Deep Graph Kernels for Inferring Bitcoin Transaction Dynamics *

Pankaj Kumar†

There has been significant research done to analyze bitcoin transaction network, but very limited research has been executed to analyze the networks influence on overall Bitcoin price, which is next step to forecast price. To achieve the former, one need to efficiently measures the structural change of a dynamic large-scale graph. With the above primary goal, this thesis contributes in area related to bitcoin transaction, a major input for graph isomorphisms problem. Graph isomorphism is then used to to give quantitative measure of large-scale graph (bitcoin transaction graph) transformation over time or by a significant event (bubbles).

With the growing size of blockchain (65 GB), and recent bitcoin clients indexing the full blockchain using LevelDB have made the existing software tools obsolete to parse from the raw blockchain. On the data side, the thesis develops an open source blockchain parsing tools to extract agent resolved data by making significant changes in BitIodine, an open source tool developed by Spagnuolo (2013). Our tool parse postgres database dumps of the bitcoin-ruby-blockchain database generated by webbtc [1] to get transaction graph using R, which provides the flexibility at data management side.

The validation of the data parsed from our tool is then checked by reproducing the "Mathew Effect" phenomenon from the Kondor et al. (2014) paper's using their original matlab code, but with our own data.

To capture correlation between network structure and market price, we extend the seminal work (Yanardag and Vishwanathan, 2015) by Propagation kernel for fully labeled graphs (Neumann et al., 2015), which takes account

*Report

†Big Data Analytics Center, Shiv Nadar University, Gautam Buddha Nagar, India. Email: kumar.x.pankaj@gmail.com

[1] http://dumps.webbtc.com/bitcoin/

of attributed graphs with continuous values to find qualitative measure of large scale transformation. The Matlab code of the propagation kernels was obtained from (Neumann et al., 2015), which was then coded in python. Our deep framework captures better correlation with the network, as compared to similarity index calculated by other traditional graph kernels.

We are able to show how structural changes in the network accompany significant changes (quantitative measure) in the exchange price of bitcoins. Thus giving foundation to possible extend of our work by leveraging blockchain network features, as a basis to conduct deep learning learning prediction on the price change of Bitcoin.

References

Dániel Kondor, István Csabai, János Szüle, Márton Pósfai, and Gábor Vattay. Do the rich get richer? an empirical analysis of the bitcoin transaction network. *PLoS ONE*, 9(2):1–10, 02 2014.

Marion Neumann, Roman Garnett, Christian Bauckhage, and Kristian Kersting. Propagation kernels: efficient graph kernels from propagated information. *Machine Learning*, 102(2):209–245, 2015.

Michele Spagnuolo. Bitiodine: Extracting intelligence from the bitcoin network. Master's thesis, Politecnico di Milano, Italy, 2013.

Pinar Yanardag and S.V.N. Vishwanathan. Deep graph kernels. In *Proceedings of the 21th ACM SIGKDD International Conference on Knowledge Discovery and Data Mining*, KDD '15, pages 1365–1374, New York, NY, USA, 2015. ACM.