Centrality metrics in graph node networks

Team 53

June 8, 2023

1 Motivation

Suppose you are to launch a product into the market. Who will you choose as the ambassador for your product such that the outreach of your product is maximum?

How to identify the source of a disease after the disease has spread to a substantially large scale?

Which parts of a huge construction site need special attention in terms of strength for optimal safety and structural integrity?

Centrality analysis of graphs plotted from respective datasets can answer not only the above questions but many other critical questions that drive decision making in industries.

2 Introduction

Suppose you are to launch a product into the market. Who will you choose as the ambassador for your product such that the outreach of your product is maximum?

Centrality measures are widely used in network analysis to quantify the importance or prominence of nodes within a graph. These measures help identify nodes that play crucial roles in the network structure and dynamics. Here are some commonly used centrality metrics for node networks.

How to identify the source of a disease after the disease has spread to a substantially large scale?

Which parts of a huge construction site need special attention in terms of strength for optimal safety and structural integrity?

Figure 1: This is a graph Analysis

3 Types of centrality

3.1 Degree Centrality:

It measures the number of direct connections a node has.

3.2 Closeness Centrality:

It measures how close a node is to all other nodes in the network.

3.3 Betweenness Centrality:

It quantifies the extent to which a node lies on the shortest paths between other nodes.

3.4 Eigenvector Centrality:

It assigns a relative score to each node based on its connections to other high-scoring nodes.

3.5 PageRank:

It is used for ranking web pages. It assigns a score to each node based on the number and quality of incoming links.

3.6 HITS (Hyperlink-Induced Topic Search):

It is also used for ranking web pages, focusing on both the authority and hubness of nodes.

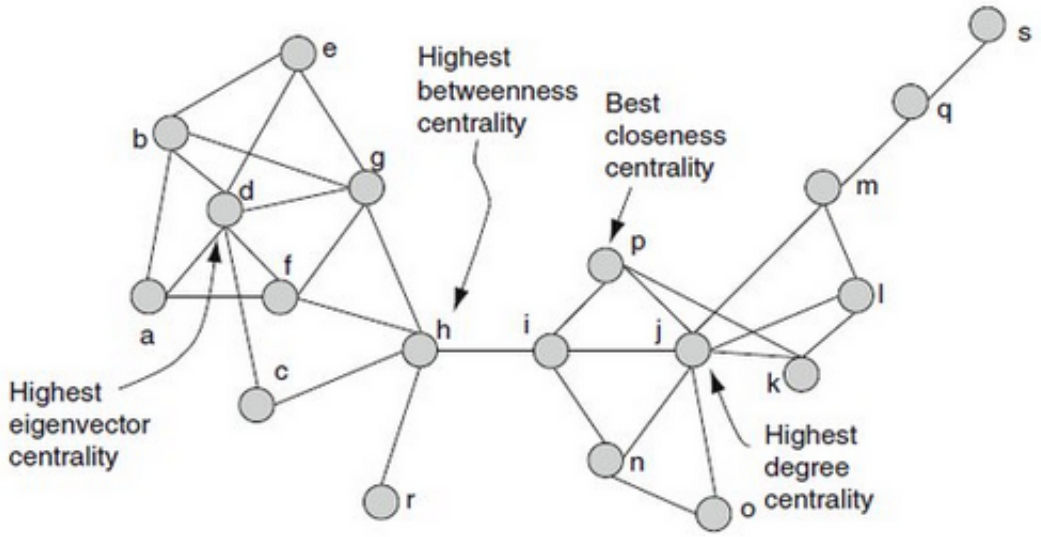

Figure 2: This figure shows different kinds of centrality

4 Contents

This project will include:

1. Role of Linear Algebra in centrality analysis
2. How can the data acquired from centrality analysis be used supported with examples
3. What are the techniques to compute centrality in a graph node network?
4. Compare the different techniques. Which one is best suited in various cases?
5. Real-life applications
6. Latest applications/SOTA
7. Code and demonstration of computations

5 Resources

The below are the links for references we used:

A Critical Review of Centrality Measures in Social Networks — SpringerLink

Applying Graph Centrality Metrics in Visual Analytics of Scientific Standard Datasets .

Assortativity Analysis of Real-World Network Graphs based on Centrality Metrics

Use Cases for Graph Databases and Graph Analytics

some refrences from coding ninja's

some refrences from geeks for geeks