

## Detecting Geographically Dispersed Overlay Communities Using Community Networks

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**Abstract :** Community detection is an extremely useful technique in understanding the structure and function of a social network. Louvain algorithm, which is based on Newman-Girman modularity optimization technique, is extensively used as a computationally efficient method extract the communities in social networks. It has been suggested that the nodes that are in close geographical proximity have a higher tendency of forming communities. Variants of the Newman-Girman modularity measure such as dist-modularity try to normalize the effect of geographical proximity to extract geographically dispersed communities, at the expense of losing the information about the geographically proximate communities. In this work, we propose a method to extract geographically dispersed communities while preserving the information about the geographically proximate communities, by analyzing the ‘community network’, where the centroids of communities would be considered as network nodes. We suggest that the inter-community link strengths, which are normalized over the community sizes, may be used to identify and extract the ‘overlay communities’. The overlay communities would have relatively higher link strengths, despite being relatively apart in their spatial distribution. We apply this method to the Gowalla online social network, which contains the geographical signatures of its users, and identify the overlay communities within it.

**Keywords :** social networks, community detection, modularity optimization, geographically dispersed communities

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