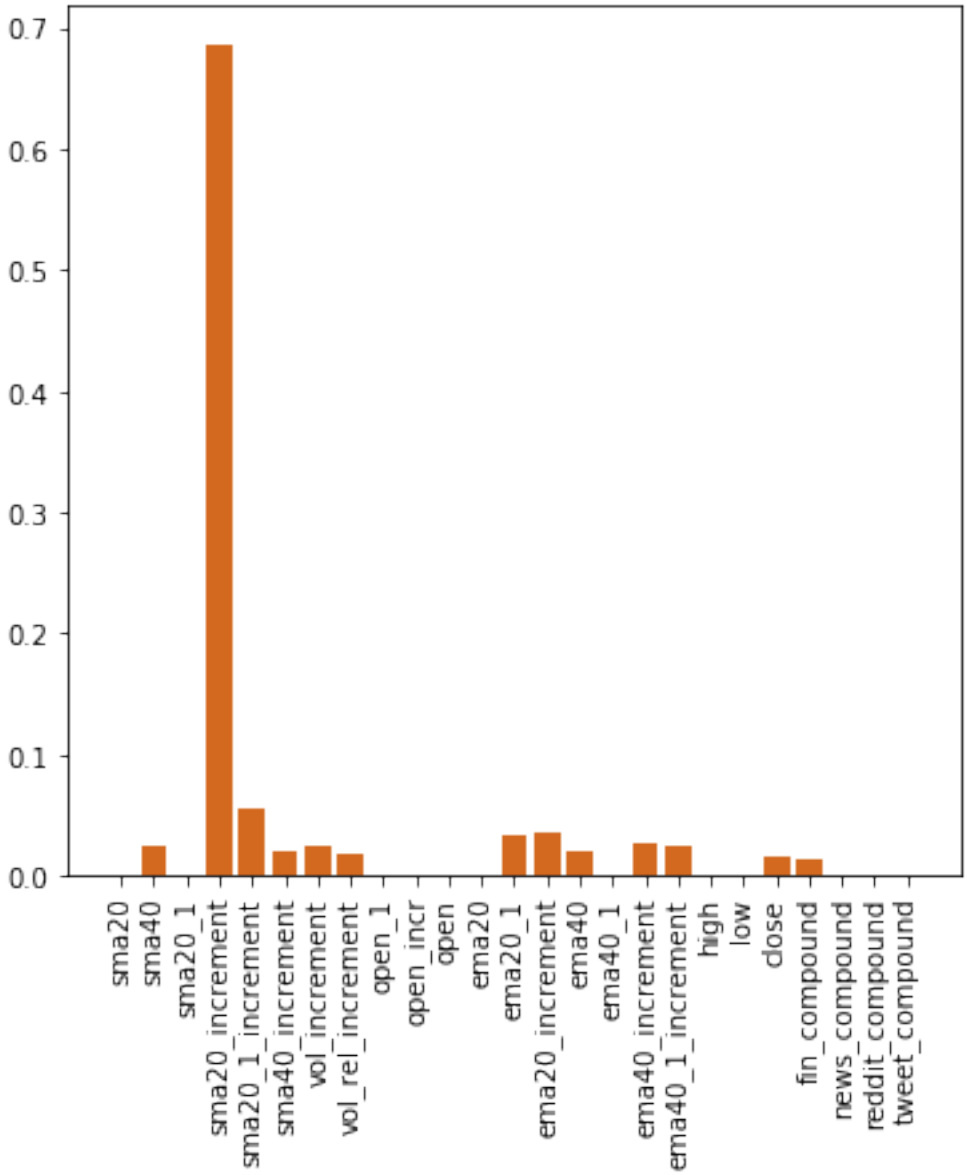


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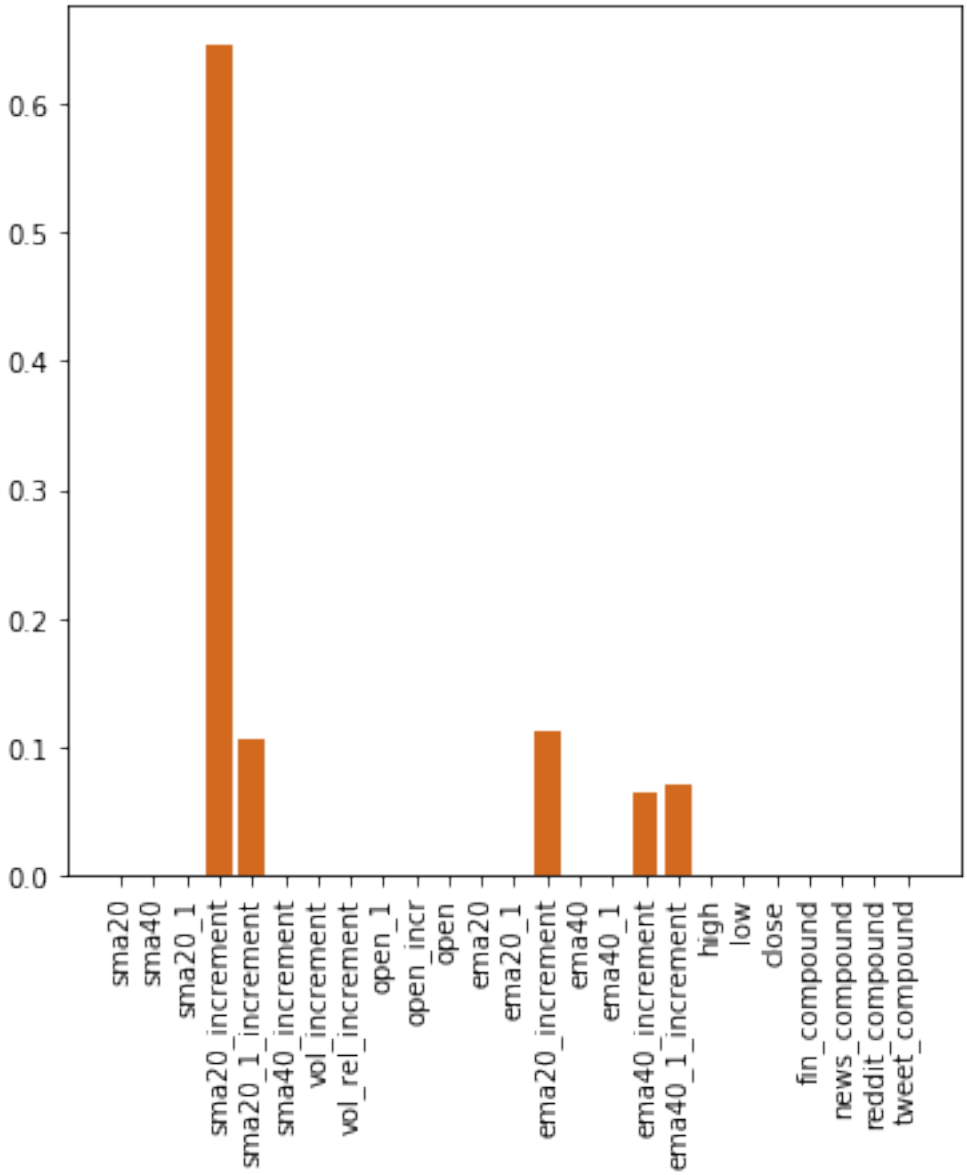


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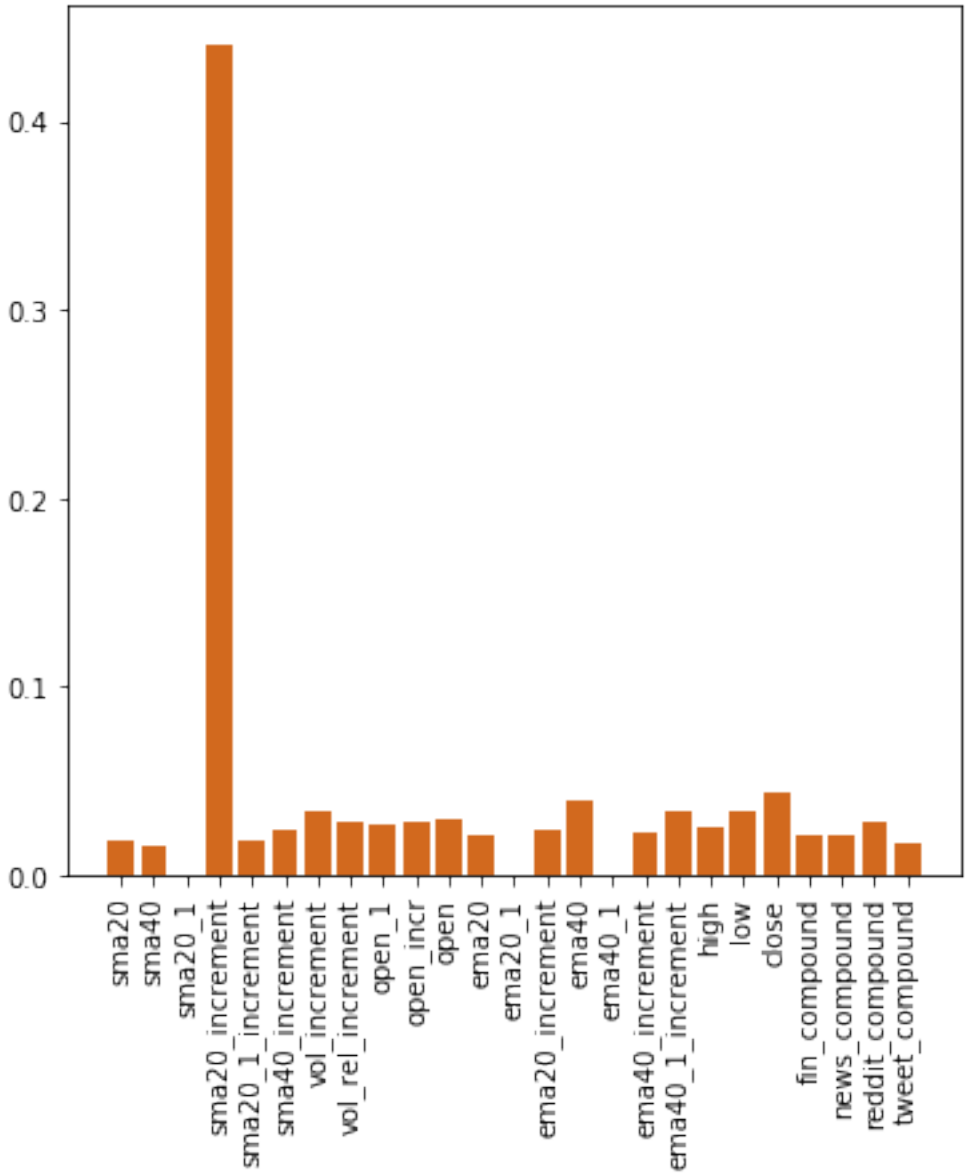


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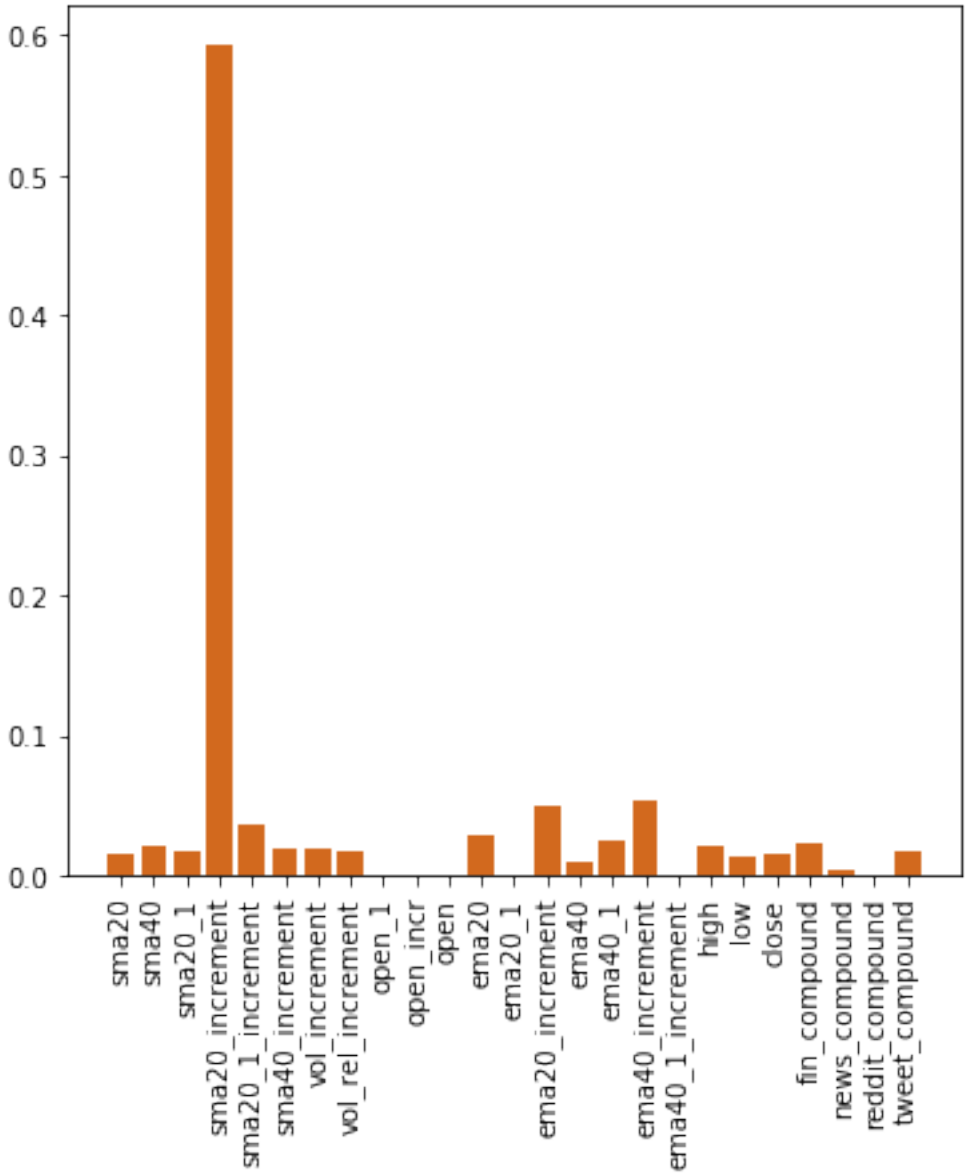


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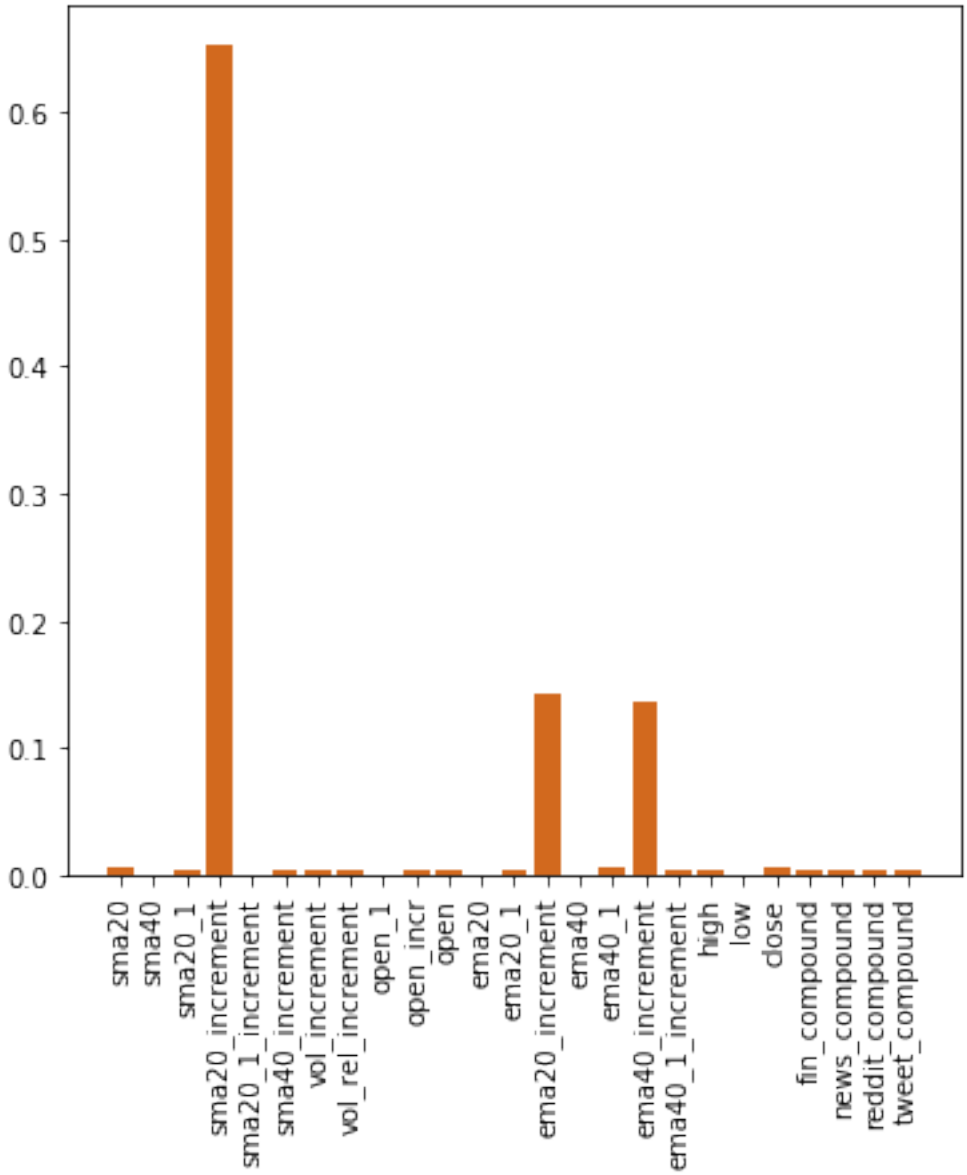


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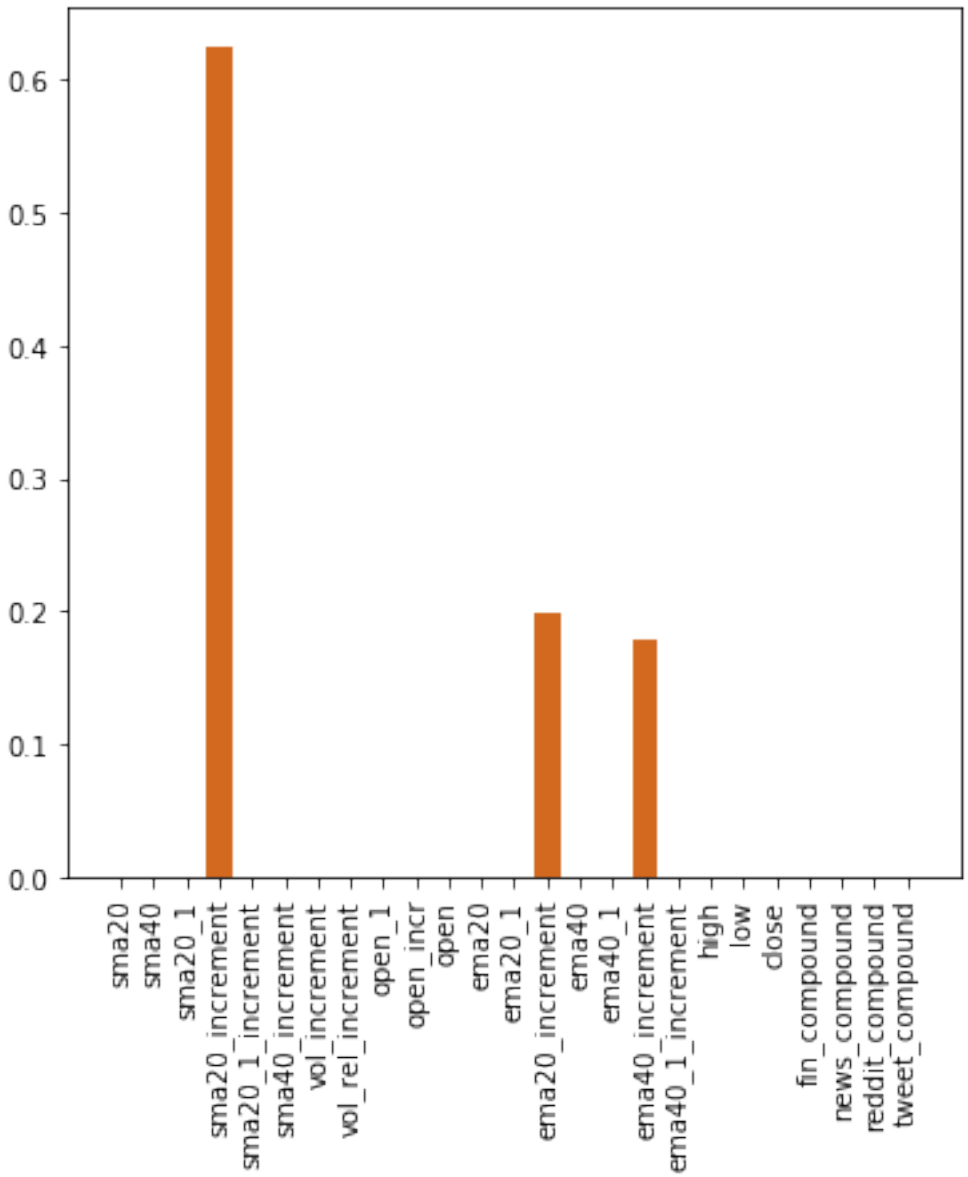


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Exxon_Mobil 0.9219858156028369
The average accuracy for stocks is: 0.9101654846335696
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```
In [ ]:
```

```
In [9]: crypto_symbol_list=['BNB', 'BTC', 'EOS', 'LTC', 'XLM', 'TRX', 'XRP', 'BCH'#, 'ETH'
                           ]
        crypto_name_list = ['Binance_Coin',
         'Bitcoin',
         'EOS',
```

```
 'Litecoin',
 'Stellar',
 'TRON',
 'XRP',
 'Bitcoin_Cash'
# ,'Ethereum'
    ]

mylist_crypto = list()

for crypto,crypto_name in zip(crypto_symbol_list,crypto_name_list):
    crypto = {"crypto_name":crypto_name, "data": df_crypto[df_crypto['symbol']==crypto]
    crypto["data"]=crypto["data"].set_index("created_utc")
    mylist_crypto.append(crypto)


save_path = "C:\\Users\\rishb\\predicted_crypto\\"

#n_estimators = [150, 200, 250, 450, 500, 550, 1000]
#max_depth = [1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12]

total_acc_crypto = 0
for dict1 in mylist_crypto:
    df = preprocessing_crypto(dict1)
    Predictors = create_predictors_crypto(df)
    target,X_train,X_test,y_train,y_test = create_test_target(Predictors)
    y_test_binary,y_predicted_binary,acc,xgbModel = model(target,X_train,X_test,y_trai
    merged = merge_original(y_test_binary,y_predicted_binary,dict1)
    merged['accuracy'] = acc
    fig = plt.figure(figsize=(6,6))
    plt.xticks(rotation='vertical')
    plt.bar([i for i in range(len(xgbModel.feature_importances_))], xgbModel.feature_i
    plt.show()
    print(dict1['crypto_name'],acc)
    dict1['acc']=acc
    dict1['feature_importance']=xgbModel.feature_importances_.tolist()
    dict1['merged'] = merged
    dict1['crypto_name'] = dict1['crypto_name']+"_with_predicted"
    total_acc_crypto+=acc
#    dict1["merged"].reset_index().to_json(save_path+dict1['crypto_name']+'.json',orie

print("Average cryptocurrency accuracy={}".format(total_acc_crypto/8))
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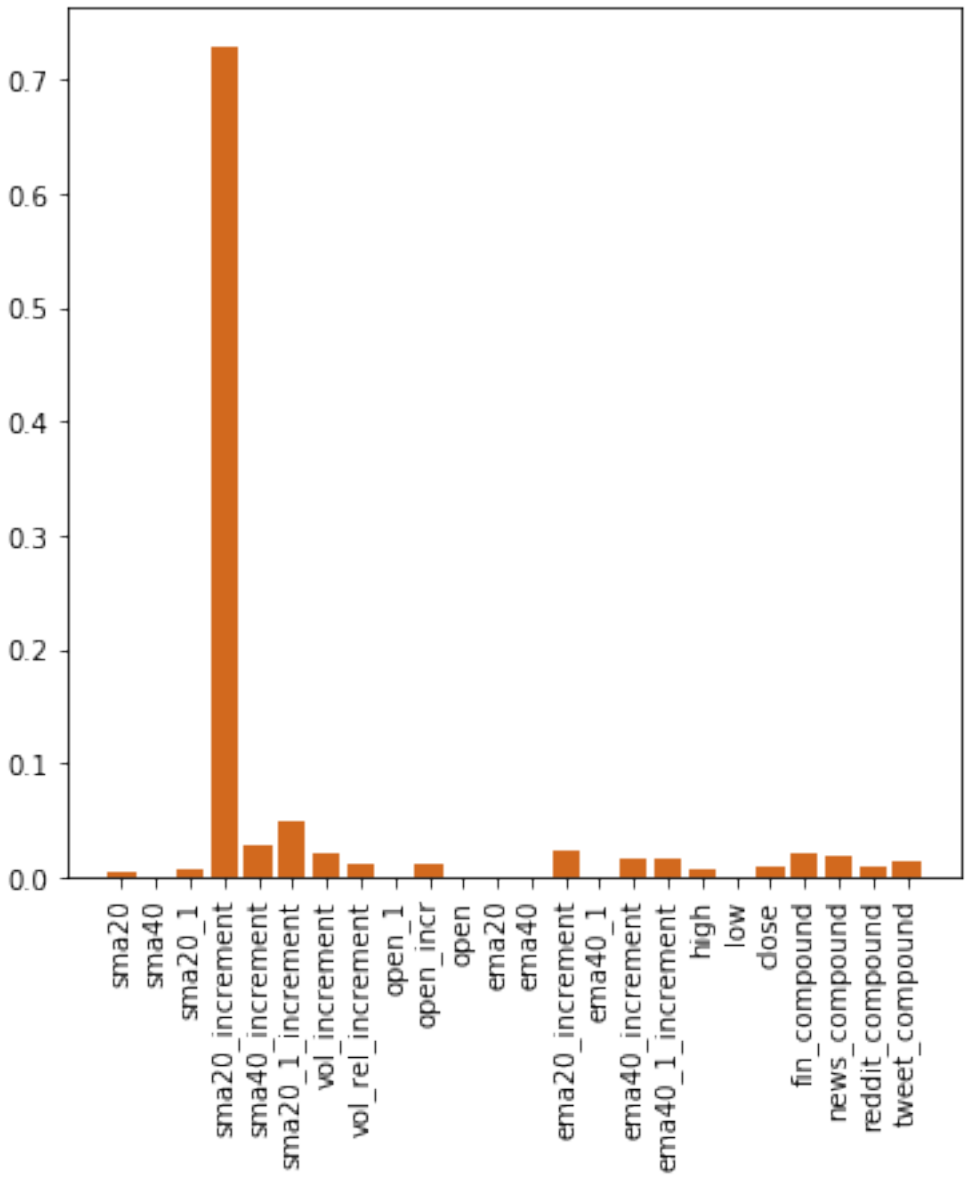


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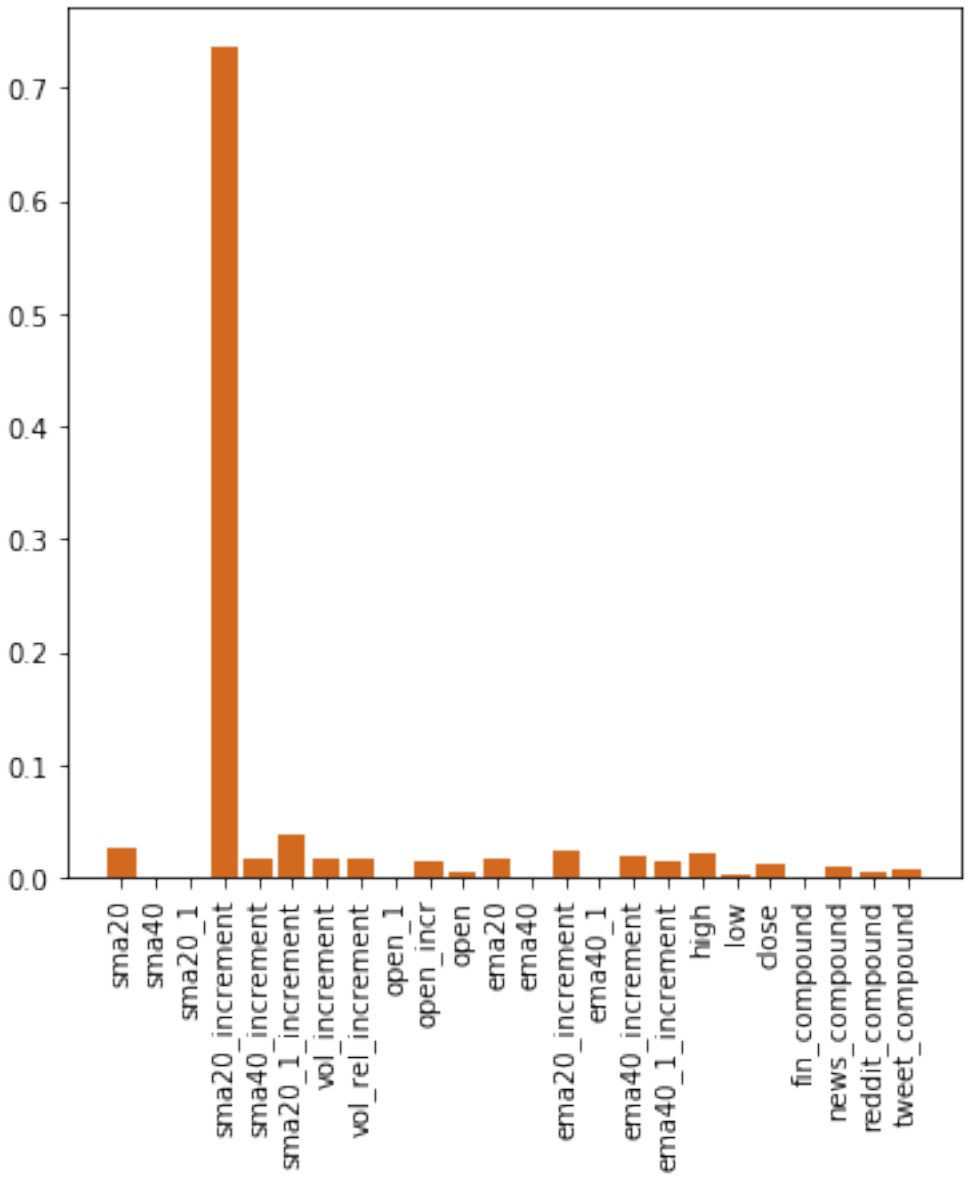


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Bitcoin 0.8691275167785235


C:\Users\rishb\Anaconda64\lib\site-packages\xgboost\core.py:587: FutureWarning: Series.base is
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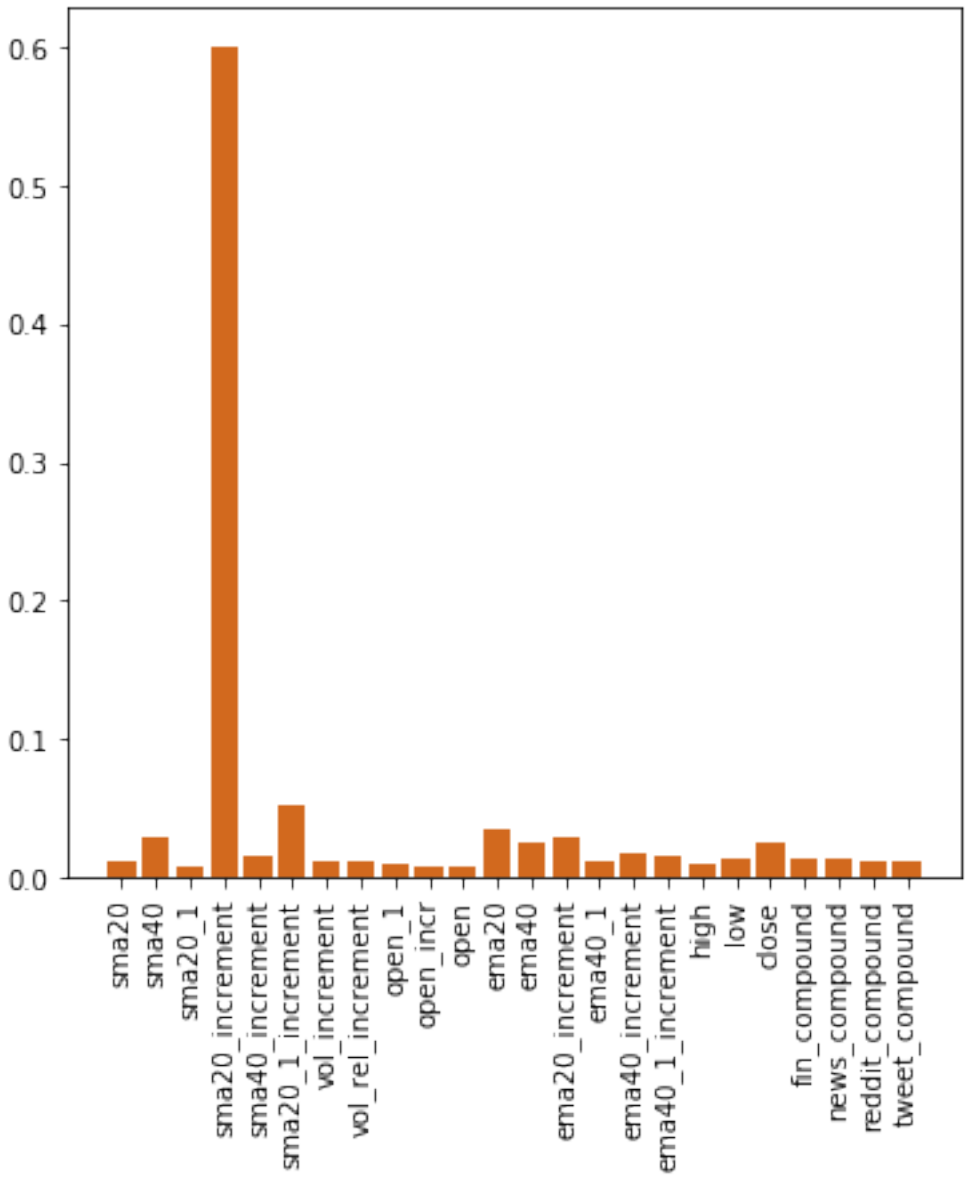


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EOS 0.8912529550827423
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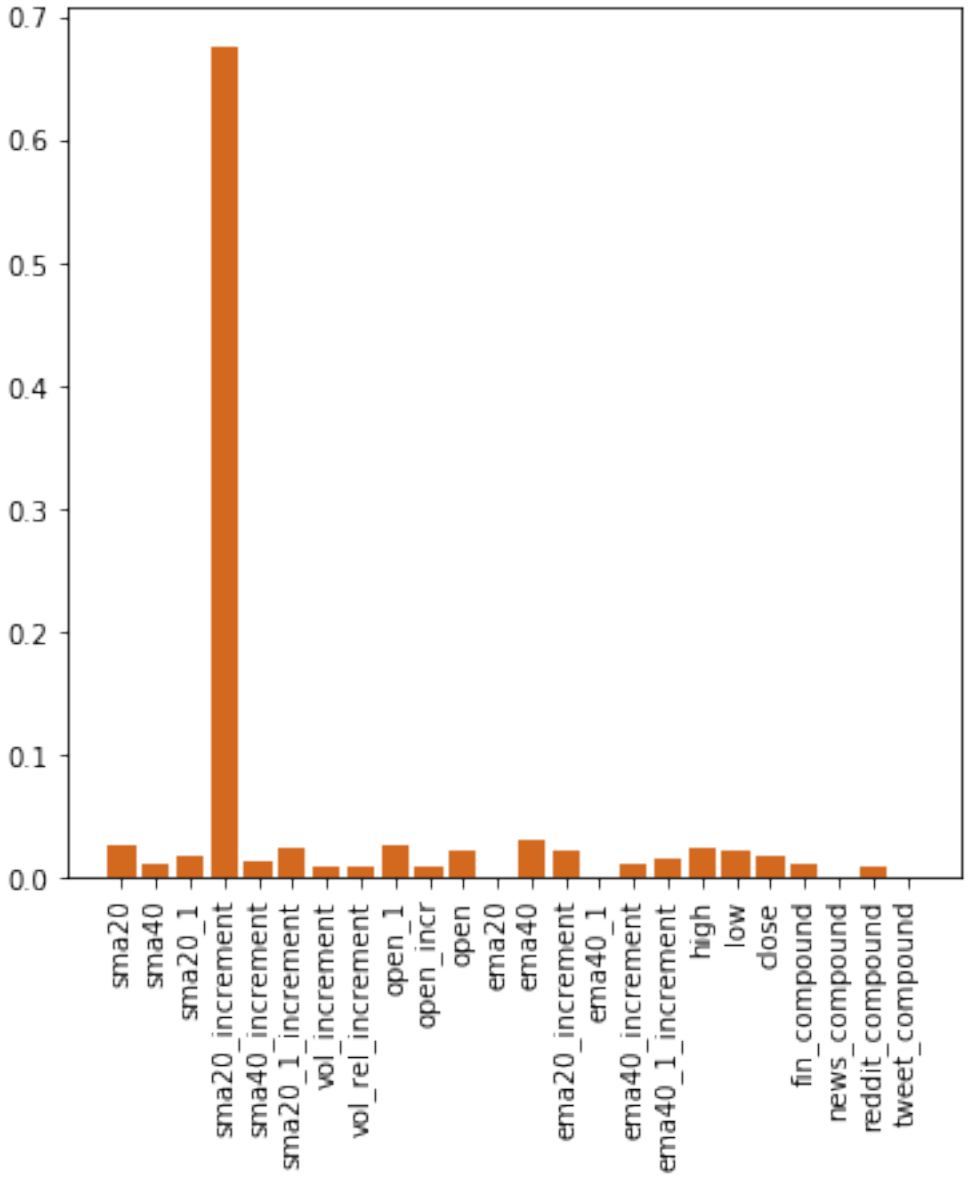


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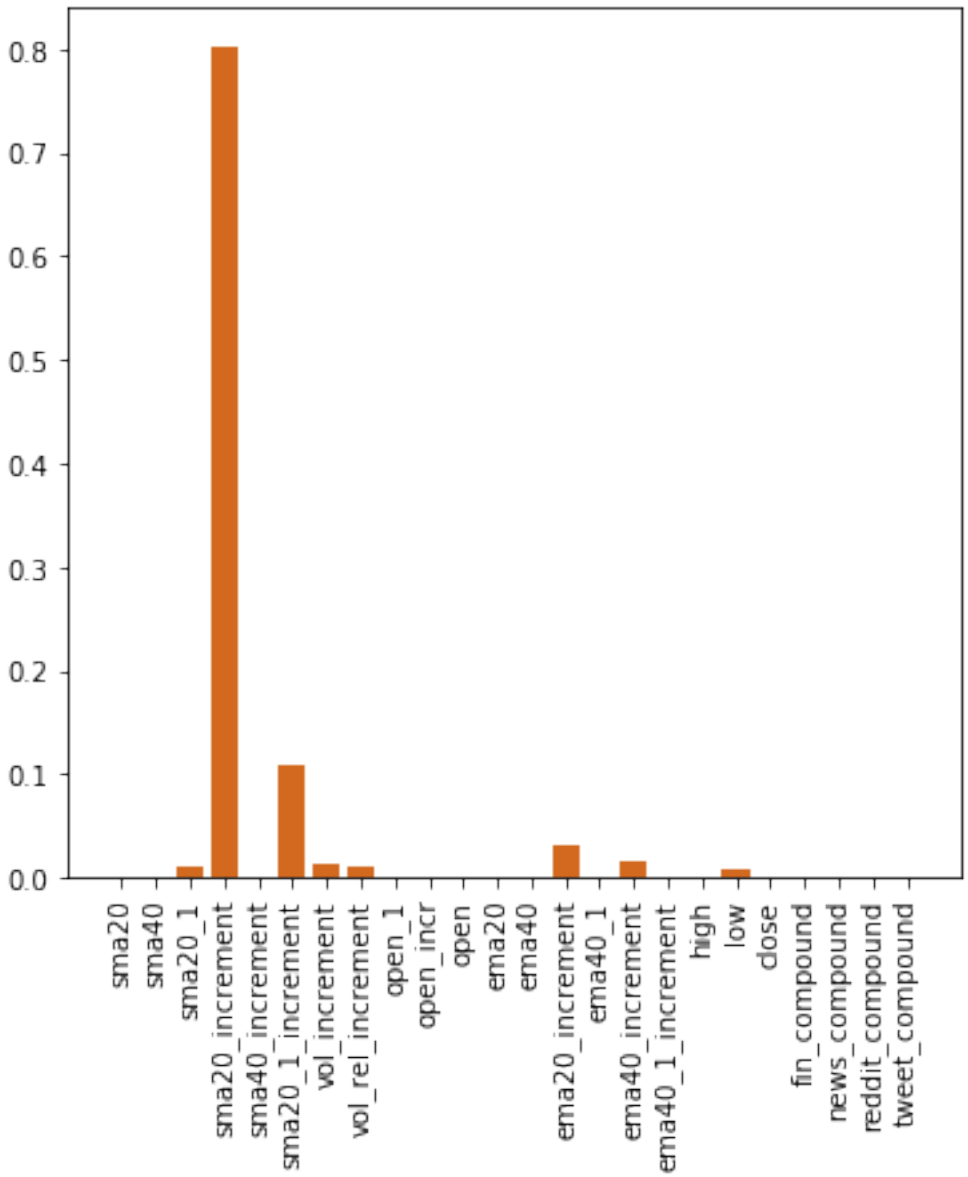


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Stellar 0.9026004728132387


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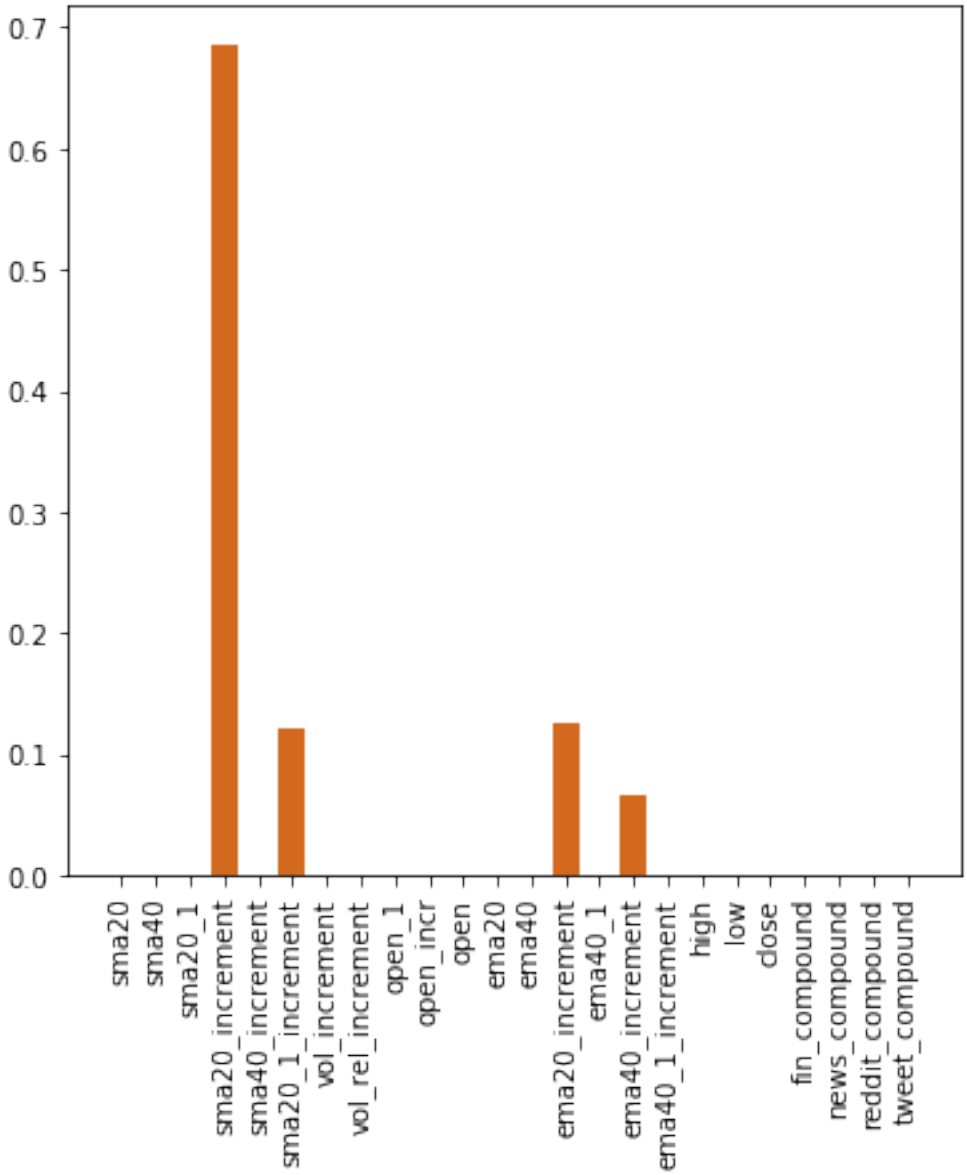


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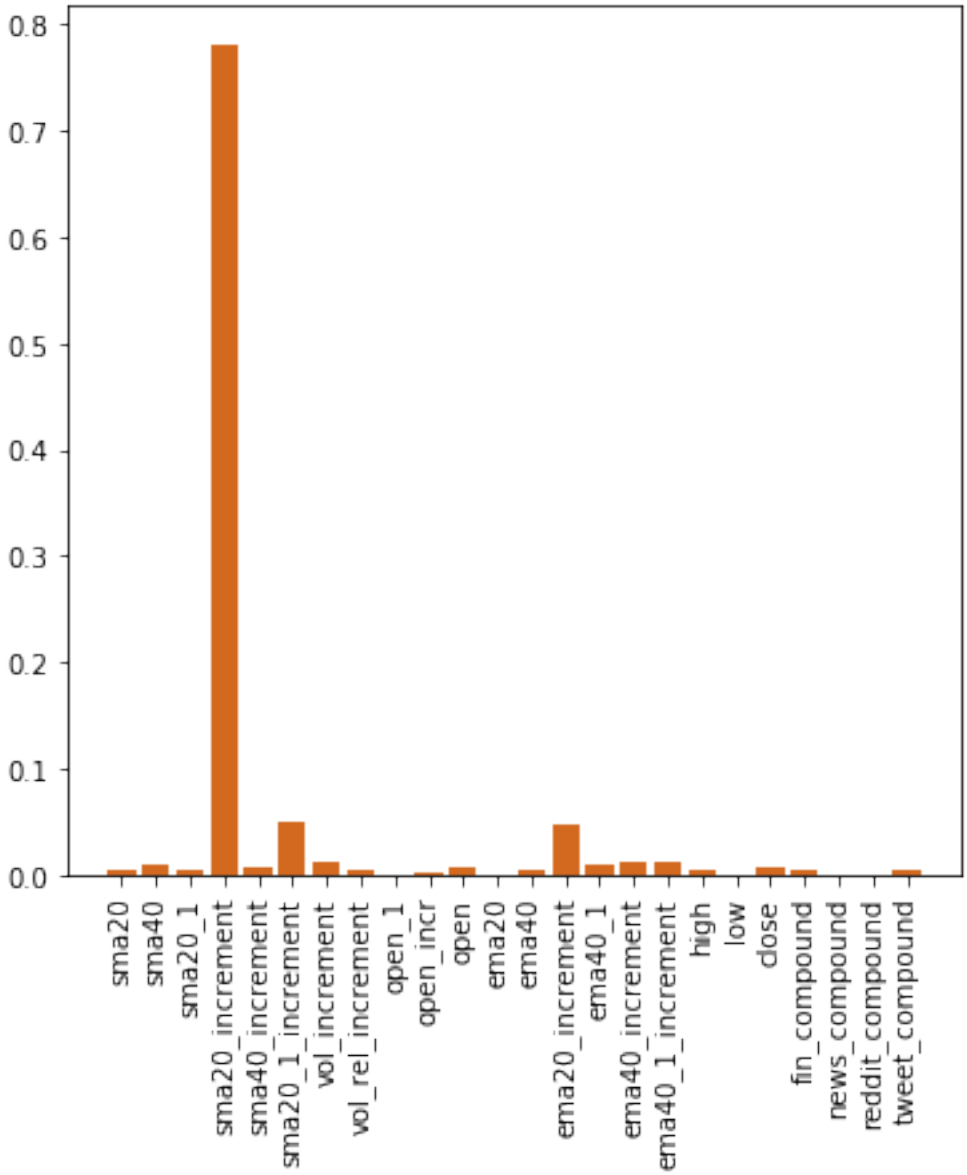


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XRP 0.8826106000876041
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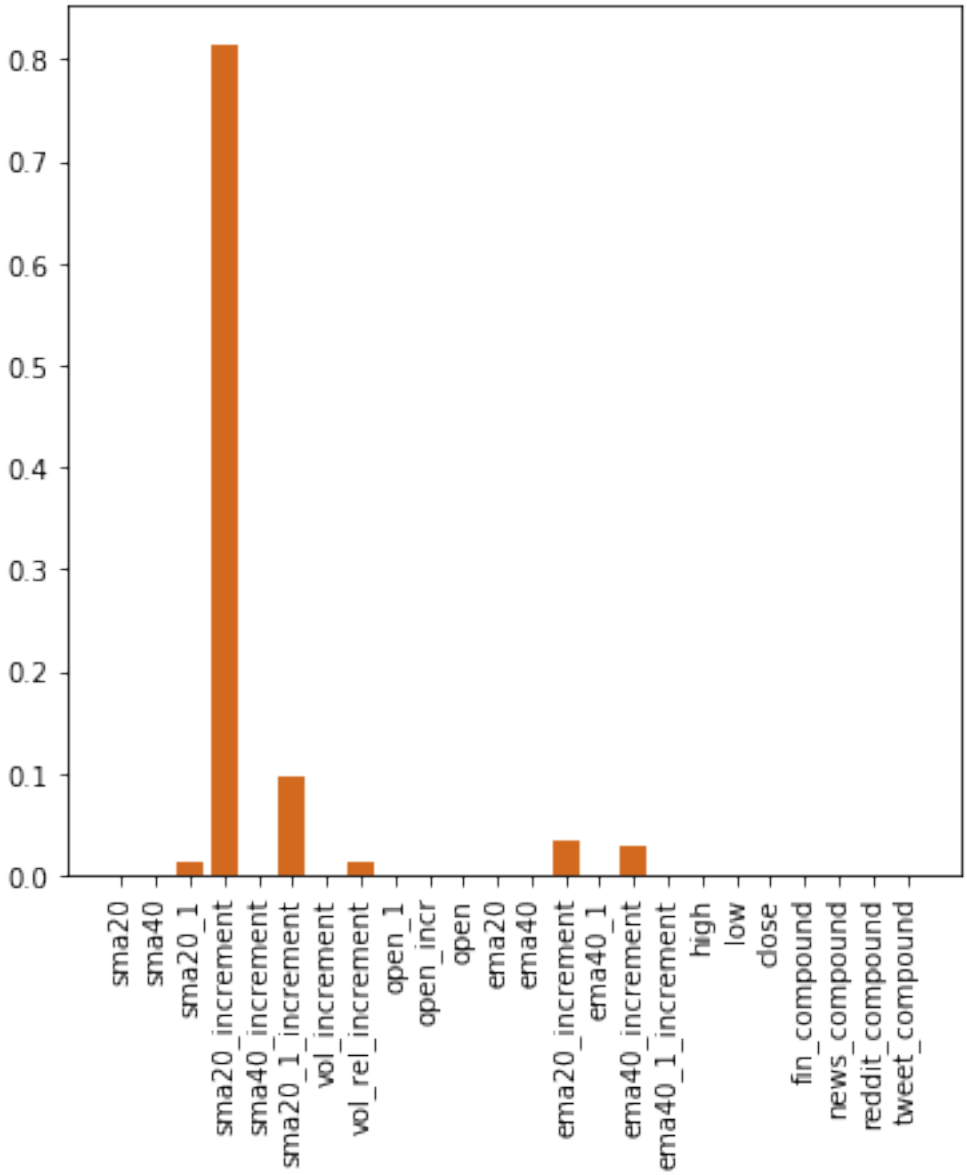


```
Bitcoin_Cash 0.8552546744036106
Average cryptocurrency accuracy=0.8853694471476877
```

```
In [43]: #Feature Analysis
         s = list()
         c = list()
         for d in mylist:
             s.append(d['feature_importance'])

         for d in mylist_crypto:
```

```
            c.append(d['feature_importance'])

        feat_imp_stock = [sum(e)/len(e) for e in zip(*l)]
        feat_imp_crypto = [sum(e)/len(e) for e in zip(*c)]
        features = ['sma20', 'sma40', 'sma20_1', 'sma20_increment', 'sma20_1_increment', 'sma4
        features_crypto = ['sma20', 'sma40', 'sma20_1', 'sma20_increment', 'sma40_increment',
        feature_dict_stock = {k:v for k,v in zip(features,feat_imp_stock)}
        feature_dict_crypto= {k:v for k,v in zip(features_crypto,feat_imp_crypto)}


        print(heapq.nlargest(5, feature_dict_stock.items(), key=lambda i: i[1]))
        print(heapq.nsmallest(5, feature_dict_stock.items(), key=lambda i: i[1]))
        print(heapq.nlargest(5, feature_dict_crypto.items(), key=lambda i: i[1]))
        print(heapq.nsmallest(5, feature_dict_crypto.items(), key=lambda i: i[1]))
        fig = plt.figure(figsize=(6,6))
        plt.xticks(rotation='vertical')
        plt.bar([i for i in range(len(feat_imp_stock))], feat_imp_stock, tick_label=features,
        plt.title("Average feature importance for stocks")
        plt.show()

        fig = plt.figure(figsize=(6,6))
        plt.xticks(rotation='vertical')
        plt.bar([i for i in range(len(feat_imp_crypto))], feat_imp_crypto, tick_label=features
        plt.title("Average feature importance for cryptocurrencies")
        plt.show()
```

```
[('open_1', 0.002971383018626107), ('sma20_1', 0.0030296132641120087), ('ema40_1', 0.003488029
[('ema40_1', 0.002608428359963), ('reddit_compound', 0.004455432062968612), ('open_1', 0.00447
```