

Chapter 15

Enhancing Privacy and Security in Online Education Using Generative Adversarial Networks

Gnanasankaran Natarajan

 <https://orcid.org/0000-0001-9486-6515>

Thiagarajar College, India

Elakkiya Elango

Government Arts College for Women, Sivagangai, India

Ahamed Labbe Hanees

South Eastern University of Sri Lanka, Sri Lanka

Shirley Chellathurai Pon Anna Bai

Karunya Institute of Technology and Sciences, India

ABSTRACT

As online education grows in popularity, issues concerning learners' privacy and security have become increasingly important. This chapter delves into the creative use of generative adversarial networks (GANs) to handle the complex difficulties of protecting sensitive information in the online education scene. The chapter opens with a detailed assessment of the present situation of online education. The chapter focuses on the integration of GANs into the online education environment to improve privacy and security. The chapter delves into the technical features of GANs, demonstrating how these networks may be tailored to generate synthetic yet indistinguishable data, reducing the danger of privacy violations. In addition to privacy protection, the chapter investigates the function of GANs in improving the overall cybersecurity posture of online education platforms. Finally, the chapter emphasises Generative Adversarial Networks' transformational potential in altering the privacy and security environment of online education.

DOI: 10.4018/979-8-3693-3597-0.ch015

A SHORT-TERM SUMMARY TO GENERATIVE ADVERSARIAL NETWORKS

Generative Adversarial Networks (GANs) are a new paradigm in artificial intelligence, providing a strong framework for producing realistic and high-quality synthetic data. Ian Goodfellow and his colleagues introduced GANs in 2014, and they *Generative Adversarial Networks, Online Education, Artificial Intelligence, Machine Learning, Privacy and Security*. have since become a cornerstone in a variety of disciplines, including computer vision, picture production, natural language processing, and others. This extensive introduction will look at the fundamental components, operating principles, applications, problems, and evolution of GANs.

Key Workings of GANs

- **Generator:** The generator is a neural network that creates synthetic data. It accepts random noise as input and converts it into data samples that ideally match the distribution of the real data.
- **Discriminator:** The discriminator, also known as a neural network, examines input data and determines whether it is real or artificial. It intends to increase its capacity to discern between actual and synthetic samples.
- **Adversarial Training:** GANs use a competitive training procedure in which both the generator and the discriminator are taught simultaneously. The generator aims to produce data that is indistinguishable from genuine data, whereas the discriminator aims to reliably discern between real and produced samples (Kaneko T, 2018).
- **Training Process:**

Minimax Game: GANs are designed as a minimax game, in which the generator seeks to reduce the likelihood of the discriminator correctly categorising produced samples while the discriminator aims to increase its accuracy.

Loss Functions: Binary cross-entropy loss functions are often used to assess the difference between the discriminator's anticipated and actual classification results.

Nash Equilibrium: The training converges to a Nash equilibrium, in which the generator creates data that is statistically indistinguishable from actual data and the discriminator is unable to consistently discriminate between them.

Applications of GANs

- **Image Synthesis:** GANs excel in producing realistic pictures, which leads to applications like photorealistic face synthesis, creative image production, and style transfer.
- **Image-to-Image Translation:** GANs may be used to convert pictures from one domain to another, such as satellite images into maps or black-and-white photos to colour.
- **Text-to-Image Synthesis:** GANs have been used to produce pictures from textual descriptions, indicating their usefulness in multimodal data synthesis.
- **Super-Resolution:** GANs help to improve picture resolution, which is important for applications like as medical imaging and surveillance.

23 more pages are available in the full version of this document, which may be purchased using the "Add to Cart" button on the publisher's webpage:

www.igi-global.com/chapter/enhancing-privacy-and-security-in-online-education-using-generative-adversarial-networks/347469

Related Content

Evaluation of Organizational E-Government Readiness in the Public Sector

Ibrahim A. Alghamdi, Robert Goodwin and Giselle Rampersad (2015). *Public Affairs and Administration: Concepts, Methodologies, Tools, and Applications* (pp. 1629-1650).

www.irma-international.org/chapter/evaluation-of-organizational-e-government-readiness-in-the-public-sector/127928

Public-Private Partnerships as a Way of Financing and Supporting Utility Companies

Pavlina Stojanova and Lence Petreska (2023). *Transformation and Efficiency Enhancement of Public Utilities Systems: Multidimensional Aspects and Perspectives* (pp. 241-271).

www.irma-international.org/chapter/public-private-partnerships-as-a-way-of-financing-and-supporting-utility-companies/325691

Policy Narratives in Formation of Comprehensive Support System for Parenting and Child Care in Japan

Mutsuko Takahashi (2018). *International Journal of Public and Private Perspectives on Healthcare, Culture, and the Environment* (pp. 22-32).

www.irma-international.org/article/policy-narratives-in-formation-of-comprehensive-support-system-for-parenting-and-child-care-in-japan/196628

Web 2.0: Harnessing Democracy's Potential

Pedro Isaías, Sara Pífano and Paula Miranda (2012). *Public Service, Governance and Web 2.0 Technologies: Future Trends in Social Media* (pp. 223-236).

www.irma-international.org/chapter/web-harnessing-democracy-potential/61861

Environmental Disclosure as a Tool for Public Sector Legitimacy: A Twitter Intelligence Approach

Enrique Bonsón, David Perea and Michaela Bednárová (2020). *International Journal of Public Administration in the Digital Age* (pp. 1-31).

www.irma-international.org/article/environmental-disclosure-as-a-tool-for-public-sector-legitimacy/264239