Abstract

During last few years, many soft computing techniques have been employed for image watermarking. These are more into delving the issue of optimization of visual quality of signed images and robustness of the embedding algorithm. The used techniques either operate in adaptive or learning mode, especially those using Artificial Neural Networks or in non adaptive analytical mode such as ones based on Fuzzy logic. Several researchers have also worked on this problem using hybrid and evolutionary algorithms. This research survey especially deals with the image watermarking techniques which rely on adaptive soft computing techniques. The results of gradient descent based Back propagation Network (BPN algorithm, Radial Basis Function Neural Network (RBFNN algorithm and a newly developed Single Layer Feed forward Neural Network (SLFN algorithm commonly known as Extreme Learning Machine (ELM) used to carry out watermarking in uncompressed grayscale images are compared. These techniques are compared for different images and the comparison is based on the visual quality of signed images, the watermark detector response coefficients such as similarity correlation and normalized correlation parameters and the robustness studies. Time complexity issue is also examined to establish the use of watermarking process on a real time scale. It is concluded that the ELM algorithm gives a reasonable generalized behavior in terms of computation of these parameters as compared to its other counterparts. It's fast training in milliseconds
and subsequent embedding and extraction makes it suitable for developing watermarking application on a real time scale.

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**Index Terms**

Computer Science  
Security

**Keywords**

BPN  
Radial Basis Function Neural Network  
ELM