# Multiple Local Community Detection via High-Quality Seed Identification over Both Static and Dynamic Networks

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## 1 GOALS

- A survey of current progress in community detection through deep learning
- Structured into three broad research streams in this domain
  - Deep neural networks
  - Deep graph embedding
  - Graph neural networks

## 2 PRELIMINARIES

- Communities: From the perspective of **connectedness and density**, communities are known as locally dense connected subgraphs or clusters of nodes
- Deep Learning Advantages:
  - Ability to encode feature representations of **high-dimensional data**
  - Deep learning models can also **learn the pattern** of nodes, neighborhoods, and subgraphs
  - Deep learning is the superior choice for **unsupervised** learning tasks
  - **performance** improvements
  - the capacity to base detection on more and **richer features**;

## 3 CHALLENGES

- An Unknown Number of Communities:
  - [Bhatia and Rani, 2018] based on random walk-based personalized PageRank. However, this type of method cannot guarantee that every node in the network is assigned to a community
- Network Heterogeneity:
  - Network heterogeneity refers to networks that contain significantly different types of entities and relationships, which means the strategies used for homogeneous networks do not necessarily work.
- Large-scale Networks:
  - Today, large-scale networks can contain millions of nodes, edges, and structural patterns and can also be highly dynamic, as networks like Facebook and Twitter demonstrate.

## 4 PREVIOUS WORK / CITATIONS

- In **conventional machine learning**, detecting communities has generally been conceived as a **clustering problem on graphs**. But these approaches are highly dependent on the characteristics of the data
- Auto-Encoders:
  - Discovery that auto-encoders and spec-tral clustering have similar frameworks in terms of a low-dimensional approximation of the spectral matrix
  - [Bhatia and Rani, 2018]

        * A random walk-based personalized PageRank and fine-tunes the detection by optimizing the modularity of the community structure
        * To avoid the need to preset the number of communities, a layer-wise stacked auto-encoder can effectively find centers of communities based on the network structure
    - [Cao et al., 2018a]
        * Developed a graph regularized auto-encode
- GAN-based Approaches
    - fast-adjusting training precision
    - [Jia et al., 2019]
        * Argued that traditional graph clustering-based community detection methods cannot handle the dense overlapping of communities
        * CommunityGAN that jointly solves overlapping community detection and graph representation learning based on GANs
- Spatial GCN
    - Pairwise relations to avoid searching a sparse adjacency matrix
    - [Xie et al., 2018]
        * An unsupervised deep learning algorithm extracts the network features, which are then used to partition the network

## 5 CODE

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## 6 RESOURCES

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