Final Project Proposal - Ethereum Price Prediction

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Goal/Objective:

Implement and backtest deep learning models that build and expand upon approaches in existing literature that our team reviewed for our midterm seminar on Bitcoin prediction, then translate and apply the approaches to predict the price movement of Ethereum with the aim to be able to deploy a profitable trading strategy. Previous models on cryptocurrency prediction have shown success with Stacked Denoising Auto Encoders (SDAE) and Long Short Term Memory (LSTM), and we will compare against a baseline model such as a standard deep neural network (DNN). Our team has extensive domain knowledge in the blockchain technology underpinning Ethereum [COMS 6998 - Foundations of Blockchains], which we will apply through improved feature engineering and ethereum specific network parameters. We will evaluate our developed models by allotting each an initial investment and allowing it trade over a designated testing interval of actual price data.

Challenges:

With Ethereum being a second generation blockchain, there is added complexity of smart contracts, dynamic transaction fees and coin supply. Consequently there is added emphasis in smart and selective feature engineering. Additionally Ethereum has undergone significant changes in its network structure over its history (such as EIP-1559 which drastically changed transaction fee mechanism), so we will limit our training and testing set to the most recent and adopted iteration of Ethereum, which presents difficulties associated with a smaller dataset.

Approach/Techniques:

As previously mentioned, we will use as a starting point models and techniques that proved successful in previous literature on Bitcoin price prediction (SDAE, LSTM) , then modify and map these where appropriate to Ethereum modeling. As we have seen in the papers we reviewed for the midterm seminar, a more effective way to measure performance for this use case is to measure its profitability. Our models will learn to minimize a loss function related to correctly predicting whether the next day’s price would rise or fall. We assess the profitability of the model based on its performance on unseen testing data.

Implementation Details:

Due to blockchains being a somewhat new asset class/technology, the time scale and data obtained from Etheruem is limited in size relative to other deep learning application datasets. We do not foresee training time or memory requirements to be a significant obstacle for this application, as the LSTM and SDAE models in the published papers on Bitcoin which are similar to the ones we will be developing did not require specialized GPUs or advanced distributed training techniques. We plan to use publicly available GPUs on Google Colab Pro (K80, P100,T4), with 2x vCPU, and 24 GB of RAM. We plan on using Tensorflow’s Keras library and numpy to implement our models. The dataset will be queried from from publicly available cryptocurrency historical data repositories such as Coindesk.com, and Ethereum tracking websites such as Etherscan.io

Demo Planned:

Visualization of various models’ performance over time, profitability, and analysis of accuracy over testing, validation, and training data time intervals.

References:

A Comparative Study of Bitcoin Price Prediction Using Deep Learning - Suhwan Ji, Jongmin Kim and Hyeonseung Im

Deep Learning Methods for Modeling Bitcoin Price - Prosper Lamothe-Fernández, David Alaminos, Prosper Lamothe-López and Manuel A. Fernández-Gámez

Cryptocurrency forecasting with deep learning chaotic neural networks - Salim Lahmiri, Stelios Bekiros

Forecasting the price of Bitcoin using deep learning - Mingxi Liu, Guowen Li, Jianping Li, Xiaoqian Zhu, Yinhong Yao

Transaction Fee Mechanism Design for the Ethereum Blockchain: An Economic Analysis of EIP-1559 - Tim Roughgarden (Columbia)