**Edited Article**

In our study we surveyed the historical data of 80 cryptocurrency coinpairs on Binance Exchange (all countered with BTC). We qualified alternative coins based on low price, volume and market cap. These coins, similar to penny stocks, are typically most vulnerable to manipulation schemes such as pump and dump. We also selected what are called ‘Big Tickers’, which are coins that are frequently traded. Before training our models, we ensured that manipulated periods were at least 3 months after the initial listing of the coin pair. Further, coinpairs were qualified as pump and dump if there was at least a 20% increase in price over a 30 minute interval. We used a supervised method called K-nearest neighbors with 6 neighbors and tested accuracy using train-test split. This supervised training resulted in 89% classification accuracy. Put another way, when unlabeled test data is provided we can classify the test data as good behavior or a pump and dump instance with almost 90% classification accuracy.

**Using machine learning to detect instances of market manipulation**

Pump and dump is a scheme that attempts to boost the price of a stock through recommendations based on false, misleading or greatly exaggerated statements.

In order to employ machine learning algorithms for pump and dump pattern recognition we need to clearly define the features that will serve as input in our training algorithms.

Feature extraction: what are the metrics we can use to detect pump and dump?

Based on a survey of the literature on machine learning and stock manipulation we determined the relevant features to be Price, volatility, and volume.

Can we teach machines to recognize patterns (based on price, volatility, and volume ) associated with good market behavior and pump and dump?

-We can turn to two types of learning models for market manipulation pattern recognition

Types of learning: Supervised learning, unsupervised learning

Supervised learning: Develop predictive model based on both input and output data (labeled data). This type of learning falls under regression and classification. Methods include K-nearest neighbors, support vector machines, and classification via artificial neural networks.

· In supervised learning we know what the expected output of our data. For the case of pump and dump, a subset of the training data will be labeled as bonafide pump and dump instances while the remaining subset will be labeled as instances of good behavior. A pump and dump label is qualified by large short-term returns, large changes in volume and high price volatility.

Unsupervised learning: Group and interpret data based only on input data. This is typically done via clustering such as k-means clustering, hierarchical clustering, and artificial neural networks.

· In unsupervised learning we seek to find patterns for which we have no labels. This may fall under detecting market manipulation in general while remaining agnostic to the kind of manipulation occurring. Additionally, unsupervised models may pick up on patterns for which we have yet to define labels. This is increasingly of concern as market manipulators become more creative with their efforts toward carrying out undetected manipulation.

In our study we surveyed the historical data of 80 cryptocurrency coinpairs on Binance Exchange (all countered with BTC). We qualified alternative coins based on low price, volume and market cap. These coins, similar to penny stocks, are typically most vulnerable to manipulation schemes such as pump and dump. We also selected what are called ‘Big Tickers’, which are coins that are frequently traded. Before training our models, we ensured that manipulated periods were at least 3 months after the initial listing of the coin pair. Further, coinpairs were qualified as pump and dump if there was at least a 20% increase in price over a 30 minute interval. We used a supervised method called K-nearest neighbors with 6 neighbors and tested accuracy using train-test split. This supervised training resulted in 89% classification accuracy. Put another way, when unlabeled test data is provided we can classify the test data as good behavior or a pump and dump instance with almost 90% classification accuracy.