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Convolutional neural networks for classifying central and peripheral nodes

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Identifying central and peripheral nodes within network science has gained significant attention due to its wide range of applications across physics, engineering, biology, and social science. For example, in social networks, central nodes often correspond to influential individuals who can affect information dissemination (1), while in biological networks, central nodes might represent critical proteins or genes essential for cellular functions. Over the years, numerous algorithms have been devised to address this task, utilizing centrality measures and statistical tools (2). In the past decade, artificial neural networks (ANNs) have ruled machine learning methodologies, demonstrating remarkable success in various domains. However, their application to graphs and networks remains relatively unexplored, with few notable success stories (3). This study introduces a novel ANN architecture based on convolutional neural networks, designed specifically for node classification, including the critical task of distinguishing between central and peripheral nodes. The proposed ANN was applied to classify nodes in the four major synthetic network models: Barabasi-Albert, Erdos-Renyi, Waxman, and Watts-Strogatz. Additionally, the ANN was tested on real-world networks, demonstrating its versatility and effectiveness.

Palavras-chave: Network science; Redes complexas; Pattern recognition.

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