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-

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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.