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Learning Dynamic Representations of Nodes in Temporally Variant Graphs

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Abstract : In many industries, including telecommunications, churn prediction has been a topic of active research. A lot of attention has been drawn on devising the most informative features, and this area of research has gained even more focus with spread of (social) network analytics. The call detail records (CDRs) have been used to construct customer networks and extract potentially useful features. However, to the best of our knowledge, no studies including network features have yet proposed a generic way of representing network information. Instead, ad-hoc and dataset dependent solutions have been suggested. In this work, we build upon a recently presented method (node2vec) to obtain representations for nodes in observed network. The proposed approach is generic and applicable to any network and domain. Unlike node2vec, which assumes a static network, we consider a dynamic and time-evolving network. To account for this, we propose an approach that constructs the feature representation of each node by generating its node2vec representations at different timestamps, concatenating them and finally compressing using an auto-encoder-like method in order to retain reasonably long and informative feature vectors. We test the proposed method on churn prediction task in telco domain. To predict churners at timestamp ts+1, we construct training and testing datasets consisting of feature vectors from time intervals [t1, ts-1] and [t2, ts] respectively, and use traditional supervised classification models like SVM and Logistic Regression. Observed results show the effectiveness of proposed approach as compared to ad-hoc feature selection based approaches and static node2vec.

Keywords : churn prediction, dynamic networks, node2vec, auto-encoders
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