A novel clique relaxation formulation based on clustering coefficients to find cohesive subgroups in networks. In addition, I develop models for determining clustering coefficients corresponding induced subgraph. I consider two variations of the clustering coefficient, namely, the local and global.

I introduce a new clique relaxation, characterizing small subgroups in social network analysis. Clustering coefficient was introduced more recently as a structural feature in the best predictions come from electronic health records.

Furthermore, using this framework, I show that out of the more than 600 flu-related data sources some of the best predictions come from electronic medical health records. Specifically, I will describe a new forecasting algorithm that uses multiple data sources to timely and accurately predict the flu epidemic in the US. This hierarchical framework uses multi-linear regression to combine forecasts from multiple data sources and greedy optimization with forward-selection to sequentially choose the most predictive combinations of data sources. We show that the systematic integration of complementary data sources can substantially improve forecast accuracy over single data sources. Using multiple data sources, this method achieves 15% more accuracy than a baseline model that only uses one data source while forecasting the Center for Disease Control and Prevention (CDC) influenza-like-illness reports. Furthermore, using this framework, I show that out of the more than 600 flu-related data sources some of the best predictions come from electronic health records. Clique relaxations are used in classical models of cohesive subgroups in social network analysis. Clustering coefficient was introduced more recently as a structural feature characterizing small-world networks. Noting that cohesive subgroups tend to have high clustering coefficients, here I introduce a new clique relaxation, \(\alpha\)-cluster, defined by enforcing a lower bound on the clustering coefficient in the corresponding induced subgraph. I consider two variations of the clustering coefficient, namely, the local and global clustering coefficient. I analyze certain structural properties of \(\alpha\)-clusters and I develop mathematical optimization models for determining \(\alpha\)-clusters of the largest size in a network and apply these models to several real-life social networks. In addition, I develop a novel network clustering algorithm based on local \(\alpha\)-clusters.

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