Abstract

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Image Encryption and Watermarking Combined Dynamic Chaotic Hopping Pattern with Double Random Phase Encoding DRPE

In modern civilization information, security is a crucial problem. Image encryption and watermarking can effectively protect information from unauthorized access. This paper introduces a new vigorous optical image encryption and watermarking technique. This technique depends on a novel dynamic delay chaotic hopping pattern (DDCHP) combined with double random phase encoding (DRPE). To get a robust watermark image, the plain image is first watermarked with a binary secret message using a new chaotic hopping pattern (CHP) and then encrypted using a DRPE system that is controlled by double random independent keys generated with double DDCHP. In this cryptosystem, three different chaotic maps are used to enlarge the key space of the proposed cryptosystem against brute-force attack and overcome the linearity and vulnerable of the classical DRPE. The system keys are hypersensitive and their initial parameters are Selected carefully. Security scrutiny proves the efficiency of the suggested cryptosystem. Therefore, the obtained simulation results prove that the cryptosystem is robust enough against the known attacks, such as statistical attack (uniform histograms of different encrypted images, correlation coefficients between the plain and the encrypted image is as low as 5.46 ×10-6), differential attack (99.99% NPCR and 38.6% UACI), brute force attack (large enough key space), and entropy attack. Moreover, the robustness of the watermark (secret message) is proved due to the solidity of CHP. The proposed approach can be used in different implementations like secure military communications, e-finance, e-healthcare, authenticated multimedia broadcasting, etc.