


# Chapter 12

## Digital Watermarking Using Machine Learning and Artificial Intelligence: Methodologies, Challenges, and Future Directions

**Nidhi Singh**

 <https://orcid.org/0009-0002-3262-8022>

*Teerthanker Mahaveer University, India*

**Preeti Rani**

 <https://orcid.org/0000-0001-5655-975X>

*Teerthanker Mahaveer University, India*

**Smriti Sachan**

*G.L. Bajaj Institute of Technology and Management, India*

**Satya Prakash Yadav**

 <https://orcid.org/0000-0002-2634-5600>

*Department of Computer Science and Engineering, Madan Mohan Malaviya  
University of Technology, Gorakhpur, UP, India*

**Mohammed Al-Farouni**

*The Islamic University, Iraq*

### ABSTRACT

*Digital watermarking has emerged as a major method for protecting multimedia content through copyright protection, authentication, and tamper detection. While conventional watermarking methods are useful, they often struggle to strike a bal-*

DOI: 10.4018/979-8-3373-3785-2.ch012

*ance between impermeability, robustness, and capacity, particularly in the face of signal processing attacks. As smart algorithms and data-driven methods have evolved, watermarking systems have become more adaptive and secure. The latest algorithms make it easier to embed watermarks in various media types and to enhance resistance to compression, noise, and rotation or scaling using powerful computational tools. This chapter provides an overview of digital watermarking, focusing on classical and computational models, upcoming challenges, and prominent applications. Secondly, it discusses upcoming directions aiming at developing cross-domain, secure and privacy-compliant watermarking solutions to meet the requirements of an evolving digital and smart world.*

## **1 INTRODUCTION**

Multimedia community finds many possibilities to work and connect with others because artificial intelligence (AI), machine learning (ML), the Internet of Things (IOT), robotics, and cyber-physical systems and intelligent devices become more and more ubiquitous. Research groups are also undertaking the digital images in order to develop the use of multimedia data/ image (Yang 2020). The watermarking design can form intelligent and powerful framework due to the capability of the machine learning to learn and adapt the characteristics of data to recognize complex patterns (Cox et al. 1997). With physical transmission media, internet and networking technologies have evolved a great deal, and this makes replication, alteration, reproduction and transmission of multimedia contents very easy. Besides being able to communicate, process and store data at low costs, the content ought to be of good quality. To protect digital information from evolving hacker threats, multiple data hiding techniques have been proposed, including steganography, digital watermarking and cryptography. In addition to communicating, processing, and storing data at low costs, the content is likely to be of high quality. Watermarking an image involves integrating watermark data into it. A watermark is an encoded digital signal that is easily identifiable and can be extracted by algorithms so it can remain invisible to human vision. Watermarking images using the traditional paradigm is summarised succinctly in Figure 1.

22 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/digital-watermarking-using-machine-learning-and-artificial-intelligence/388665](http://www.igi-global.com/chapter/digital-watermarking-using-machine-learning-and-artificial-intelligence/388665)

## Related Content

---

### Improving Virtual Machine Migration Effects in Cloud Computing Environments Using Depth First Inspired Opportunity Exploration

Kamal Kumar and Jyoti Thaman (2022). *International Journal of Cloud Applications and Computing* (pp. 1-22).

[www.irma-international.org/article/improving-virtual-machine-migration-effects-in-cloud-computing-environments-using-depth-first-inspired-opportunity-exploration/314209](http://www.irma-international.org/article/improving-virtual-machine-migration-effects-in-cloud-computing-environments-using-depth-first-inspired-opportunity-exploration/314209)

### Artificial Intelligence of Things for Smart Healthcare Development: An Experimental Review

Jennyfer Susan M. B., P. Subashini and M. Krishnaveni (2023). *Handbook of Research on Deep Learning Techniques for Cloud-Based Industrial IoT* (pp. 29-60).

[www.irma-international.org/chapter/artificial-intelligence-of-things-for-smart-healthcare-development/325934](http://www.irma-international.org/chapter/artificial-intelligence-of-things-for-smart-healthcare-development/325934)

### Towards a Better Understanding of Ubiquitous Cloud Computing

Hamed Vahdat-Nejad, Shaghayegh Ostadi Eilaki and Shaghayegh Izadpanah (2018). *International Journal of Cloud Applications and Computing* (pp. 1-20).

[www.irma-international.org/article/towards-a-better-understanding-of-ubiquitous-cloud-computing/196189](http://www.irma-international.org/article/towards-a-better-understanding-of-ubiquitous-cloud-computing/196189)

### Blockchain Based Sensitive Attribute Storage and Access Monitoring in Banking System

M. Sumathi and S. Sangeetha (2020). *International Journal of Cloud Applications and Computing* (pp. 77-92).

[www.irma-international.org/article/blockchain-based-sensitive-attribute-storage-and-access-monitoring-in-banking-system/249163](http://www.irma-international.org/article/blockchain-based-sensitive-attribute-storage-and-access-monitoring-in-banking-system/249163)

### A Resource Prediction Engine for Efficient Multimedia Services Provision

Yiannos Kryftis, George Mastorakis, Constandinos X. Mavromoustakis, Jordi Mongay Batalla, Athina Bourdena and Evangelos Pallis (2015). *Resource Management of Mobile Cloud Computing Networks and Environments* (pp. 361-380).

[www.irma-international.org/chapter/a-resource-prediction-engine-for-efficient-multimedia-services-provision/125972](http://www.irma-international.org/chapter/a-resource-prediction-engine-for-efficient-multimedia-services-provision/125972)