Chapter 14
Enhancing Network Analysis Through Computational Intelligence in GANs

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ABSTRACT

In the discipline of allowsrative artificial intelligence, generative adversarial networks have become an effective tool that allow for the creation, modification, and synthesis of extremely realistic content in a variety of domains. This chapter focuses on applying computational intelligence techniques to improve network analysis in GANs. The authors examine the research on GANs' uses in radiology, emphasizing their potential for diagnosis and image enhancement in healthcare. Next, we investigate the application of computational intelligence techniques, like Wasserstein GANs and recurrent neural networks, to enhance training stability and produce higher-quality generated data. In order to increase the accuracy of the generated data even further, they also look into adding other features made with the Fourier transform and ARIMA. Trials show that the information produced by these upgraded GANs can be efficiently used for training energy forecasting models.

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INTRODUCTION

In modern interactive world, networks are becoming more and more important in a variety of areas, from infrastructure management and financial transactions to interpersonal interactions and communication systems. Nowadays, networks are extremely intricate, necessitating the use of advanced analytical techniques to identify patterns, deduce behaviors, and maximize performance. Amidst this intricacy, Generative Adversarial Networks (GANs) offer an exciting opportunity to improve network research via the computational intelligence perspective. Since their introduction by Goodfellow et al. in 2014, GANs have completely changed the field of machine learning by making it possible to use adversarial training to create realistic-looking synthetic data. In addition to being used in natural language processing and image generation, GANs have enormous promise for studying and comprehending network dynamics, behaviors, and structures.

The combination of GANs and network analysis presents new ways to tackle the problems caused by complex network dynamics and data. When working with massive, diverse, and dynamic network datasets, conventional network analysis approaches frequently run into problems. GANs are one of the computational intelligence techniques that offer an adaptable framework for collecting intricate patterns, modeling uncertainty, and adjusting to changing network settings. Researchers and practitioners can investigate new areas of network analysis, such as identifying anomalies, traffic prediction, community detection, and link prediction, between others, by utilizing the generative potential of GANs. Nevertheless, there are particular theoretical and technical difficulties when incorporating GANs into network analysis. Because networks are dynamic and GAN designs are inherently complicated, new approaches and algorithms that are customized to the unique properties of network data are required. Moreover, there is still work to be done to guarantee the scalability, interpretability, and resilience of GAN-based network analysis frameworks.

In order to improve our comprehension of intricate network phenomenon and speed up the creation of intelligent network management systems, we investigate the synergies between computational intelligence—represented by GANs—and network analysis in this research. We review the current literature, point out important areas for future research, and provide fresh ideas for utilizing GANs to improve network analysis techniques. We show the effectiveness and adaptability of GAN-based methods in tackling a variety of problems in various network domains through empirical assessments and case studies. We foresee an era where GAN-driven computational intelligence enables businesses and communities to fully utilize networked systems for the benefit of humankind by promoting interdisciplinary collaboration and creativity.

LITERATURE REVIEW

Artificial intelligence fields such as computer vision, natural language processing, and now network analysis have found great use for Generative Adversarial Networks (GANs). The utilization of GANs in the integration of computational intelligence presents innovative methods for comprehending, simulating, and enhancing the intricacies present in interconnected systems. Researchers examine the current research contributions, approaches, and applications that demonstrate how GANs can improve network analysis in the present overview of the literature.