stack-encoder-ensemble-xgb

September 29, 2021

[1]:
```
import tensorflow as tf
import numpy as np
import matplotlib.pyplot as plt
import seaborn as sns
import pandas as pd
from sklearn.preprocessing import MinMaxScaler
import model
import time
from datetime import datetime
from datetime import timedelta
sns.set()
```

[2]:
```
df = pd.read_csv('GOOG-year.csv')
date_ori = pd.to_datetime(df.iloc[:, 0]).tolist()
df.head()
```

[2]:

	Date	Open	High	Low	Close	Adj Close	Volume
0	2016-11-02	778.200012	781.650024	763.450012	768.700012	768.700012	1872400
1	2016-11-03	767.250000	769.950012	759.030029	762.130005	762.130005	1943200
2	2016-11-04	750.659973	770.359985	750.560974	762.020020	762.020020	2134800
3	2016-11-07	774.500000	785.190002	772.549988	782.520020	782.520020	1585100
4	2016-11-08	783.400024	795.632996	780.190002	790.510010	790.510010	1350800

[3]:
```
minmax = MinMaxScaler().fit(df.iloc[:, 3].values.reshape((-1,1)))
close_normalize = minmax.transform(df.iloc[:, 3].values.reshape((-1,1))).
↪reshape((-1))
```

[4]:
```
close_normalize.shape
```

[4]:
```
(252,)
```

[5]:
```
class encoder:
    def __init__(self, input_, dimension = 2, learning_rate = 0.01,␣
↪hidden_layer = 256, epoch = 20):
        input_size = input_.shape[1]
        self.X = tf.placeholder("float", [None, input_.shape[1]])

        weights = {
        'encoder_h1': tf.Variable(tf.random_normal([input_size, hidden_layer])),
        'encoder_h2': tf.Variable(tf.random_normal([hidden_layer, dimension])),
        'decoder_h1': tf.Variable(tf.random_normal([dimension, hidden_layer])),
        'decoder_h2': tf.Variable(tf.random_normal([hidden_layer, input_size])),
        }

        biases = {
        'encoder_b1': tf.Variable(tf.random_normal([hidden_layer])),
        'encoder_b2': tf.Variable(tf.random_normal([dimension])),
        'decoder_b1': tf.Variable(tf.random_normal([hidden_layer])),
        'decoder_b2': tf.Variable(tf.random_normal([input_size])),
        }

        first_layer_encoder = tf.nn.sigmoid(tf.add(tf.matmul(self.X,␣
↪weights['encoder_h1']), biases['encoder_b1']))
        self.second_layer_encoder = tf.nn.sigmoid(tf.add(tf.
↪matmul(first_layer_encoder, weights['encoder_h2']), biases['encoder_b2']))
        first_layer_decoder = tf.nn.sigmoid(tf.add(tf.matmul(self.
↪second_layer_encoder, weights['decoder_h1']), biases['decoder_b1']))
        second_layer_decoder = tf.nn.sigmoid(tf.add(tf.
↪matmul(first_layer_decoder, weights['decoder_h2']), biases['decoder_b2']))
        self.cost = tf.reduce_mean(tf.pow(self.X - second_layer_decoder, 2))
        self.optimizer = tf.train.RMSPropOptimizer(learning_rate).minimize(self.
↪cost)
        self.sess = tf.InteractiveSession()
        self.sess.run(tf.global_variables_initializer())

        for i in range(epoch):
            last_time = time.time()
            _, loss = self.sess.run([self.optimizer, self.cost],␣
↪feed_dict={self.X: input_})
            if (i + 1) % 10 == 0:
                print('epoch:', i + 1, 'loss:', loss, 'time:', time.time() -␣
↪last_time)

    def encode(self, input_):
        return self.sess.run(self.second_layer_encoder, feed_dict={self.X:␣
↪input_})
```

[6]:
```
tf.reset_default_graph()
Encoder=encoder(close_normalize.reshape((-1,1)), 32, 0.01, 128, 100)
thought_vector = Encoder.encode(close_normalize.reshape((-1,1)))
thought_vector.shape
```

```
epoch: 10 loss: 0.150638 time: 0.0008144378662109375
epoch: 20 loss: 0.0652009 time: 0.0007433891296386719
epoch: 30 loss: 0.0556741 time: 0.0007736682891845703
epoch: 40 loss: 0.0430575 time: 0.0007085800170898438
epoch: 50 loss: 0.0287333 time: 0.0006804466247558594
epoch: 60 loss: 0.0152949 time: 0.0007014274597167969
epoch: 70 loss: 0.0436488 time: 0.0006766319274902344
epoch: 80 loss: 0.0830372 time: 0.0007102489471435547
epoch: 90 loss: 0.0531746 time: 0.0007026195526123047
epoch: 100 loss: 0.0455618 time: 0.0006778240203857422
```

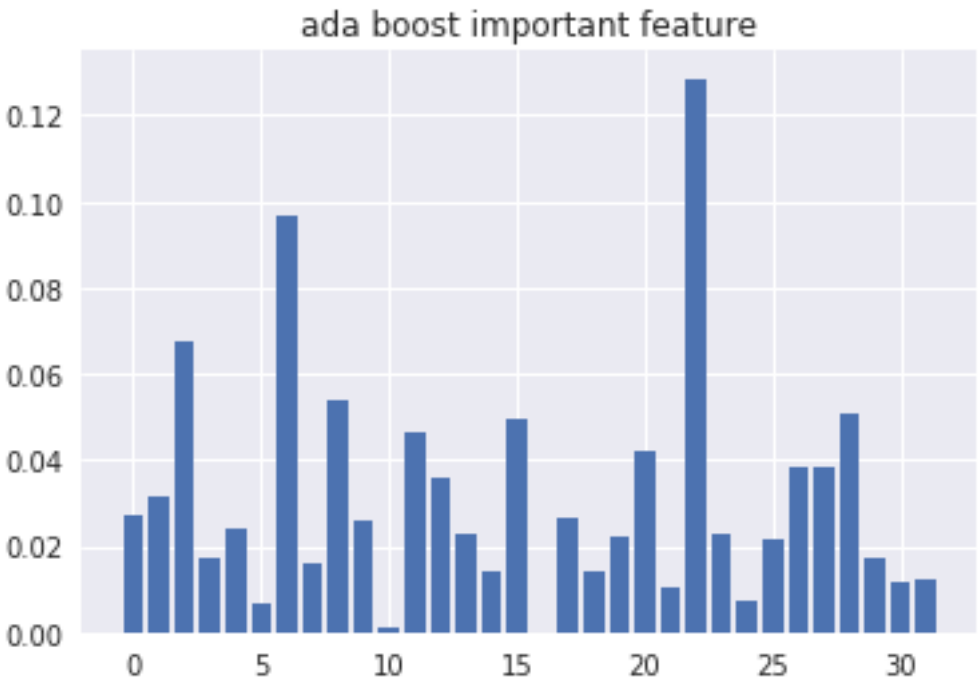
[6]:
```
(252, 32)
```

[7]:
```
from sklearn.ensemble import *
ada = AdaBoostRegressor(n_estimators=500, learning_rate=0.1)
bagging = BaggingRegressor(n_estimators=500)
et = ExtraTreesRegressor(n_estimators=500)
gb = GradientBoostingRegressor(n_estimators=500, learning_rate=0.1)
rf = RandomForestRegressor(n_estimators=500)
```

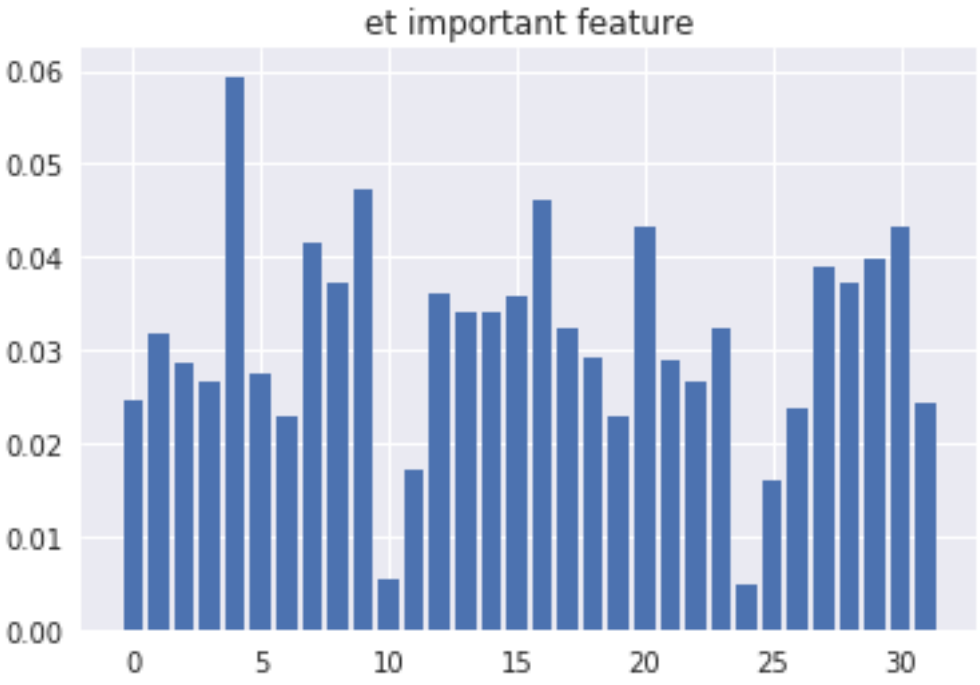
[8]:
```
ada.fit(thought_vector[:-1, :], close_normalize[1:])
bagging.fit(thought_vector[:-1, :], close_normalize[1:])
et.fit(thought_vector[:-1, :], close_normalize[1:])
gb.fit(thought_vector[:-1, :], close_normalize[1:])
rf.fit(thought_vector[:-1, :], close_normalize[1:])
```

[8]:
```
RandomForestRegressor(bootstrap=True, criterion='mse', max_depth=None,
           max_features='auto', max_leaf_nodes=None,
           min_impurity_decrease=0.0, min_impurity_split=None,
           min_samples_leaf=1, min_samples_split=2,
           min_weight_fraction_leaf=0.0, n_estimators=500, n_jobs=1,
           oob_score=False, random_state=None, verbose=0, warm_start=False)
```

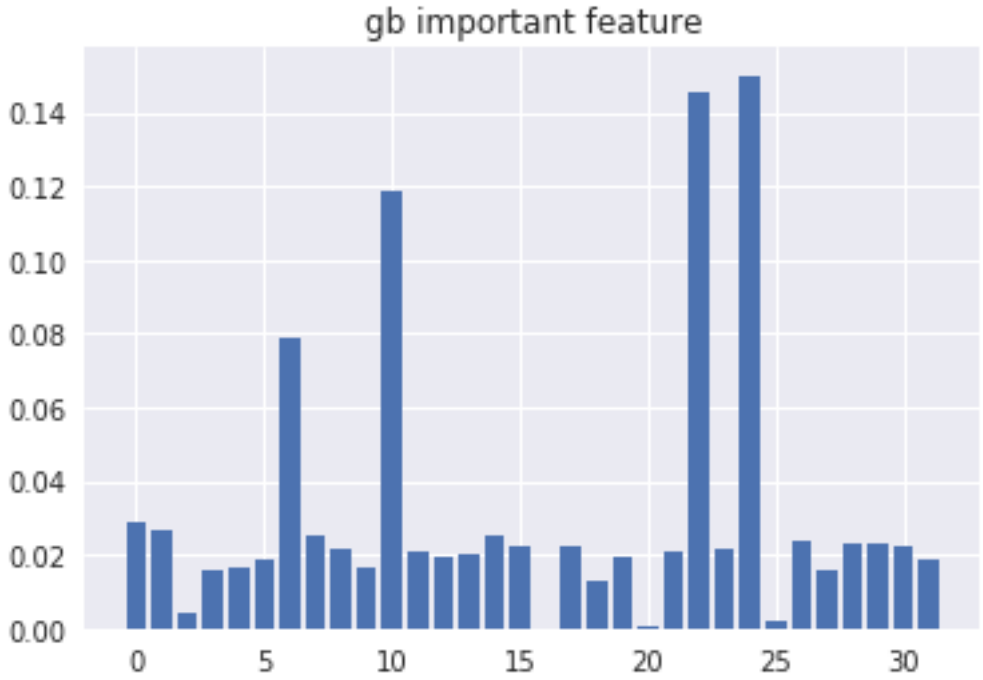
[9]:
```
plt.bar(np.arange(32), ada.feature_importances_)
plt.title('ada boost important feature')
plt.show()
```



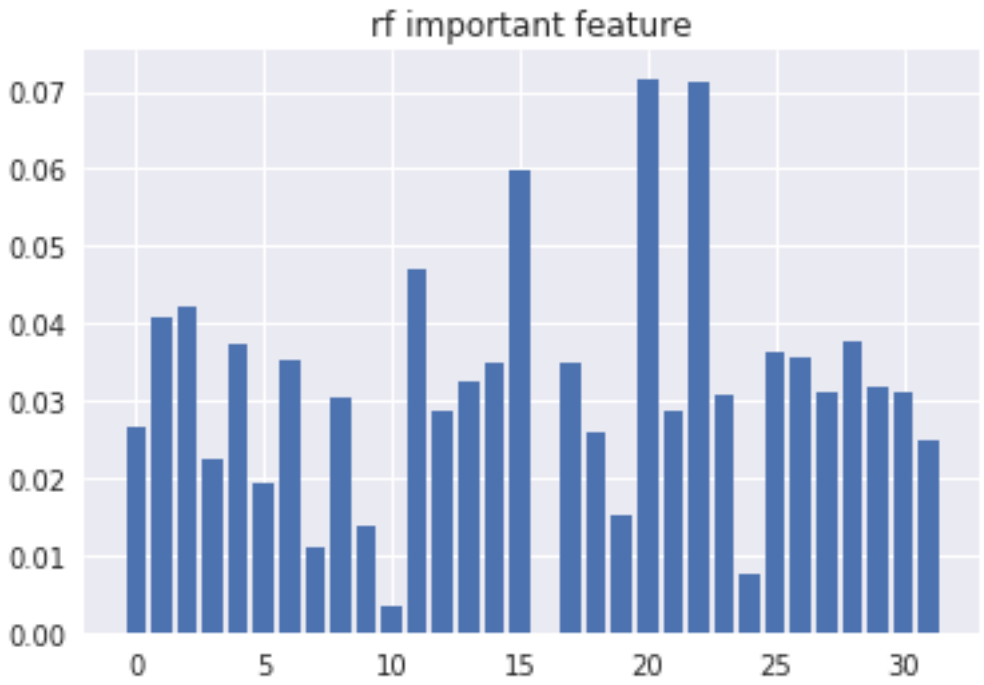
[10]:
```
plt.bar(np.arange(32), et.feature_importances_)
plt.title('et important feature')
plt.show()
```



[11]:
```
plt.bar(np.arange(32), gb.feature_importances_)
plt.title('gb important feature')
plt.show()
```



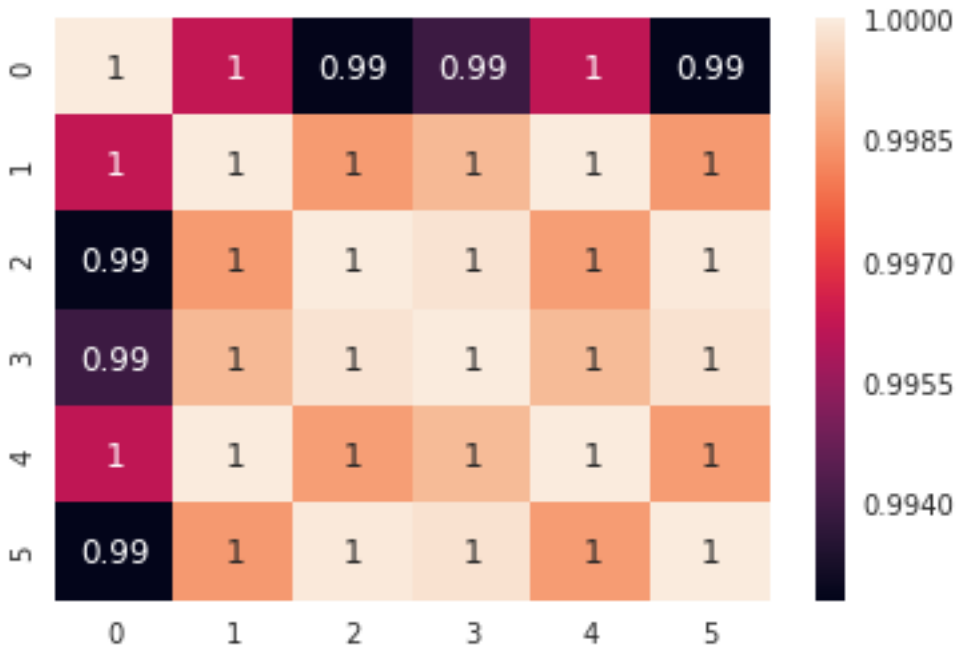
[12]:
```
plt.bar(np.arange(32), rf.feature_importances_)
plt.title('rf important feature')
plt.show()
```



[13]:
```
ada_pred=ada.predict(thought_vector)
bagging_pred=bagging.predict(thought_vector)
et_pred=et.predict(thought_vector)
gb_pred=gb.predict(thought_vector)
rf_pred=rf.predict(thought_vector)
```

[14]:
```
ada_actual = np.hstack([close_normalize[0],ada_pred[:-1]])
bagging_actual = np.hstack([close_normalize[0],bagging_pred[:-1]])
et_actual = np.hstack([close_normalize[0],et_pred[:-1]])
gb_actual = np.hstack([close_normalize[0],gb_pred[:-1]])
rf_actual = np.hstack([close_normalize[0],rf_pred[:-1]])
stack_predict = np.
 ↪vstack([ada_actual,bagging_actual,et_actual,gb_actual,rf_actual,close_normalize]).
 ↪T
corr_df = pd.DataFrame(stack_predict)
```

[15]:
```
sns.heatmap(corr_df.corr(), annot=True)
plt.show()
```



1 Wow, I do not expect this heatmap. Totally a heat!

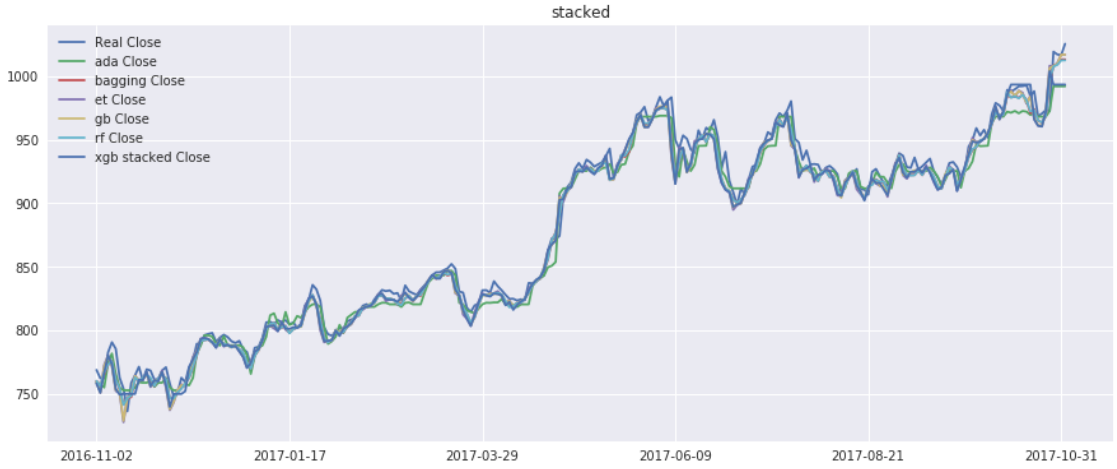
[16]:
```
import xgboost as xgb
params_xgd = {
    'max_depth': 7,
    'objective': 'reg:logistic',
    'learning_rate': 0.05,
    'n_estimators': 10000
    }
train_Y = close_normalize[1:]
clf = xgb.XGBRegressor(**params_xgd)
clf.fit(stack_predict[:-1,:],train_Y, eval_set=[(stack_predict[:-1,:],train_Y)],
        eval_metric='rmse', early_stopping_rounds=20, verbose=False)
```

[16]:
```
XGBRegressor(base_score=0.5, colsample_bylevel=1, colsample_bytree=1, gamma=0,
       learning_rate=0.05, max_delta_step=0, max_depth=7,
       min_child_weight=1, missing=None, n_estimators=10000, nthread=-1,
       objective='reg:logistic', reg_alpha=0, reg_lambda=1,
       scale_pos_weight=1, seed=0, silent=True, subsample=1)
```

[17]:
```
xgb_pred = clf.predict(stack_predict)
xgb_actual = np.hstack([close_normalize[0],xgb_pred[:-1]])
date_original=pd.Series(date_ori).dt.strftime(date_format='%Y-%m-%d').tolist()
```

[18]:
```
def reverse_close(array):
    return minmax.inverse_transform(array.reshape((-1,1))).reshape((-1))
```

[25]:
```
plt.figure(figsize = (15,6))
x_range = np.arange(df.Close.shape[0])
plt.plot(x_range, df.Close, label = 'Real Close')
plt.plot(x_range, reverse_close(ada_pred), label = 'ada Close')
plt.plot(x_range, reverse_close(bagging_pred), label = 'bagging Close')
plt.plot(x_range, reverse_close(et_pred), label = 'et Close')
plt.plot(x_range, reverse_close(gb_pred), label = 'gb Close')
plt.plot(x_range, reverse_close(rf_pred), label = 'rf Close')
plt.plot(x_range, reverse_close(xgb_pred), label = 'xgb stacked Close')
plt.legend()
plt.xticks(x_range[::50], date_original[::50])
plt.title('stacked')
plt.show()
```

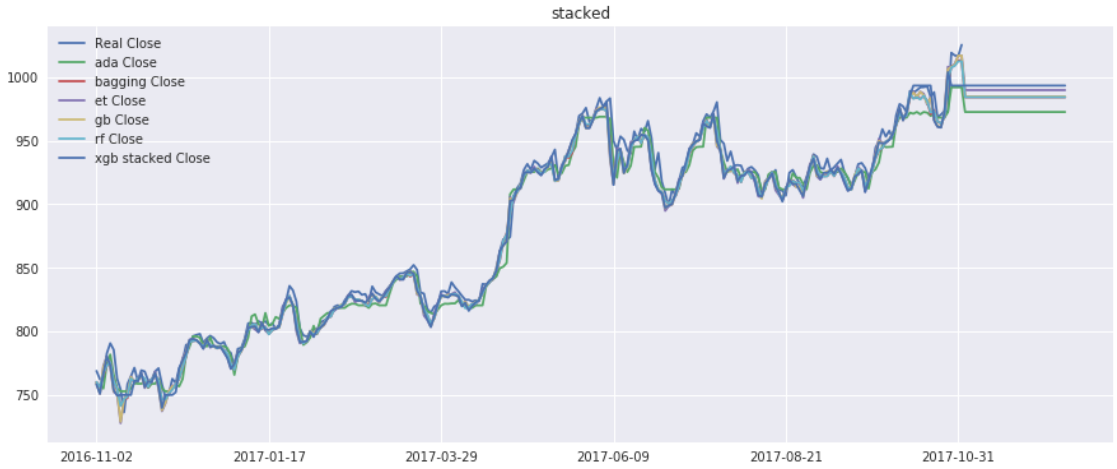


[20]:
```
ada_list = ada_pred.tolist()
bagging_list = bagging_pred.tolist()
et_list = et_pred.tolist()
gb_list = gb_pred.tolist()
rf_list = rf_pred.tolist()
xgb_list = xgb_pred.tolist()
def predict(count, history = 5):
    for i in range(count):
        roll = np.array(xgb_list[-history:])
        thought_vector = Encoder.encode(roll.reshape((-1,1)))
        ada_pred=ada.predict(thought_vector)
        bagging_pred=bagging.predict(thought_vector)
        et_pred=et.predict(thought_vector)
        gb_pred=gb.predict(thought_vector)
```

```
        rf_pred=rf.predict(thought_vector)
        ada_list.append(ada_pred[-1])
        bagging_list.append(bagging_pred[-1])
        et_list.append(et_pred[-1])
        gb_list.append(gb_pred[-1])
        rf_list.append(rf_pred[-1])
        ada_actual = np.hstack([xgb_list[-history],ada_pred[:-1]])
        bagging_actual = np.hstack([xgb_list[-history],bagging_pred[:-1]])
        et_actual = np.hstack([xgb_list[-history],et_pred[:-1]])
        gb_actual = np.hstack([xgb_list[-history],gb_pred[:-1]])
        rf_actual = np.hstack([xgb_list[-history],rf_pred[:-1]])
        stack_predict = np.
↪vstack([ada_actual,bagging_actual,et_actual,gb_actual,rf_actual,xgb_list[-history:
↪]]).T
        xgb_pred = clf.predict(stack_predict)
        xgb_list.append(xgb_pred[-1])
        date_ori.append(date_ori[-1]+timedelta(days=1))
```

[21]:
```
predict(30, history = 5)
```

[29]:
```
plt.figure(figsize = (15,6))
x_range = np.arange(df.Close.shape[0])
x_range_future = np.arange(len(xgb_list))
plt.plot(x_range, df.Close, label = 'Real Close')
plt.plot(x_range_future, reverse_close(np.array(ada_list)), label = 'ada Close')
plt.plot(x_range_future, reverse_close(np.array(bagging_list)), label =␣
↪'bagging Close')
plt.plot(x_range_future, reverse_close(np.array(et_list)), label = 'et Close')
plt.plot(x_range_future, reverse_close(np.array(gb_list)), label = 'gb Close')
plt.plot(x_range_future, reverse_close(np.array(rf_list)), label = 'rf Close')
plt.plot(x_range_future, reverse_close(np.array(xgb_list)), label = 'xgb␣
↪stacked Close')
plt.legend()
plt.xticks(x_range_future[::50], pd.Series(date_ori).dt.
↪strftime(date_format='%Y-%m-%d').tolist()[::50])
plt.title('stacked')
plt.show()
```


stacked
Real Close
ada Close
bagging Close
et Close
gb Close
rf Close
xgb stacked Close
1000
950
900
850
800
750
2016-11-02
2017-01-17
2017-03-29
2017-06-09
2017-08-21
2017-10-31

[ ]: