Buying Bitcoin - When The Low Comes Before The High

Overview:

- Data
- Current Progress
- Short Comings
- Future Work

Paul Boehringer

BitMEX Exchange – Raw Trade by Trade Data

Field	Description
• timestamp	- time (microsecond)
• symbol	- contract
• Side	- buy/sell
• size	- # of contracts = USD
• Price	- Price of Contract
• tickDirection	- ['MinusTick', 'ZeroMinusTick', 'ZeroPlusTick', 'PlusTick’]
• grossValue	- Number of satoshis 1 satoshi = 0.00000001 units

How Data Is (currently) Used

Field	Description
• timestamp	- Collect trades into 1 minute intervals for analysis
• symbol	- Include trade in analysis (yes/no)
• Side	- buy/sell
• size	- for volume weight average price
• Price	- Price of Contract

Future Uses of Data

Field	Description
• tickDirection	- ['MinusTick', 'ZeroMinusTick', 'ZeroPlusTick', 'PlusTick’]
• grossValue	- Number of satoshis 1 satoshi = 0.00000001 units (vol alternative)

Additional Data:

- Other Exchanges
  - BitMEX is swaps (in BTC)… actual exchange data may prove valuable

Now the Current Models Is Built

Data Imports as:
~ 500k trades/day

```
In [93]: df.head()
Out[93]:
```

timestamp	symbol	side	size	price	tickDirection	trdMatchID	grossValue	homeNotional	foreignNotional
2017-08-18 00:00:01.536113	XBTUSD	Buy	202	4278.3	ZeroPlusTick	fd8cc9de-9e76-a2ce-196c-1e5e64bedeee	4721548	0.047215	202.0
2017-08-18 00:00:01.536113	XBTUSD	Buy	909	4278.4	PlusTick	3c4f3bb7-c431-22b9-033b-4e769b506dce	21246057	0.212461	909.0
2017-08-18 00:00:02.160534	XBTUSD	Sell	398	4278.2	MinusTick	e05c6ef3-ae5b-e001-e253-324ece1b9133	9302852	0.093029	398.0
2017-08-18 00:00:02.160534	XBTUSD	Sell	11643	4278.1	MinusTick	a815b31a-9cfa-b6ef-b2fe-b5c074887561	272155125	2.721551	11643.0
2017-08-18 00:00:02.472558	XBTUSD	Buy	1988	4278.3	PlusTick	f9e800b2-72ff-5e47-9c3f-f789e9ce91ae	46467512	0.464675	1988.0

Transformed to:

Observation #	$\boldsymbol{X}$ (features)			$\boldsymbol{Y}$ (target)		
1	x_1	…	x_t	y_{t+1}	…	y_{t+z}
…	…	…	…	…	…	…
n	x_n	…	x_{n+t-1}	y_{t+n}	…	y_{t+n+z}

500 minute lookback
(~ 8 hours)

30 minute prediction

Description of One Observation

	$\boldsymbol{X}$ (features)			$\boldsymbol{Y}$ (target)		
Observation:	x_1	…	x_t	y_{t+1}	…	y_{t+z}

Currently Prices

Transform To returns by

	$\boldsymbol{X}$ (features)			$\boldsymbol{Y}$ (target)		
Observation:	$\frac{x_1 - x_t}{x_t}$	…	$\frac{x_t - x_t}{x_t}$	$\frac{y_{t+1} - x_t}{x_t}$	…	$\frac{y_{t+z} - x_t}{x_t}$

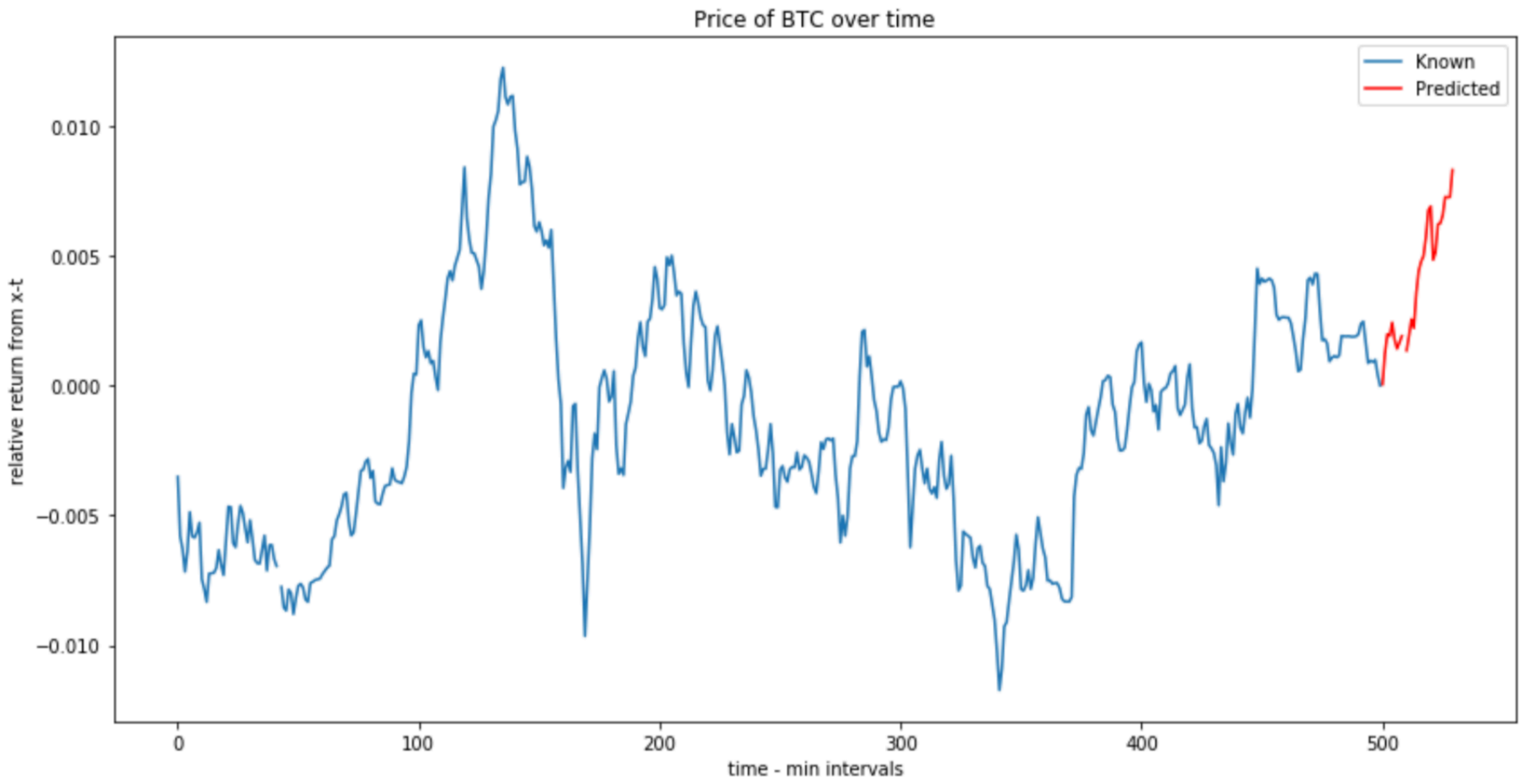
Note on Current Experimentation:

Can use more than just the equity's price history here. Using the same method for the price of other commodities

Price Prediction

Primary Goal:

- **Predict Future Returns In Short Term**

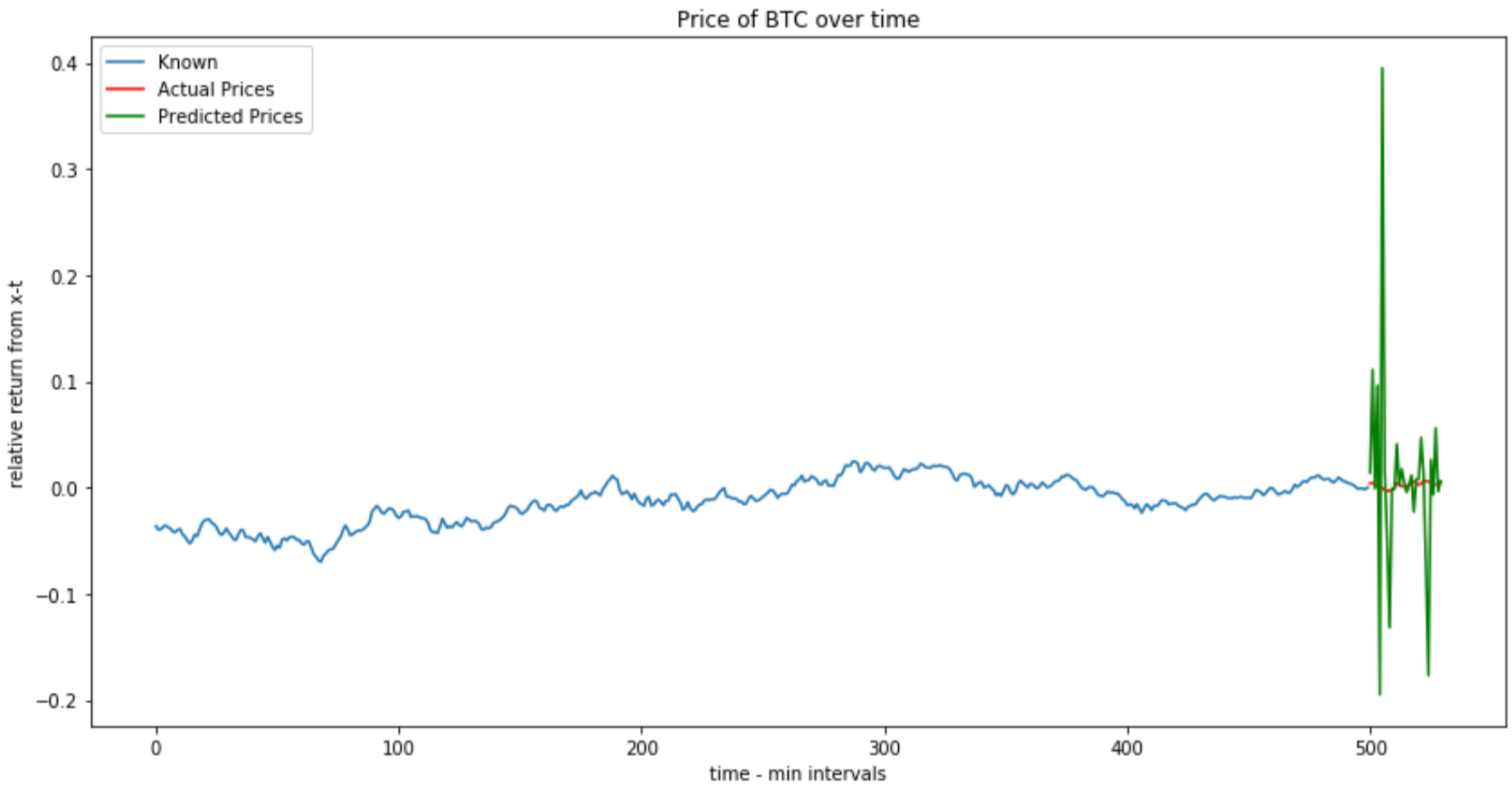


Unfortunately…
LSTMs can be tricky

Insert Legal Here:
Past performance is not indicative of future returns…

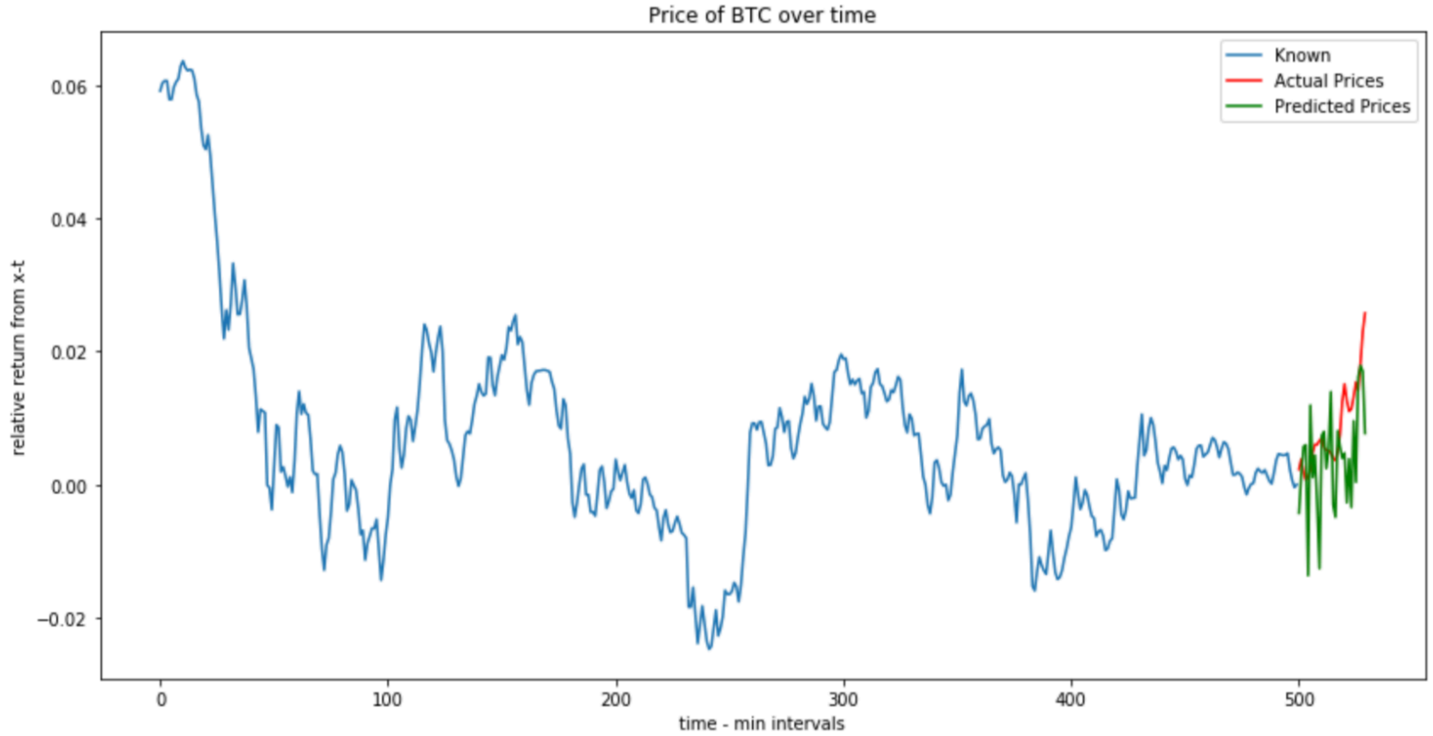
In Reality Predictions Have Looked More Like This:

LSTM Predictions… much more volatile than actual prices



With Some Hyper-Parameter Tuning

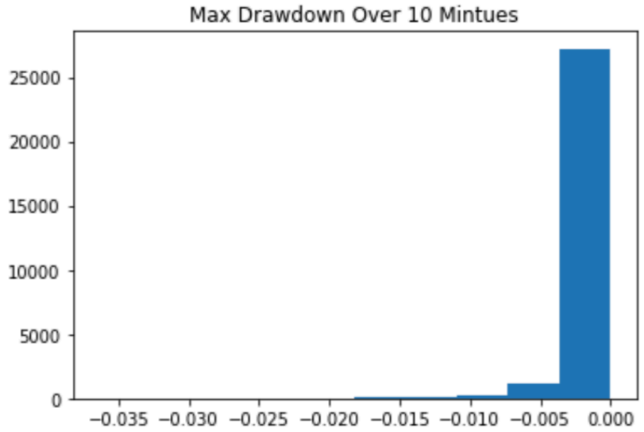
We Can Fix This Problem (slightly)

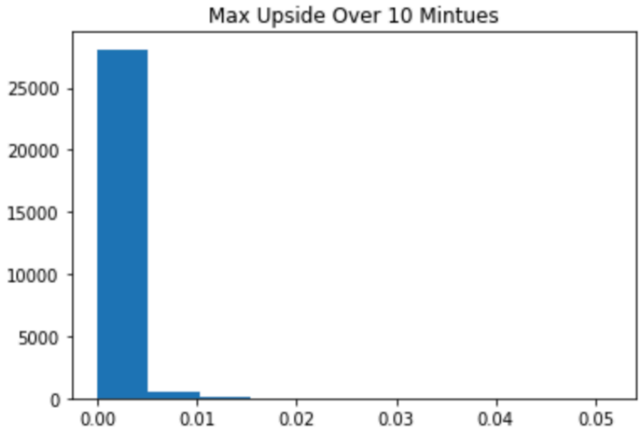


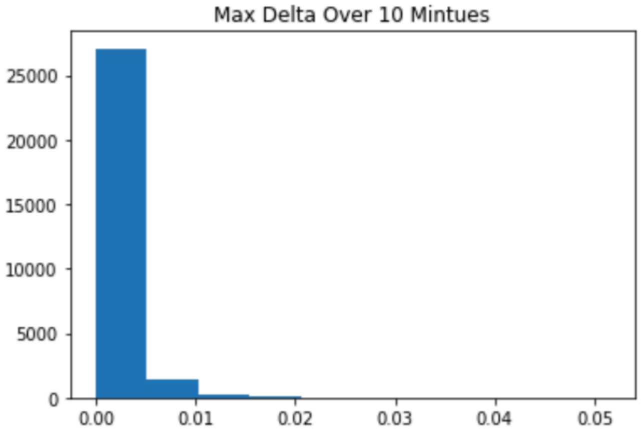
Prediction volatility persists enough…

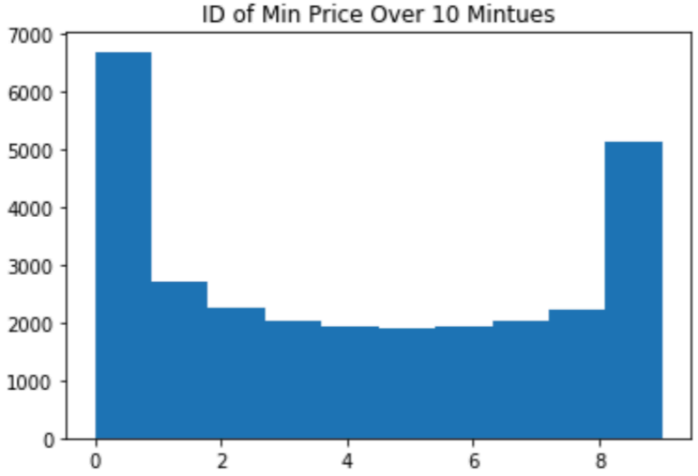
Maybe good to explore alternatives to price timeseries forecasting

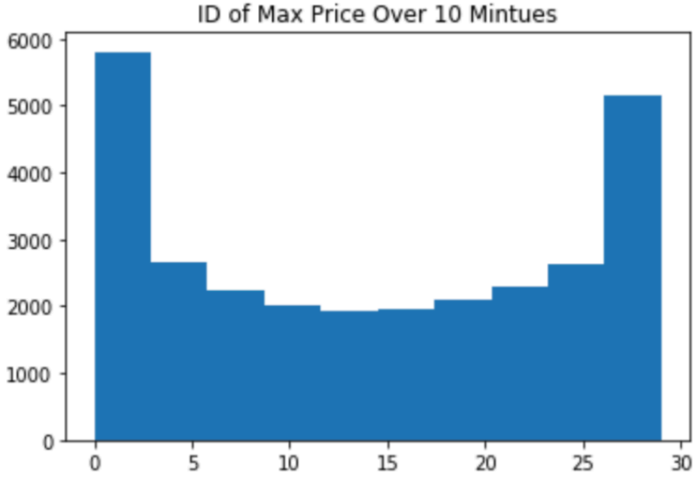
Investigating Returns Over Time (10 minutes)



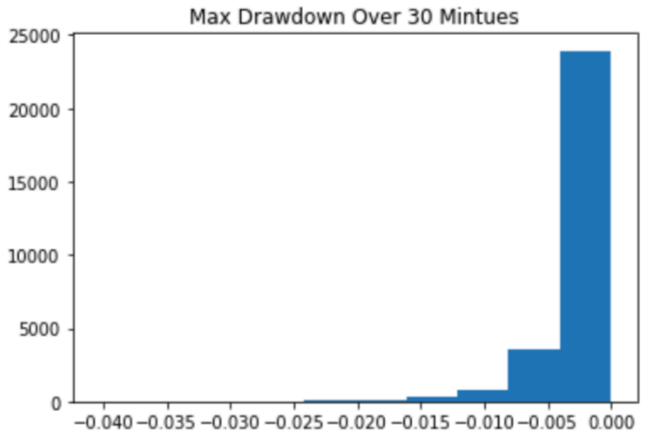


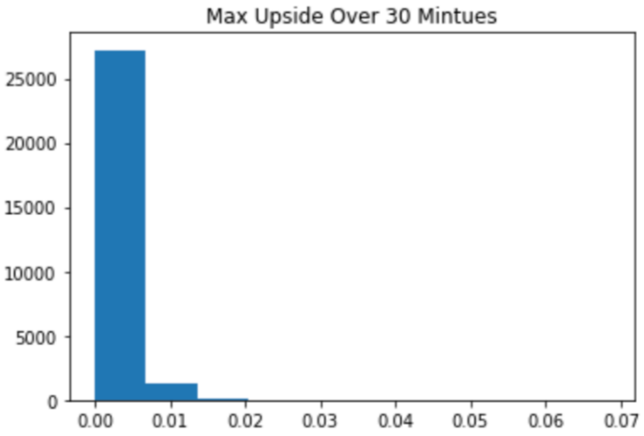


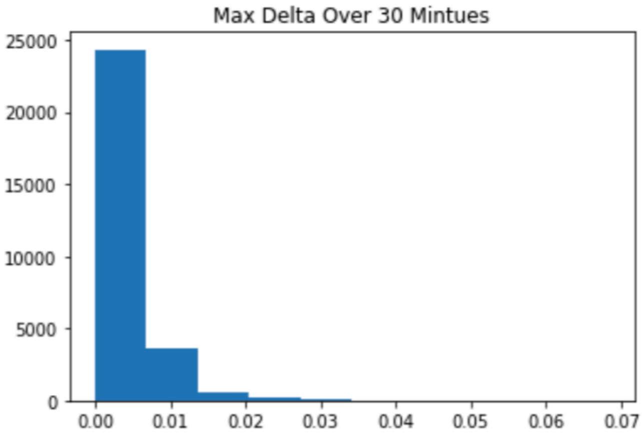


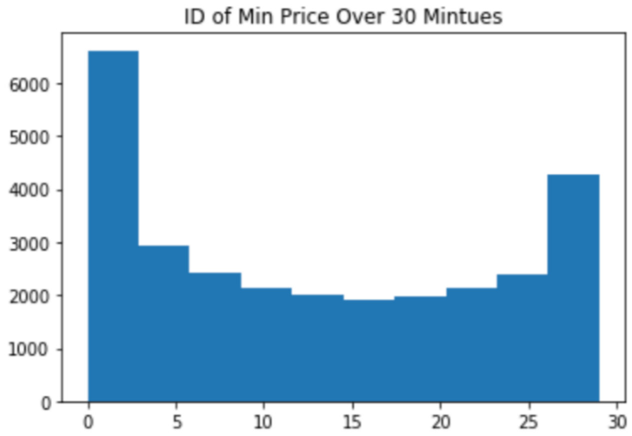


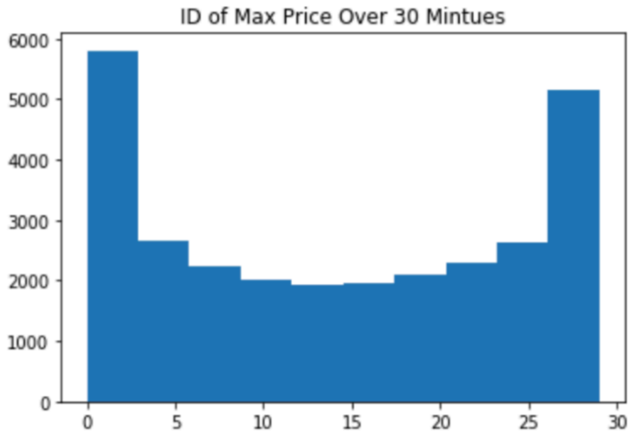
Investigating Returns Over Time (30 minutes)



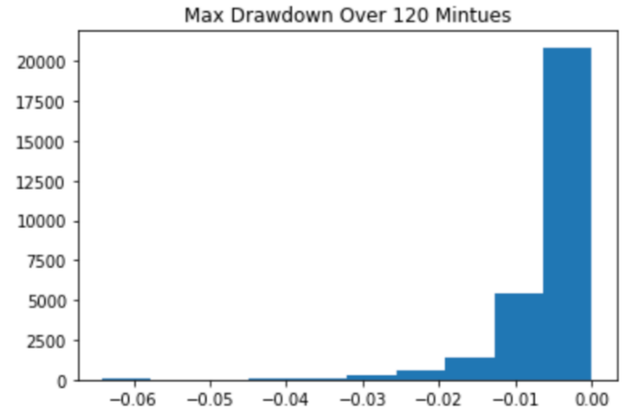


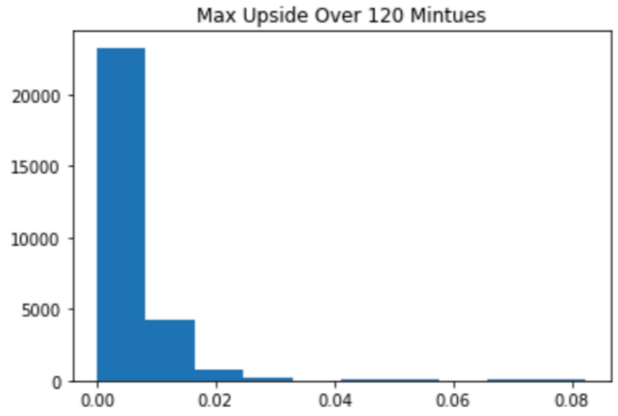


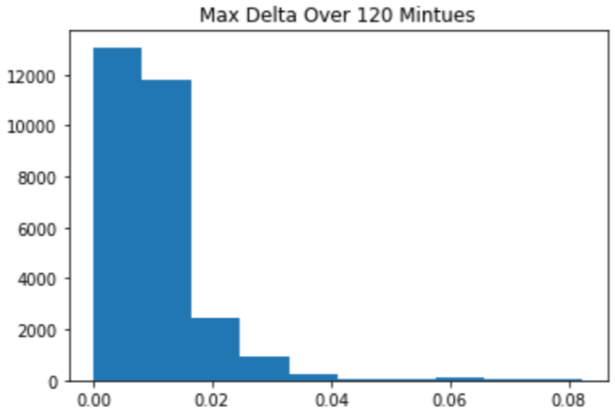


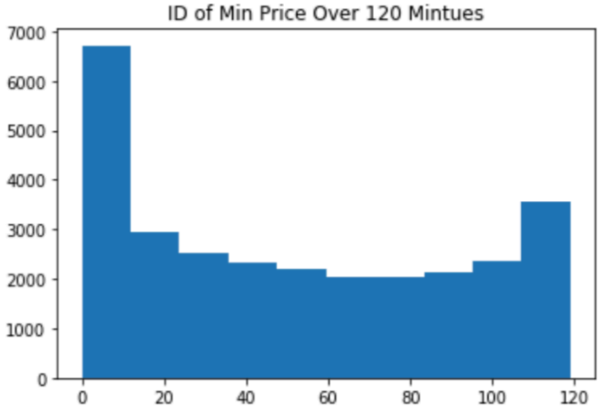


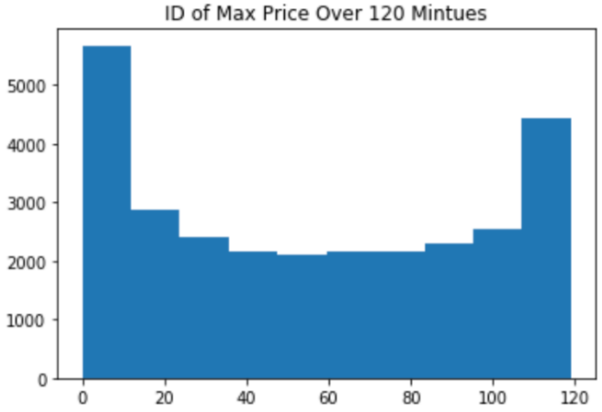
Investigating Returns Over Time (120 minutes)











Feasibility and Issues With This Approach

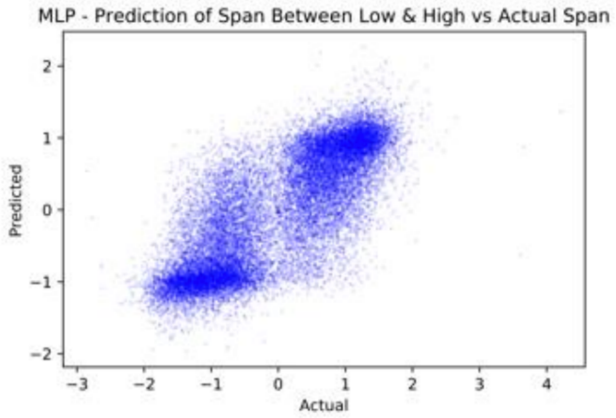
Confidence

- **Finding the appropriate cut off**
  - Min vs max
    - price
    - timing

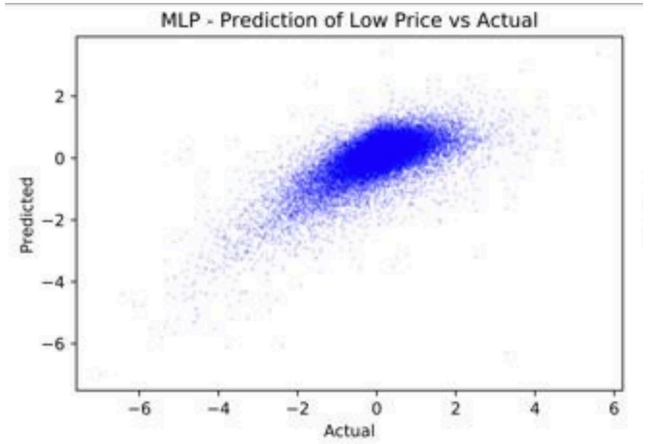
Uncertainty

- **Trading Fees vs. Expected Alpha**

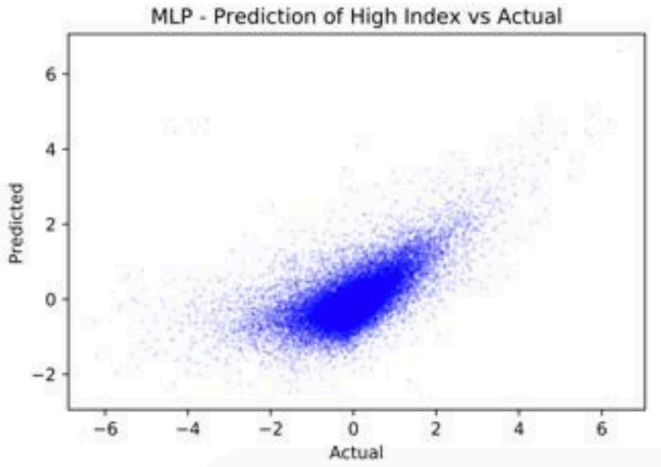
Future Work



MLP - Prediction of Span Between Low & High vs Actual Span
Predicted
Actual



MLP - Prediction of Low Price vs Actual
Predicted
Actual



MLP - Prediction of High Index vs Actual
Predicted
Actual