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ORIGINAL ARTICLE

Sustainable signals: a heterogeneous graph neural framework for fake news detection

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Abstract Digital technology has increased the spread of fake news, leading to misconceptions, misunderstandings, and economic challenges. Researchers have developed automated techniques to identify false information using various data features, driven by advancements in AI. Most algorithms focus on signals from the news itself and its context, often ignoring user preferences. According to confirmation bias theory, individuals are more likely to spread false information that aligns with their beliefs. Users' historical and social activities, such as their postings, can help identify fake news and inform their news choices. However, there is limited research on incorporating user preferences in fake news detection. This study introduces a framework based on Graph Neural Networks (GNNs) and natural language models to capture signals from both graph and content perspectives, considering user preferences. We chose GNNs for their ability to model complex relationships in graph-structured data. Specifically, we used the Graph Attention Network due to its ability to weigh the importance of different nodes, enhancing the capture of relevant signals. The framework integrates user preferences by analyzing social activities and news choices. Experimental results on a real-world dataset show our model achieves an accuracy of 98%. Outperforming models that do even consider user preferences. These findings highlight the potential of leveraging user preferences to enhance fake news detection, offering a more robust approach to tackling information pollution.

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1 Introduction

Big data and information dissemination technology have rapidly changed Internet communication. Low cost, easy accessibility, and fast information dissemination characterize this transformation Khan and Chishti (2022); Malla and Amin (2023). More people now use social media and online portals for news than print media. Online platforms allow convenient access to news content. According to Pew Research Center, 73% of Americans & 33% of Indians get their news from social mediaCenter (2021). The lack of authoritative censorship lowers news quality compared to traditional methods. Factually inaccurate or exaggerated news articles are called "fake news". Fake news is intentionally created, unlike rumors, which are unverified and spread without the intent to deceive.

The digital landscape is filled with noise and disinformation, which threaten society's stability. False news leads to misleading decisions, opposition, and social fragmentation, undermining public trust and social order. Fake news spreads faster, further, and to a larger audience than the truth, implying a higher level of novelty. This has led to an "information epidemic" where false information spreads widely through social networks and media. Differentiating genuine from counterfeit information is challenging. To address the issue, a variety of technologies based on artificial intelligence comes at rescue. It actually consists of machine learning algorithms and Deep learning based technologies like computer vision, Natural natural language processing (NLP), apart from some advanced hetergeneous pre-training

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