In [1]:
```
"""
Data (Daily & Minute): Binance API-Will need Binance API keys to be able to pull the data.
Binance API Documentation: https://binance-docs.github.io/apidocs/spot/en/#introduction

"""
```
Out[1]:
```
'\nData (Daily & Minute): Binance API-Will need Binance API keys to be able to pull the data. \nBinance API Documentation: https://binance-docs.github.io/ap
idocs/spot/en/#introduction\n\n'
```

In [2]:
```
# J.Guanzon Comment-Imports needed to run this file
from binance import Client, ThreadedWebsocketManager, ThreadedDepthCacheManager
import pandas as pd
import mplfinance as mpl
import mplfinance as mpf
import os
import json
import requests
from keras.models import Sequential
from keras.layers import Activation, Dense, Dropout, LSTM
import matplotlib.pyplot as plt
import matplotlib.dates as mdates
import numpy as np
from pathlib import Path
import seaborn as sns
from sklearn.metrics import mean_absolute_error
%matplotlib inline
```

In [3]:
```
# Pull API keys from .env file
api_key = os.environ.get("api_key")
api_secret = os.environ.get("api_secret")
```

In [4]:
```
client = Client(api_key, api_secret)
```

In [5]:
```
# J.Guanzon Comment: Gather tickers for all
tickers = client.get_all_tickers()
```

In [6]:
```
ticker_df = pd.DataFrame(tickers)
```

In [7]:
```
ticker_df.set_index('symbol', inplace=True)
ticker_df
```

Out[7]:

	price
symbol	
ETHBTC	0.06261300
LTCBTC	0.00311100
BNBBTC	0.00805000
NEOBTC	0.00077300
QTUMETH	0.00365800
...	...
SHIBAUD	0.00004034
RAREBTC	0.00003559
RAREBNB	0.00442000
RAREBUSD	2.06800000
RAREUSDT	2.06700000

1695 rows × 1 columns

In [8]:
```
"""
Ability to save csv file of all tickers.
Allows the user to see what types of cryptocurrencies are out there.
For now, we will only focus on Bitcoin.
"""
```
Out[8]:
```
' \nAbility to save csv file of all tickers.\nAllows the user to see what types of cryptocurrencies are out there.\nFor now, we will only focus on Bitcoi
n.\n'
```

In [9]:
```
ticker_df.to_csv("Resources/binance_tickers.csv")
```

In [10]:
```
display(float(ticker_df.loc['BTCUSDT']['price']))
```
```
58121.51
```

In [11]:
```
depth = client.get_order_book(symbol='BTCUSDT')
```

In [12]:
```
depth_df = pd.DataFrame(depth['asks'])
depth_df.columns = ['Price', 'Volume']
depth_df.head()
```

Out[12]:

	Price	Volume
0	58121.52000000	1.41785000
1	58121.56000000	0.00244000
2	58121.84000000	0.02819000
3	58124.87000000	0.15828000
4	58124.94000000	0.00221000

In [13]:
```
"""
Pulling historical daily data
"""
```

Out[13]: '\nPulling historical daily data\n'

In [14]:
```
btc_daily_data = client.get_historical_klines('BTCUSDT', Client.KLINE_INTERVAL_1DAY, '1 Jan 2020')
```

In [15]:
```
btc_daily_df = pd.DataFrame(btc_daily_data)
btc_daily_df.columns = ['Open Time', 'Open', 'High', 'Low', 'Close', 'Volume', 'Close Time', 'Quote Asset Volume',
                    'Number of Trades', 'TB Base Volume', 'TB Quote Volume', 'Ignore']
```

In [16]:
```
btc_daily_df['Open Time'] = pd.to_datetime(btc_daily_df['Open Time']/1000, unit='s')
btc_daily_df['Close Time'] = pd.to_datetime(btc_daily_df['Close Time']/1000, unit='s')
```

In [17]:
```
numeric_columns = ['Open', 'High', 'Low', 'Close', 'Volume', 'Quote Asset Volume', 'TB Base Volume', 'TB Quote Volume']
btc_daily_df[numeric_columns] = btc_daily_df[numeric_columns].apply(pd.to_numeric, axis=1)
```

In [18]:
```
btc_ohlcv_daily = btc_daily_df.iloc[:,0:6]
btc_ohlcv_daily = btc_ohlcv_daily.set_index('Open Time')
btc_ohlcv_daily
```

Out[18]:

	Open	High	Low	Close	Volume
Open Time					
2020-01-01	7195.24	7255.00	7175.15	7200.85	16792.388165
2020-01-02	7200.77	7212.50	6924.74	6965.71	31951.483932
2020-01-03	6965.49	7405.00	6871.04	7344.96	68428.500451
2020-01-04	7345.00	7404.00	7272.21	7354.11	29987.974977
2020-01-05	7354.19	7495.00	7318.00	7358.75	38331.085604
...	...	...	...	...	...
2021-10-10	54949.72	56561.31	54080.00	54659.00	89237.836128
2021-10-11	54659.01	57839.04	54415.06	57471.35	52933.165751
2021-10-12	57471.35	57680.00	53879.00	55996.93	53471.285500
2021-10-13	55996.91	57777.00	54167.19	57367.00	55808.444920
2021-10-14	57370.83	58532.54	57138.72	58121.47	8780.829391

653 rows × 5 columns

In [19]:
```
btc_ohlcv_daily.to_csv("Resources/daily_btc_ohclv_2021.csv")
```

In [20]:
```
"""
Pulling historical minute data
"""
```

Out[20]: '\nPulling historical minute data \n'

In [21]:
```
historical_minute = client.get_historical_klines('BTCUSDC', Client.KLINE_INTERVAL_1MINUTE, '5 day ago UTC')
```

In [22]:
```
hist_min = pd.DataFrame(historical_minute)
```

In [23]:
```
hist_min.columns = ['Open Time', 'Open', 'High', 'Low', 'Close', 'Volume', 'Close Time', 'Quote Asset Volume',
                    'Number of Trades', 'TB Base Volume', 'TB Quote Volume', 'Ignore']
```

In [24]:
```
hist_min['Open Time'] = pd.to_datetime(hist_min['Open Time']/1000, unit='s')
hist_min['Close Time'] = pd.to_datetime(hist_min['Close Time']/1000, unit='s')
```

In [25]:
```
numeric_columns = ['Open', 'High', 'Low', 'Close', 'Volume', 'Quote Asset Volume', 'TB Base Volume', 'TB Quote Volume']
hist_min[numeric_columns] = hist_min[numeric_columns].apply(pd.to_numeric, axis=1)
```

In [26]:

```
btc_ohlcv_minute = hist_min.iloc[:,0:6]
btc_ohlcv_minute = btc_ohlcv_minute.set_index('Open Time')
btc_ohlcv_minute
```

Out[26]:

	Open	High	Low	Close	Volume
Open Time					
2021-10-09 03:56:00	54604.52	54618.00	54585.12	54585.12	0.32278
2021-10-09 03:57:00	54579.31	54599.15	54576.20	54586.18	0.38916
2021-10-09 03:58:00	54586.19	54586.19	54570.33	54581.76	0.27224
2021-10-09 03:59:00	54593.89	54601.88	54577.41	54591.01	0.63749
2021-10-09 04:00:00	54577.47	54586.19	54577.47	54585.26	0.23532
...	...	...	...	...	...
2021-10-14 03:51:00	58180.10	58180.10	58163.38	58163.38	0.09036
2021-10-14 03:52:00	58172.35	58174.78	58167.91	58174.78	0.09604
2021-10-14 03:53:00	58168.42	58199.90	58154.86	58164.24	2.53756
2021-10-14 03:54:00	58166.56	58166.56	58117.30	58118.54	0.15568
2021-10-14 03:55:00	58108.57	58123.15	58095.88	58123.15	0.66003

7200 rows × 5 columns

In [27]:

```
btc_ohlcv_minute.to_csv("Resources/minute_btc_ohclv_2021.csv")
```

In [28]:

```
"""
Next, we will be using the daily data for our Recurrent Neural Network. We are using Recurrent Neural Network for its use of time series and sequential data
RNN specializes in using information from prior inputs and uses it to influence current inputs and outputs, and the cycle repeats.
"""
```

Out[28]:

```
'\nNext, we will be using the daily data for our Recurrent Neural Network. We are using Recurrent Neural Network for its use of time series and sequential d
ata. \nRNN specializes in using information from prior inputs and uses it to influence current inputs and outputs, and the cycle repeats. \n'
```

In [29]:

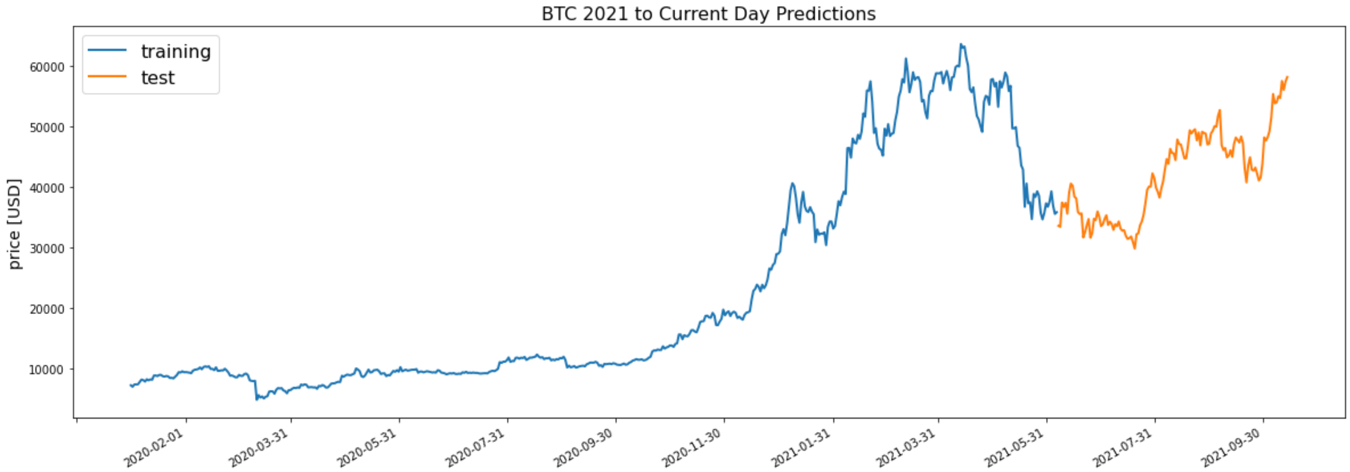
```
btc_df = pd.read_csv(Path("Resources/daily_btc_ohclv_2021.csv"),
                     index_col= "Open Time")
target_col = 'Close'
```

In [30]:

```
# J.Guanzon Comment: Using an 80/20 split for our training data and testing data. Testing 2 other testing sizes to see if there are any differnces in accura

def train_test_split(btc_df, test_size=0.2):
  split_row = len(btc_df) - int(test_size * len(btc_df))
  train_data = btc_df.iloc[:split_row]
  test_data = btc_df.iloc[split_row:]
  return train_data, test_data

train, test = train_test_split(btc_df, test_size=0.2)

# def train_test_split(btc_df, test_size=0.3):
#   split_row = len(btc_df) - int(test_size * len(btc_df))
#   train_data = btc_df.iloc[:split_row]
#   test_data = btc_df.iloc[split_row:]
#   return train_data, test_data

# train, test = train_test_split(btc_df, test_size=0.3)

# def train_test_split(btc_df, test_size=0.1):
#   split_row = len(btc_df) - int(test_size * len(btc_df))
#   train_data = btc_df.iloc[:split_row]
#   test_data = btc_df.iloc[split_row:]
#   return train_data, test_data

# train, test = train_test_split(btc_df, test_size=0.1)
```

In [31]:

```
def line_plot(line1, line2, label1=None, label2=None, title='', lw=2):
    fig, ax = plt.subplots(1, figsize=(20, 7))
    ax.plot(line1, label=label1, linewidth=lw)
    ax.plot(line2, label=label2, linewidth=lw)
    ax.set_ylabel('price [USD]', fontsize=14)
    fmt_bimonthly = mdates.MonthLocator(interval=2)
    ax.xaxis.set_major_locator(fmt_bimonthly)
    ax.set_title(title, fontsize=16)
    fig.autofmt_xdate()
    ax.legend(loc='best', fontsize=16)

line_plot(train[target_col], test[target_col], 'training', 'test', title='BTC 2021 to Current Day Predictions')
```



In [32]:
```
"""
Next, we have to prep the data for RNN by normalizing the numeric columns in the dataset to a common scale, without distorting differences in the range of v
"""
```

Out[32]:
```
'\nNext, we have to prep the data for RNN by normalizing the numeric columns in the dataset to a common scale, without distorting differences in the range o
f values.\n'
```

In [33]:
```
def normalise_zero_base(df):
    return df / df.iloc[0] - 1

def normalise_min_max(df):
    return (df - df.min()) / (data.max() - df.min())
```

In [34]:
```
def extract_window_data(btc_df, window_len=10, zero_base=True):
    window_data = []
    for idx in range(len(btc_df) - window_len):
        tmp = btc_df[idx: (idx + window_len)].copy()
        if zero_base:
            tmp = normalise_zero_base(tmp)
        window_data.append(tmp.values)
    return np.array(window_data)
```

In [35]:
```
# J.Guanzon Comment: We want to use the data from Jan-Jun 2021 and use the rest of the data to train and predict the rest of the data.
X_train= btc_df[:"2021-06-01"]
X_test = btc_df["2021-06-01":]
y_train = btc_df.loc[:"2021-06-01",target_col]
y_test = btc_df.loc["2021-06-01":,target_col]
```

In [36]:
```
def prepare_data(btc_df, target_col, window_len=10, zero_base=True, test_size=0.2):
    train_data, test_data = train_test_split(btc_df, test_size=test_size)
    X_train = extract_window_data(train_data, window_len, zero_base)
    X_test = extract_window_data(test_data, window_len, zero_base)
    y_train = train_data[target_col][window_len:].values
    y_test = test_data[target_col][window_len:].values
    if zero_base:
        y_train = y_train / train_data[target_col][:-window_len].values - 1
        y_test = y_test / test_data[target_col][:-window_len].values - 1

    return train_data, test_data, X_train, X_test, y_train, y_test

# def prepare_data(btc_df, target_col, window_len=10, zero_base=True, test_size=0.3):
#     train_data, test_data = train_test_split(btc_df, test_size=test_size)
#     X_train = extract_window_data(train_data, window_len, zero_base)
#     X_test = extract_window_data(test_data, window_len, zero_base)
#     y_train = train_data[target_col][window_len:].values
#     y_test = test_data[target_col][window_len:].values
#     if zero_base:
#         y_train = y_train / train_data[target_col][:-window_len].values - 1
#         y_test = y_test / test_data[target_col][:-window_len].values - 1

#     return train_data, test_data, X_train, X_test, y_train, y_test

# def prepare_data(btc_df, target_col, window_len=10, zero_base=True, test_size=0.1):
#     train_data, test_data = train_test_split(btc_df, test_size=test_size)
#     X_train = extract_window_data(train_data, window_len, zero_base)
#     X_test = extract_window_data(test_data, window_len, zero_base)
#     y_train = train_data[target_col][window_len:].values
#     y_test = test_data[target_col][window_len:].values
#     if zero_base:
#         y_train = y_train / train_data[target_col][:-window_len].values - 1
#         y_test = y_test / test_data[target_col][:-window_len].values - 1

#     return train_data, test_data, X_train, X_test, y_train, y_test
```

In [37]:
```
def build_lstm_model(input_data, output_size, neurons=100, activ_func='linear', dropout=0.2, loss='mse', optimizer='adam'):
    model = Sequential()
    stm= LSTM(neurons, input_shape=(input_data.shape[1], input_data.shape[2]))
    model.add(stm)
    model.add(Dropout(dropout))
```

```
    model.add(Dense(units=output_size))
    model.add(Activation(activ_func))
    model.compile(loss=loss, optimizer=optimizer)
    return model
```

In [38]:
```
np.random.seed(50)
window_len = 10
test_size = 0.2
zero_base = True
lstm_neurons = 100
epochs = 20
batch_size = 32
loss = 'mse'
dropout = 0.2
optimizer = 'adam'
```

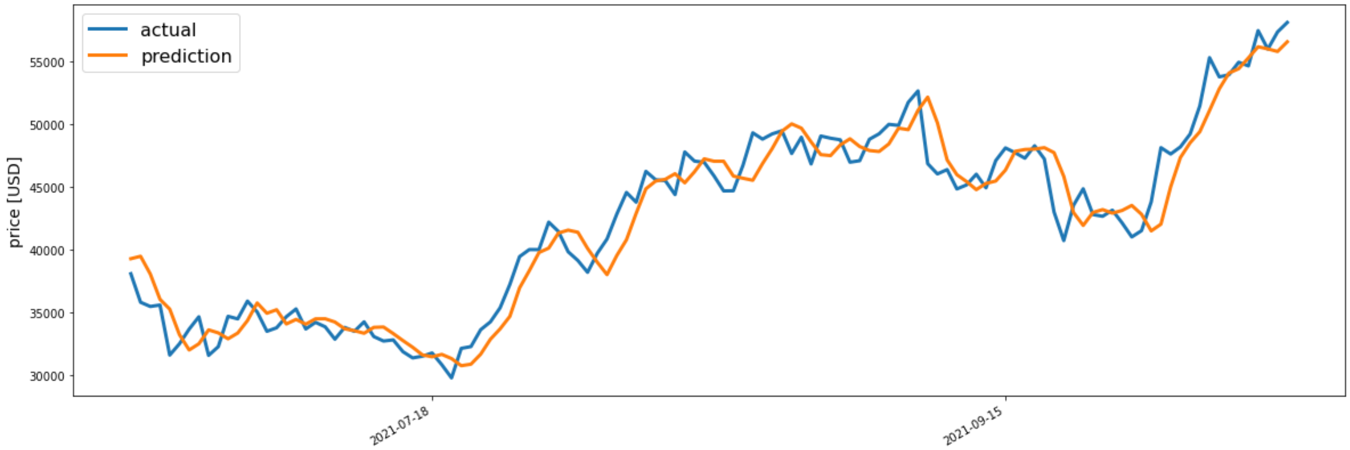
In [39]:
```
train, test, X_train, X_test, y_train, y_test = prepare_data(
    btc_df, target_col, window_len=window_len, zero_base=zero_base, test_size=test_size)
model = build_lstm_model(
    X_train, output_size=1, neurons=lstm_neurons, dropout=dropout, loss=loss,
    optimizer=optimizer)
history = model.fit(
    X_train, y_train, epochs=epochs, batch_size=batch_size, verbose=1, shuffle=True)
```

```
Epoch 1/20
17/17 [==============================] - 1s 4ms/step - loss: 0.0117
Epoch 2/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0066
Epoch 3/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0058
Epoch 4/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0050
Epoch 5/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0044
Epoch 6/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0039
Epoch 7/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0035
Epoch 8/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0039
Epoch 9/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0034
Epoch 10/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0043
Epoch 11/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0032
Epoch 12/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0032
Epoch 13/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0031
Epoch 14/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0033
Epoch 15/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0030
Epoch 16/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0028
Epoch 17/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0028
Epoch 18/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0028
Epoch 19/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0028
Epoch 20/20
17/17 [==============================] - 0s 4ms/step - loss: 0.0028
```

In [40]:
```
targets = test[target_col][window_len:]
preds = model.predict(X_test).squeeze()
mean_absolute_error(preds, y_test)
```

Out[40]:
```
0.03625412632016035
```

In [41]:
```
# Plotting predictions against the actual.
preds = test[target_col].values[:-window_len] * (preds + 1)
preds = pd.Series(index=targets.index, data=preds)
line_plot(targets, preds, 'actual', 'prediction', lw=3)
```


actual
prediction
55000
50000
45000
40000
35000
30000
price [USD]
2021-07-18
2021-09-15

In [ ]: