Altcoin Price Prediction

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What is cryptocurrency and why do people use it?

Motivations and Methods

- Develop models capable of predicting altcoin cryptocurrency close prices, as well as forecast prices
- Altcoins generally have high volatility and large price swings, which are conducive to short-term trading
- We look at short / long term trading and low-cap coins

Data

- https://www.kaggle.com/sudalairajkumar/cryptocurrencypricehistory
- Historical data of various cryptocurrencies (BTC, ETH, LTC, ADA, LINK, etc.)
- Generally use ~2 years of historical data for models
- CoinAPI historical (past ~2 years) queries for up-to-date forecasts (https://www.coinapi.io/)

Date	Name	Symbol	High	Low	Open	Close	Volume	Marketcap
2017-10-02 23:59:59	Cardano	ADA	0.030088	0.019969	0.024607	0.025932	57641300.0	6.288991e+08
2017-10-03 23:59:59	Cardano	ADA	0.027425	0.020690	0.025757	0.020816	16997800.0	5.396927e+08
2017-10-04 23:59:59	Cardano	ADA	0.022806	0.020864	0.020864	0.021931	9000050.0	5.686195e+08
2017-10-05 23:59:59	Cardano	ADA	0.022154	0.020859	0.021951	0.021489	5562510.0	5.571390e+08
2017-10-06 23:59:59	Cardano	ADA	0.021542	0.018360	0.021359	0.018539	7780710.0	4.806646e+08
2017-10-07 23:59:59	Cardano	ADA	0.021050	0.017620	0.018414	0.020941	7411240.0	5.429362e+08
2017-10-08 23:59:59	Cardano	ADA	0.023598	0.020147	0.020929	0.020477	7727460.0	5.309138e+08
2017-10-09 23:59:59	Cardano	ADA	0.022807	0.020342	0.020344	0.022114	4663310.0	5.733435e+08
2017-10-10 23:59:59	Cardano	ADA	0.022446	0.021279	0.022112	0.021531	2725600.0	5.582435e+08
2017-10-11 23:59:59	Cardano	ADA	0.022576	0.020976	0.021480	0.022520	3606720.0	5.838647e+08

Date	price_open	price_high	price_low	price_close	volume_traded	trades_count
2021-05-04	1.3643	1.3681	1.257660	1.2719	1.145964e+08	186570
2021-05-05	1.2716	1.5000	1.260900	1.4813	2.003925e+08	283363
2021-05-06	1.4836	1.7050	1.426978	1.6503	3.079012e+08	443235
2021-05-07	1.6509	1.7499	1.530000	1.6551	2.001017e+08	342299
2021-05-08	1.6559	1.6569	1.563307	1.6250	1.123797e+08	238721

Methodology

- Exploratory Data Analysis
- Time Series Analysis
- Machine Learning
- Autoregression Techniques

Models used:

- Autoregression
- Bollinger Bands and MACD Trading
- LSTM
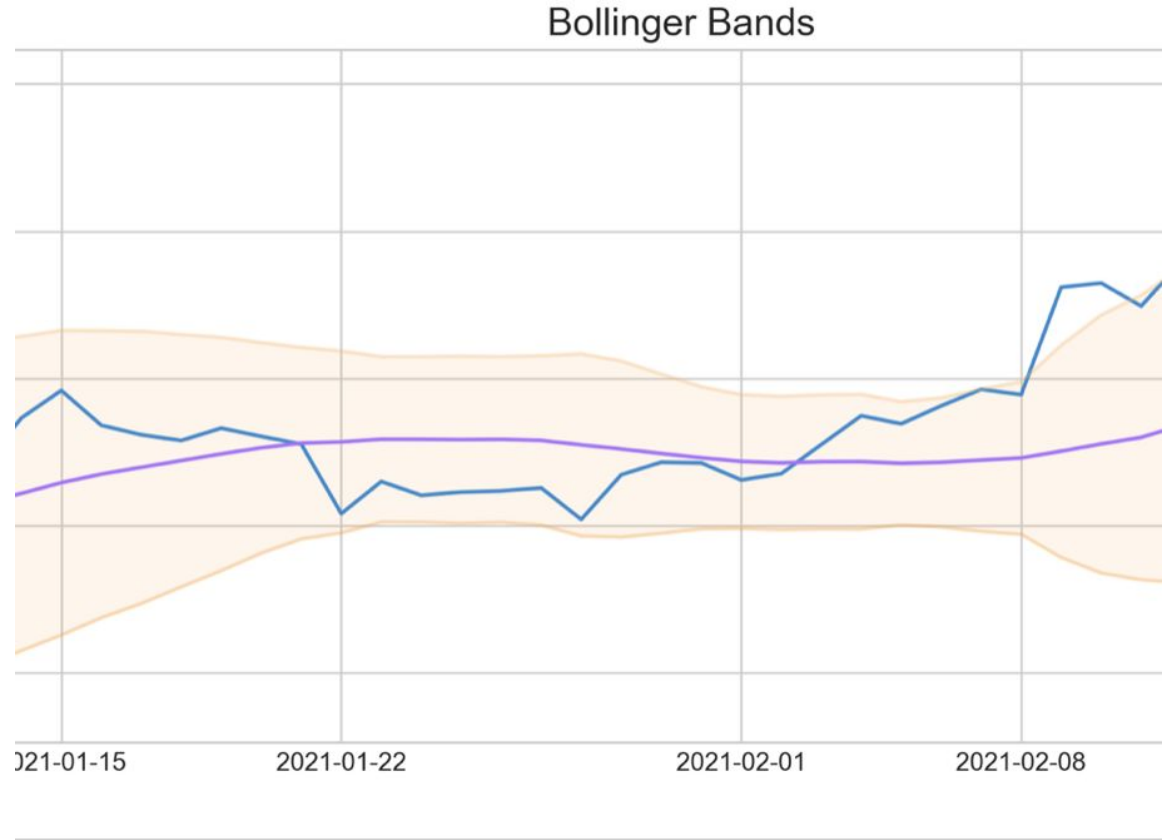
Bollinger Bands

Technical Indicators

- Moving Average (lagging) analyze whether a market is moving up, down, or sideways over time.
- Bollinger Bands (lagging) measure how far a price swing will stretch before a counter impulse triggers a retracement.
- MACD (leading) evaluate the speed of price change over time.

Date	Name	Symbol	High	Low	Open	Close	Volume	Marketcap	Return	Change	Volatility	MA7	MA21	Momentum	MACD	Signal	Upper_band	Lower_band
2013-05-19 23:59:59	Bitcoin	BTC	124.500000	119.570999	123.210999	121.989998	0.0	1.363205e+09	-0.010	-1.508003	8.471155	118.709001	117.159143	115.760002	-3.645462	-5.658709	137.200466	97.117819
2013-05-20 23:59:59	Bitcoin	BTC	123.621002	120.120003	122.500000	122.000000	0.0	1.363710e+09	-0.004	0.010002	8.256357	119.283286	116.085810	120.014999	-3.142245	-5.155416	131.946473	100.225146
2013-05-21 23:59:59	Bitcoin	BTC	123.000000	121.209999	122.019997	122.879997	0.0	1.374013e+09	0.007	0.879997	8.080808	120.909000	115.318190	120.498001	-2.641979	-4.652728	127.699871	102.936510
2013-05-22 23:59:59	Bitcoin	BTC	124.000999	122.000000	122.889999	123.889000	0.0	1.385779e+09	0.008	1.009003	7.948854	122.290285	115.646714	118.989998	-2.139434	-4.150069	128.569000	102.724428
2013-05-23 23:59:59	Bitcoin	BTC	126.933998	123.099998	123.800003	126.699997	0.0	1.417770e+09	0.023	2.810997	7.969404	123.424570	116.670048	119.000000	-1.497082	-3.619472	129.524510	103.815585

EDA

Lag Plot (Log Close Price)

- The correlation of the lag plot of closing price suggests that the data is not random, which points to the possibility of using autoregression as an appropriate model.
- Furthermore, the autocorrelation plot suggests that a possible maximum lag value for the autoregression model could be around 200-300

Autocorrelation Plot (Log Close Price)
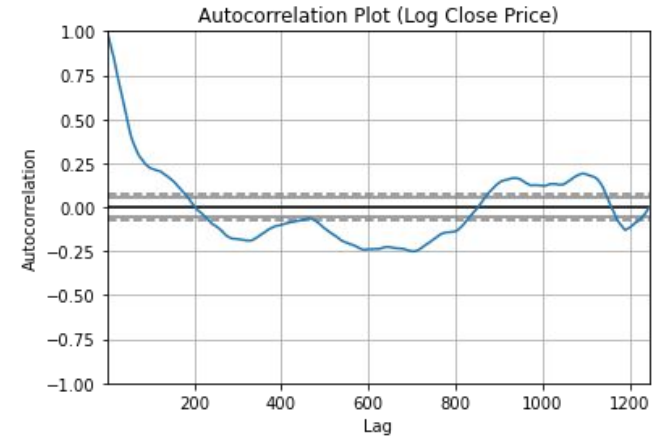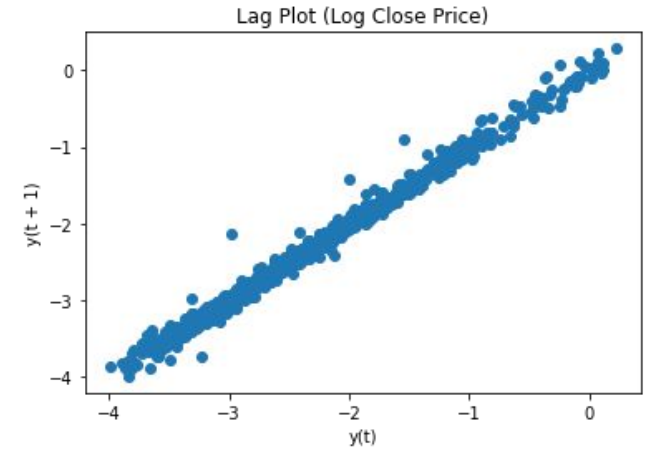
Autoregression Model (test set predictions)

- Using the non-differenced natural logarithm of close prices
- Select the best lag order for the model based on the hit rate (rate of correct sign of predicted daily percent change) and MSE of percent changes

```
Lag: 228
Hit rate: 1.0
Mean Squared Error: 0.00029623172768445343
    returns_true   returns_pred
0      -1.818621      -1.80141
```

2-Day Prediction (Test Set)

7-Day Prediction (Test Set)


```
Lag: 238
Hit rate: 0.8333333333333334
Mean Squared Error: 22.401915551358254
    returns_true   returns_pred
0       2.634749       2.542100
1      -6.711163       0.671148
2      16.463558      11.875107
3      11.408898       6.974363
4       0.290856       6.484449
```
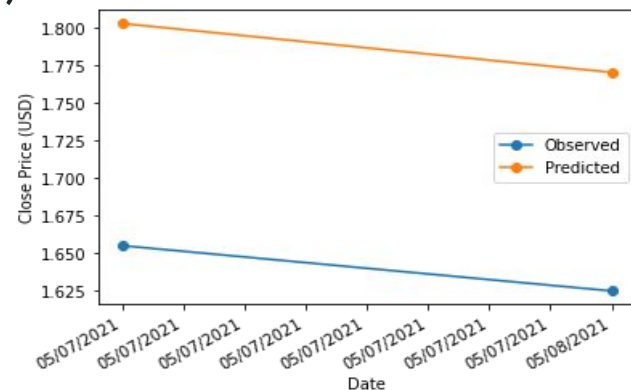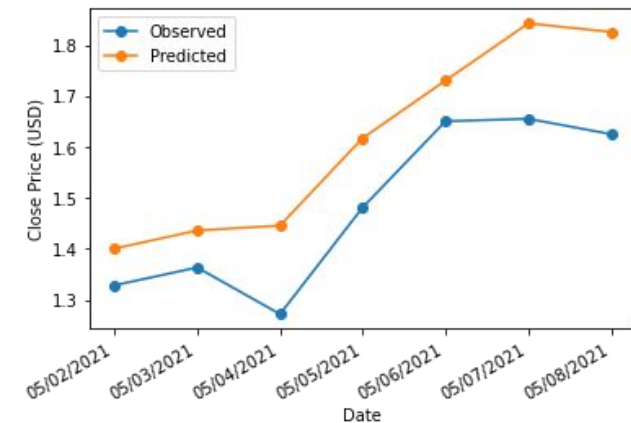
Autoregression Model (forecast and actions)

- Model outputs a forecast based on the given amount of days, along with trade actions (Simple logic, buy low, sell high)
- Assumes no profit-taking until the end of the period

7-Day Forecast (Future Days)

```
Profit (USD): 30.773580670059104
Initial Cost (USD): 100
```

	close	action	percent_change	value
2021-05-09	1.692241	wait	0.000000	100.000000
2021-05-10	1.637697	buy	-3.223214	100.000000
2021-05-11	1.809038	sell	10.462360	110.462360
2021-05-12	1.774522	buy	-1.908016	110.462360
2021-05-13	1.978066	hold	11.470360	127.287055
2021-05-14	2.052457	hold	3.760797	135.336190
2021-05-15	2.202014	sell	7.286767	135.336190
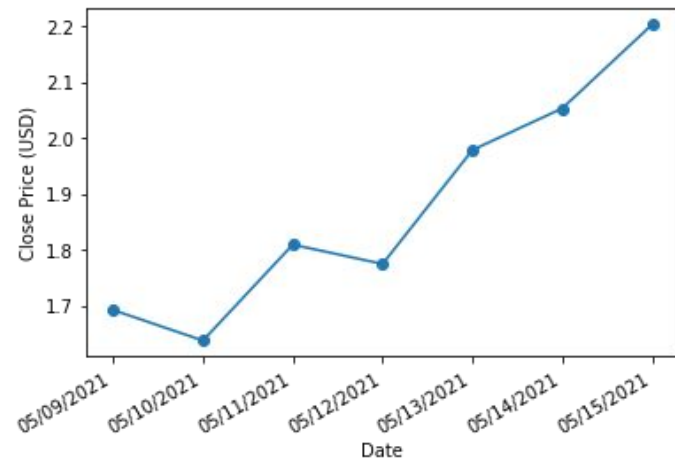
7-Day Forecast Trading
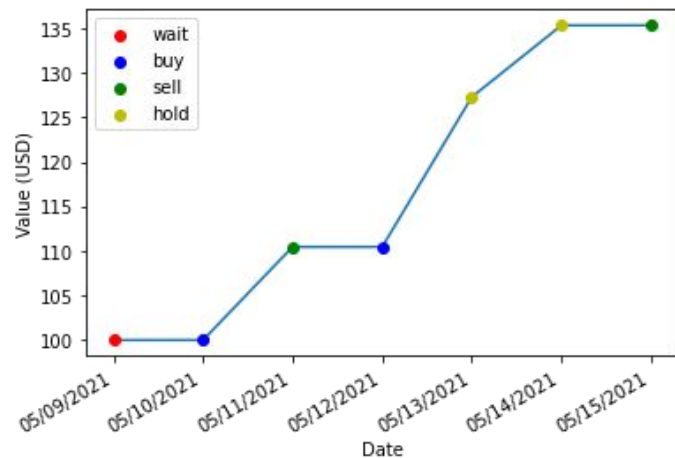
2-Day Forecasts

Profit (USD): 0.0
Initial Cost (USD): 100

ADA

	close	action	percent_change	value
2021-05-09	1.678969	wait	0.000000	100
2021-05-10	1.637941	wait	-2.443644	100

2-Day Forecast Trading
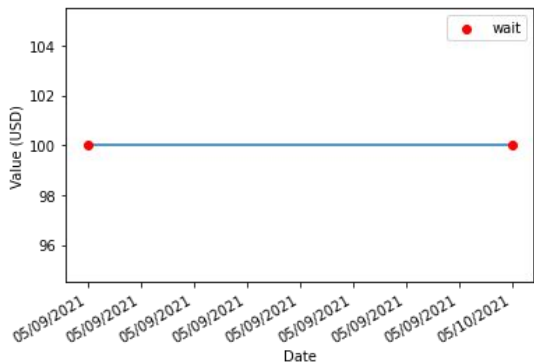
2-Day Forecast (Future Days)
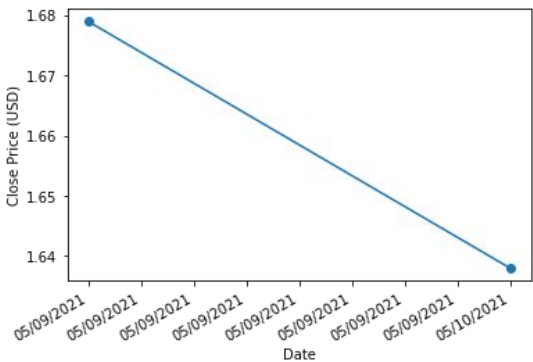
Profit (USD): -0.9435336600929105   LINK
Initial Cost (USD): 100

	close	action	percent_change	value
2021-05-09	48.119575	buy	0.000000	100.000000
2021-05-10	48.633077	sell	1.067138	101.067138

2-Day Forecast (Future Days)
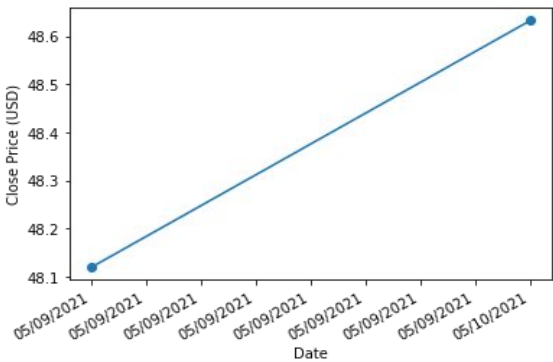
2-Day Forecast Trading
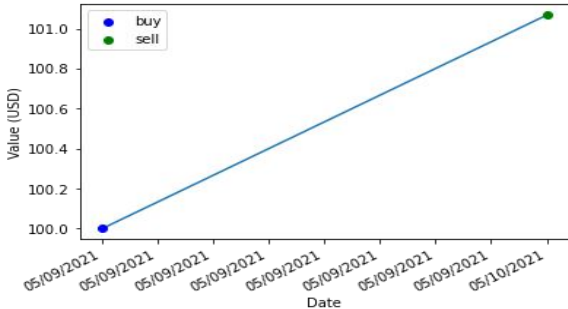
XRP

7-Day Prediction (Test Set)
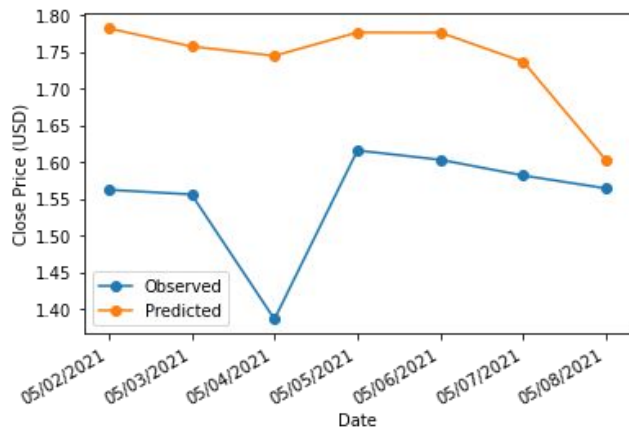
XLM

7-Day Prediction (Test Set)
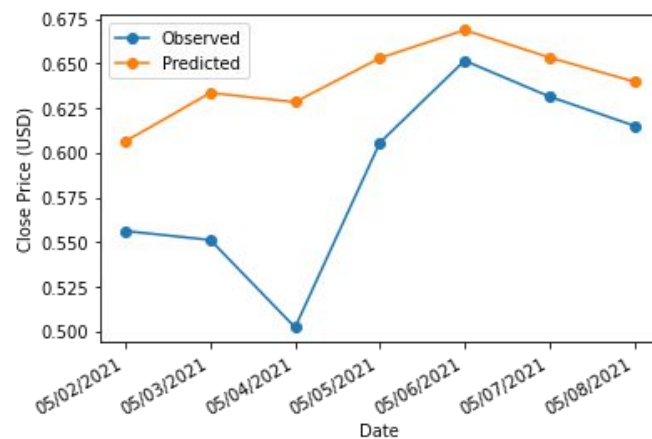
DOT

7-Day Prediction (Test Set)
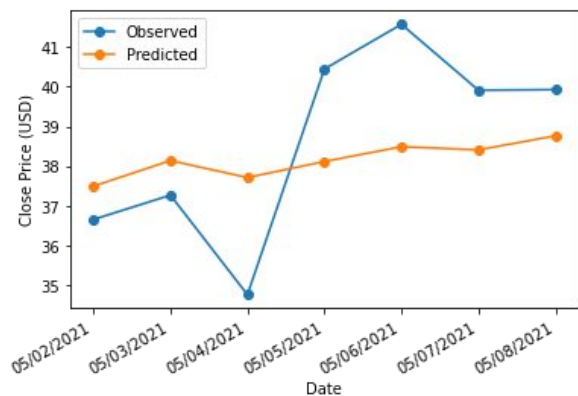
LINK

7-Day Prediction (Test Set)
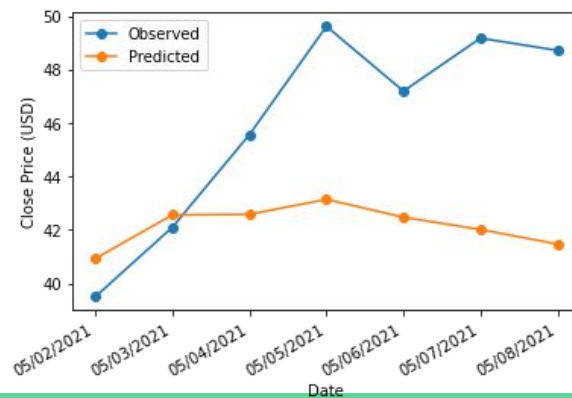
Bollinger Bands and MACD

Simple trading strategy based on technical indicators, such as Bollinger Bands and MACD can work as short-term trading technique.

```
Number of Trades: 4
Time Frame: 34 days
Profit: $10849.38 | 72.33%
```
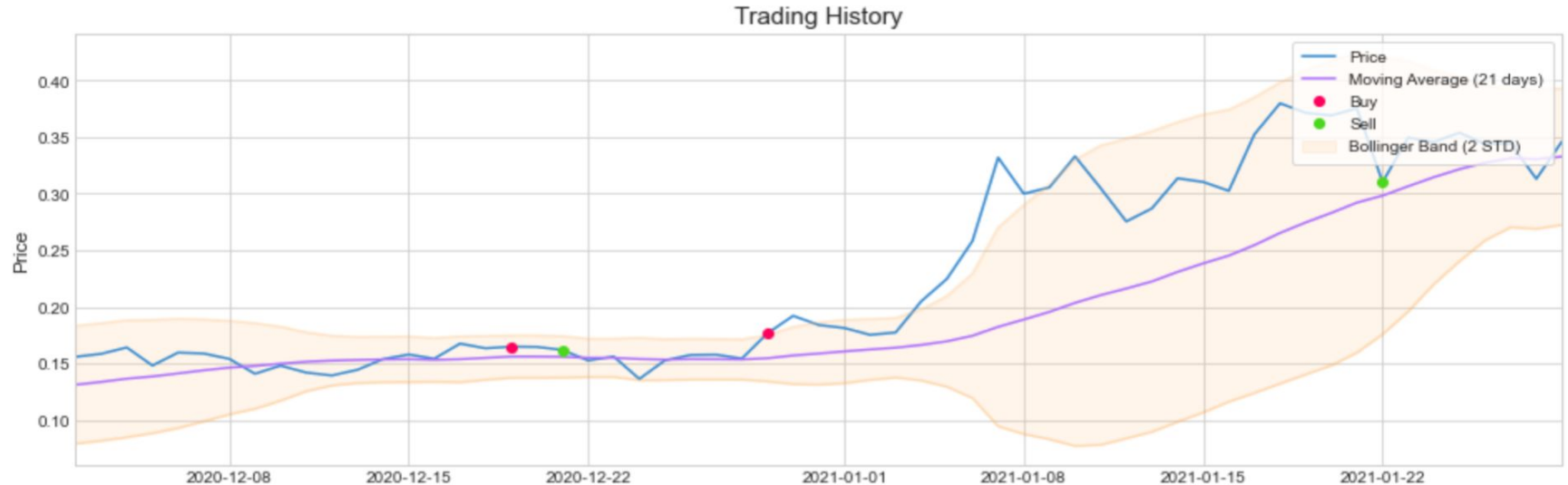

MACD for Cardano

Bollinger Bands and MACD

Number of Trades: 2
Time Frame: 5 days
Profit: $4436.39 | 29.58%
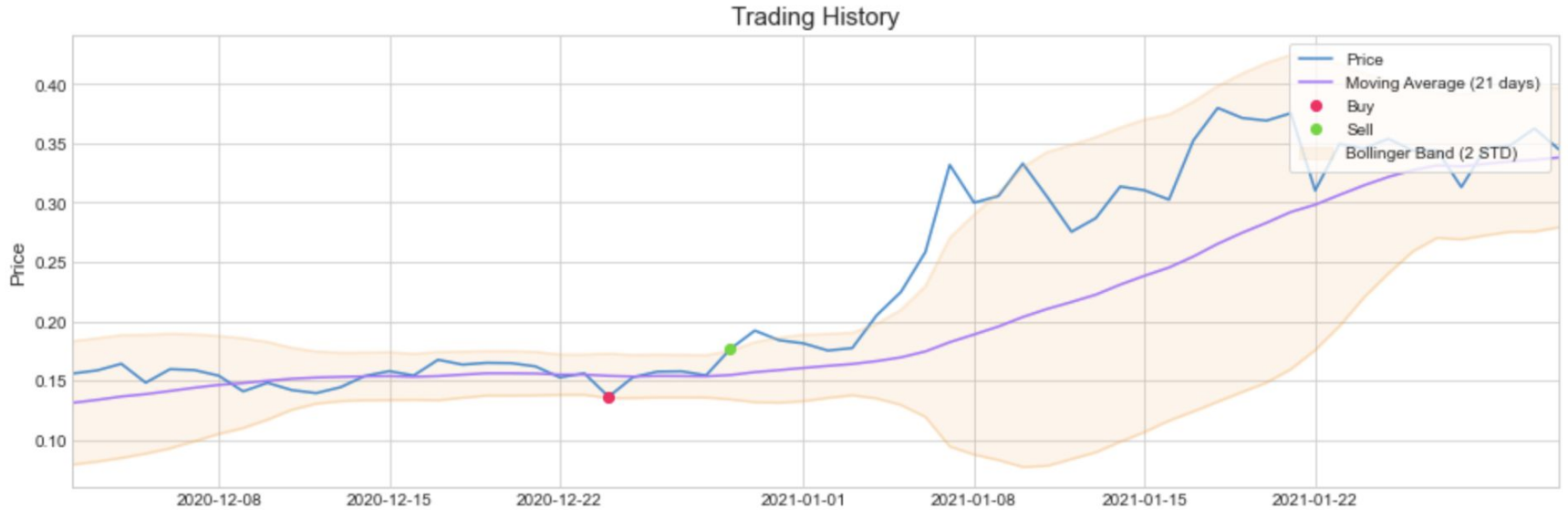
Bollinger Bands for Cardano

Modeling

Long Term-Short Term Memory (LSTM)

- type of RNN that allows processing entire sequences of data
- leaving aside any factor which may impact the price of Bitcoin, like for example, news, which can play a very important rule

Price coin_Bitcoin

Price coin_Dogecoin
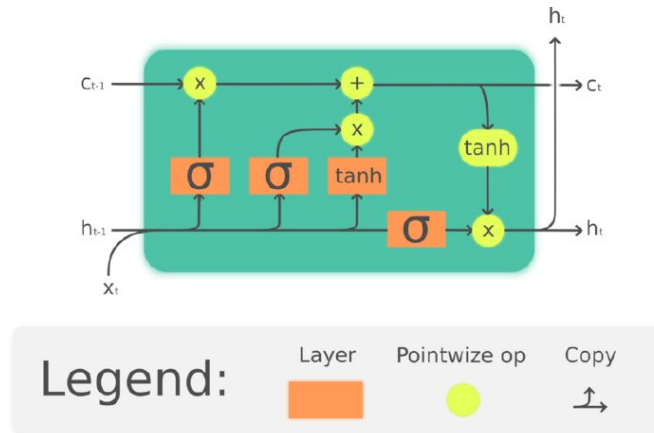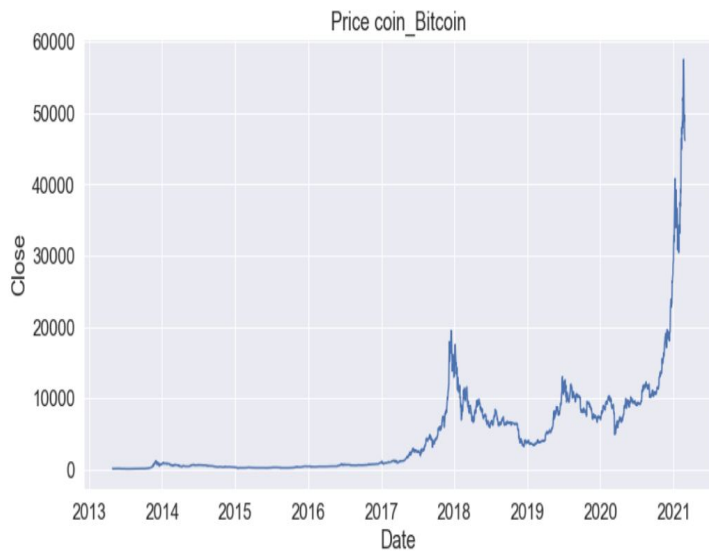
Bitcoin Training Loss
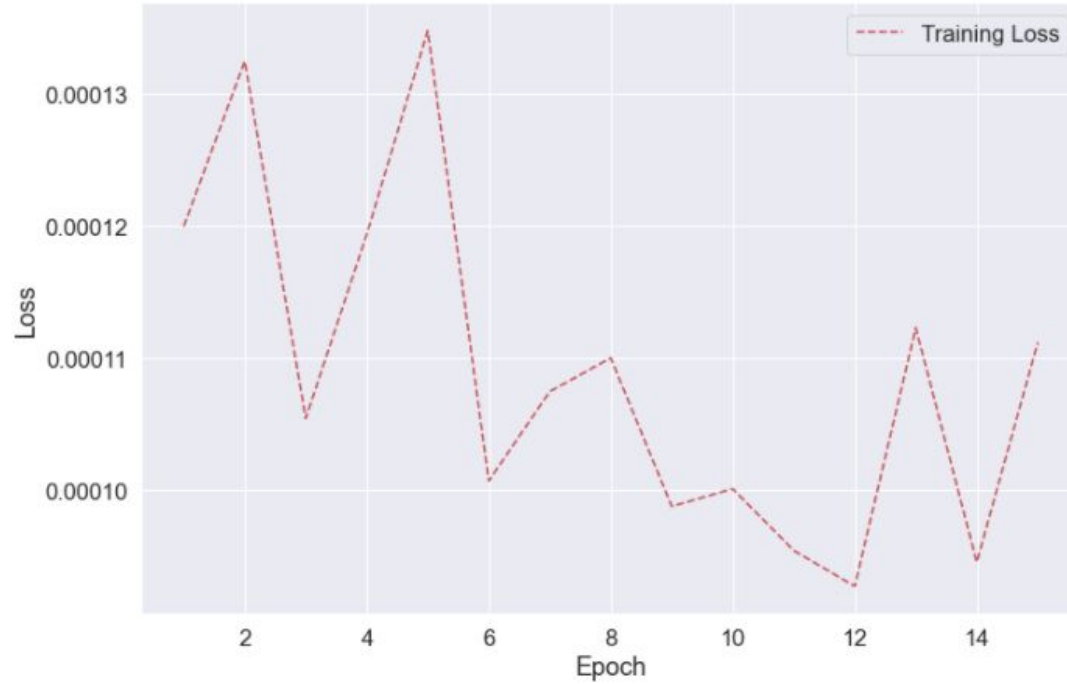
Dogecoin Training Loss
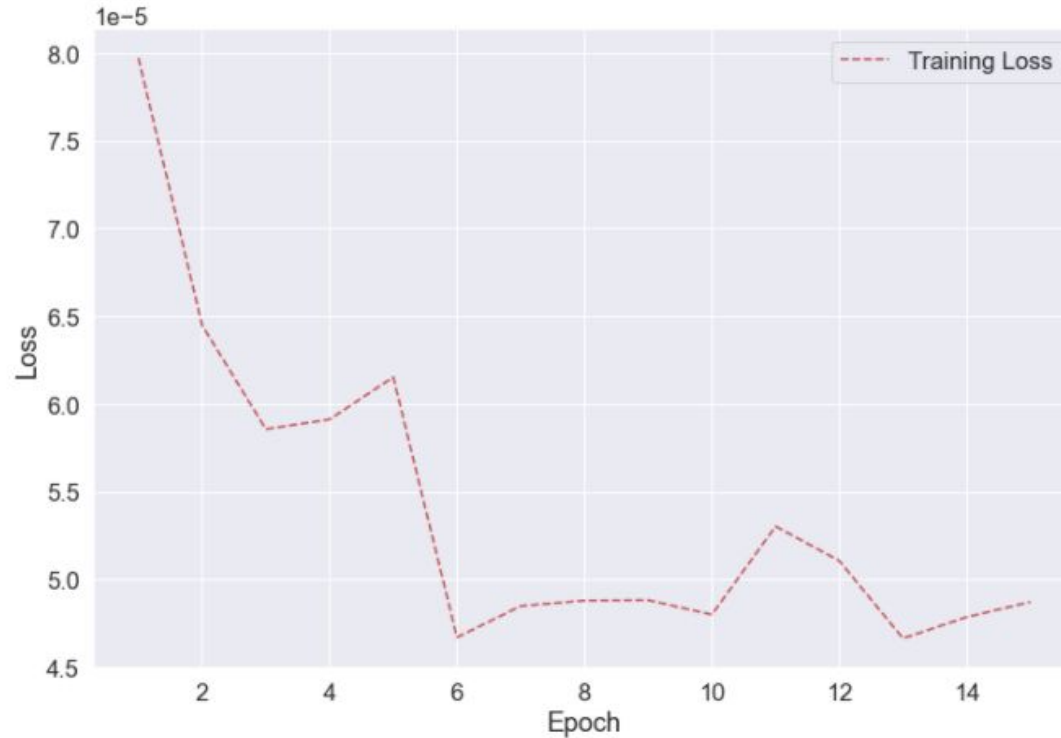
1st attempt.. Bitcoin.

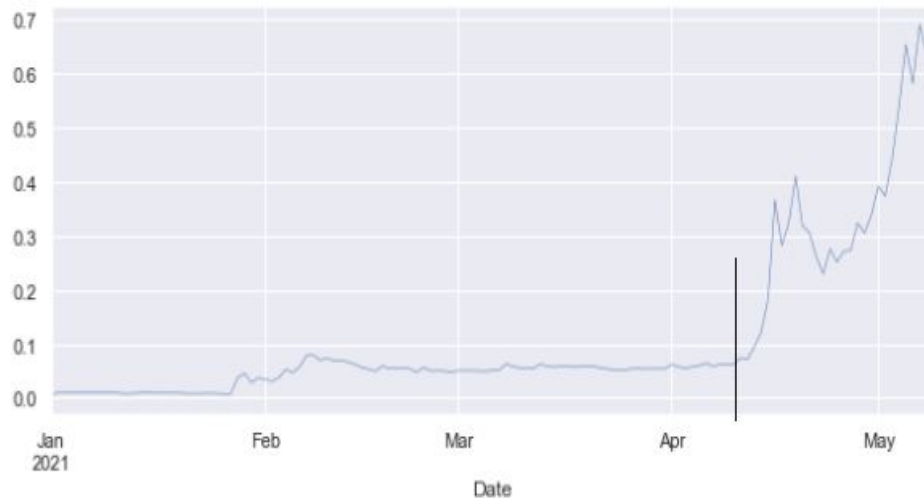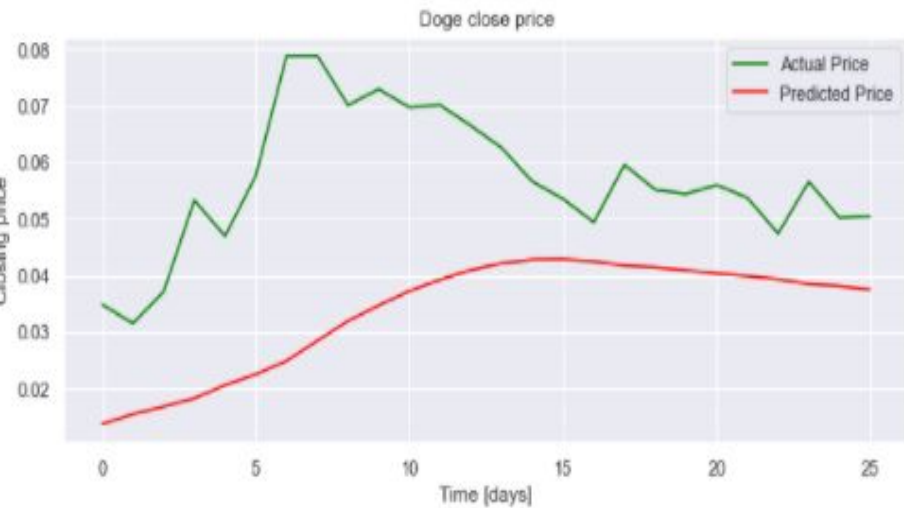|									
☆	1	🅑 Bitcoin BTC [Buy]	$58,847.51	▲ 1.16%	▲ 1.40%	$1,099,144,101,270	$64,830,119,500 1,103,298 BTC	ⓘ 18,705,550 BTC	⋮
☆	2	◆ Ethereum ETH [Buy]	$4,111.00	▲ 3.55%	▲ 32.65%	$475,514,572,467	$53,435,310,801 13,014,285 ETH	115,812,601 ETH	⋮
☆	3	◈ Binance Coin BNB [Buy]	$684.67	▲ 6.02%	▲ 8.06%	$104,932,485,996	$5,020,776,602 7,341,409 BNB	ⓘ 153,432,897 BNB	⋮

Bitcoin close price
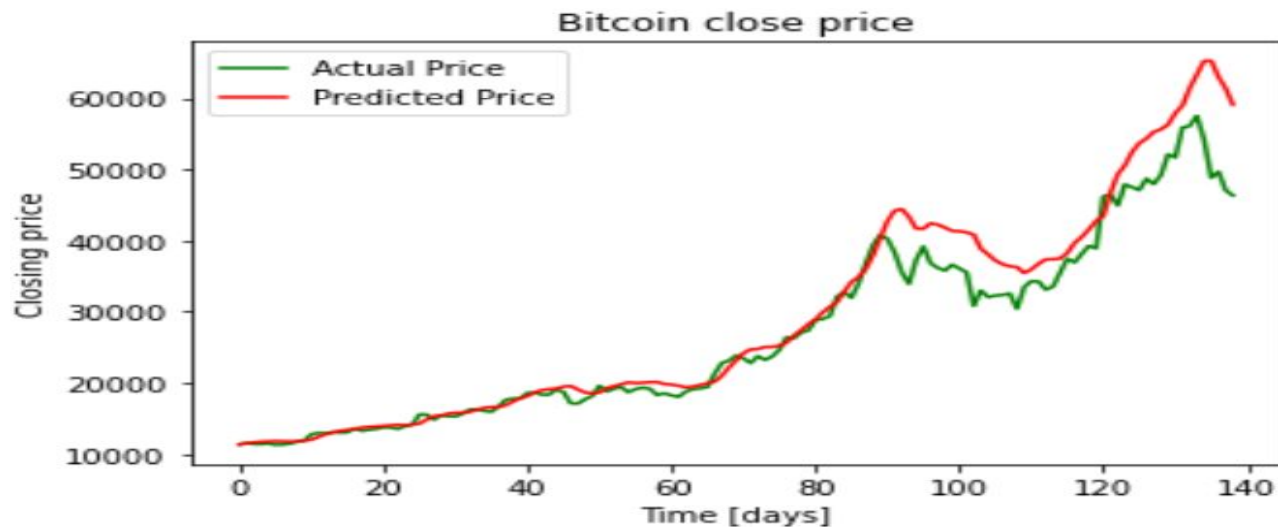
Modeling on Dogecoin

Taking 1 year data into account.. Huge limitation

Modeling on a low-cap cryptocurrency: NEM

Ranked #50 as if 5/8/2021

☆	47	Compound COMP	$752.50	▼ 4.08%	▼ 7.75%	$3,821,318,183	$241,528,398 320,807 COMP	5,075,624 COMP
☆	48	Zcash ZEC	$294.15	▼ 3.93%	▲ 19.65%	$3,453,484,119	$907,860,847 3,084,474 ZEC	11,733,275 ZEC
☆	49	Waves WAVES	$31.79	▼ 1.74%	▲ 32.63%	$3,350,717,183	$266,270,529 8,348,680 WAVES	105,058,810 WAVES
☆	50	NEM XEM	$0.367	▼ 5.38%	▲ 5.89%	$3,302,692,203	$220,602,777 601,153,505 XEM	8,999,999,999 XEM
☆	51	Elrond EGLD	$186.41	▼ 0.64%	▲ 3.95%	$3,248,965,884	$80,203,214 430,244 EGLD	17,428,825 EGLD
☆	52	Bitcoin BEP2 BTCB	$57,436.16	▼ 2.59%	▲ 1.10%	$3,135,900,782	$194,295,990 3,383 BTCB	54,598 BTCB
☆	53	UNUS SED LEO LEO	$3.03	▲ 3.31%	▲ 22.89%	$3,025,016,666	$4,455,556 1,472,165 LEO	999,498,893 LEO

Name close price
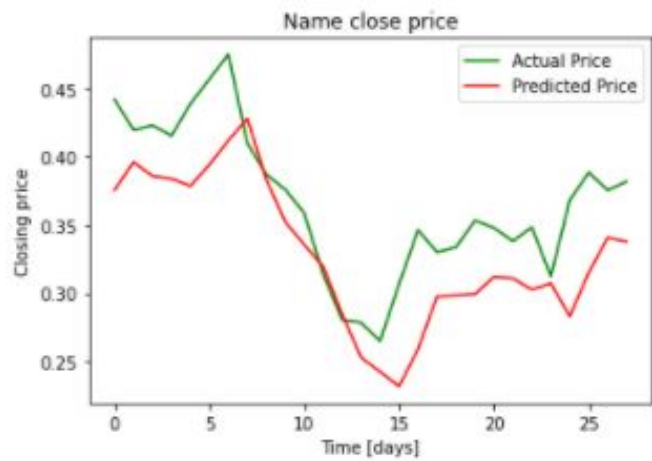
What have we accomplished?

- Ability to perform forecasting on both

  robust and volatile cryptocurrencies

- A function that can be deployed that implements

  the buy low sell high logic and informs one's decisions