Cosine-transform-based chaotic system for image encryption

By
Hua, ZY (Hua, Zhongyun) [1]; Zhou, YC (Zhou, Yicong) [2]; Huang, HJ (Huang, Hejiao) [1]

Source
INFORMATION SCIENCES
Volume: 480 Page: 403-419
DOI: 10.1016/j.ins.2018.12.048

Published
APR 2019

Abstract
Chaos is known as a natural candidate for cryptography applications owing to its properties such as unpredictability and initial state sensitivity. However, certain chaos-based cryptosystems have been proven to exhibit various security defects because their used chaotic maps do not have complex dynamical behaviors. To address this problem, this paper introduces a cosine-transform-based chaotic system (CTBCS). Using two chaotic maps as seed maps, the CTBCS can produce chaotic maps with complex dynamical behaviors. For illustration, we produce three chaotic maps using the CTBCS and analyze their chaos complexity. Using one of the generated chaotic maps, we further propose an image encryption scheme. The encryption scheme uses high-efficiency scrambling to separate adjacent pixels and employs random order substitution to spread a small change in the plain-image to all pixels of the cipher-image. The performance evaluation demonstrates that the chaotic maps generated by the CTBCS exhibit substantially more complicated chaotic behaviors than the existing ones. The simulation results indicate the reliability of the proposed image encryption scheme. Moreover, the security analysis demonstrates that the proposed image encryption scheme provides a higher level of security than several advanced image encryption schemes. (C) 2018 The Authors. Published by Elsevier Inc.

Keywords
Author Keywords: Chaotic system; Chaos-based encryption; Cryptography; Image privacy; Image encryption; Security analysis
Keywords Plus: ALGORITHM; COMPRESSION; DESIGN; SECURE; MAP

Author Information
Corresponding Address: Hua, Zhongyun (corresponding author)

Addresses:
1 Harbin Inst Technol, Sch Comp Sci & Technol, Shenzhen 518055, Peoples R China
2 Univ Macau, Dept Comp & Informat Sci, Macau 999078, Peoples R China

E-mail Addresses: huazyum@gmail.com; yicongzhou@um.edu.mo; huanghejiao@hit.edu.cn

Categories/Classification
Research Areas: Computer Science

Web of Science Categories
Computer Science, Information Systems