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## An insight into topological, machine and Deep Learning-based approaches for influential node identification in social media networks: a systematic review

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## Abstract

Online social networks are social interaction platforms having dynamic nature with billions of users around the world. Online social communications among its multiple users cause a huge chunk of information which provides an opportunity to study the human behavior. In our day-to-day activities, we always ask for suggestions or advice from our friends, neighbors, or relatives to take any kind of decision. Similarly, in case of social networks, we are moved by the decisions of influential people. It is therefore vital to discover what amount of entities impacts each other because it is mainly used to regulate and coordinate rumors, viral marketing, ailments, and information diffusion. Numerous solutions already exist to determine prominent users. Traditional methods like structure-based methods (centrality-based techniques) examine the importance of a user in accordance to their position in the graph, and likewise user-interaction-based methods (machine learning-based methods) inspect the influence of a user by only considering features. Traditional approaches measure the relevance of nodes using either network topology or node attributes. However, for in-depth insights, both node characteristics and network topologies must be considered when evaluating the influencing relevance of nodes. Deep Learning models like Graph Convolution Networks paved the way to incorporate both Network topology and node characteristics in detection of influential users in a social network. In Deep Learning, Graph Convolution Networks are used which operate on Non-Euclidean data, as most of the data in real world are Non-Euclidean. Deep Learning approaches avoid dimensionality reduction and its feature extraction is multimodal, efficient as well as automatic as compared to traditional machine learning algorithms. In this paper, we have comprehensively discussed all prevalent traditional methods to identify influential users in online social networks and have listed the shortcomings that were solved by deep learning-based methods. The paper provides an in-depth comparative analysis between traditional and deep learning methods in identifying influential users.

**Keywords** Influential user  $\cdot$  Social networks  $\cdot$  Deep Learning  $\cdot$  Graph Convolution Networks (GCNs)  $\cdot$  Isolated communities  $\cdot$  Overlapped communities

## 1 Introduction

The introduction of social media platforms has altered the manner in which individuals interact, communicate, and share information on a global scale [9]. These platforms

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<sup>1</sup> Islamic University of Science and Technology, Kashmir, India have evolved into virtual communities that facilitate the rapid dissemination of information, ideas, and opinions, thereby having a profound effect on society, politics, business, and culture. Certain elements within these extensive networks play a crucial role in shaping information flow, user behavior, and network dynamics as a whole. Various applications, such as viral marketing, opinion manipulation, and social network analysis, now require that these influential nodes be identified and comprehended [9]. The top most Social media platforms among all are Pinterest, Facebook, Reddit, Quora, twitter, Instagram, LinkedIn and YouTube. In the Fig. 2 below is shown top most social media platforms used worldwide [23] (Figs. 1, 2).