Performance of Levenberg-Marquardt Backpropagation for Full Reference Hybrid Image Quality Metrics

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***Abstract*—Image quality analysis is to study the quality of images and develop methods to efficiently and swiftly determine the quality of images. It is an important process especially in this digital age whereby transmission, compression and conversion are compulsory. Therefore, this paper proposed a hybrid method to determine the image quality by using Levenberg-Marquardt Back-Propagation Neural Network (LMBNN). Three known quality metrics were combined as the input element to the network. A proper set of network properties was chosen to represent this element and was trained using Levenberg-Marquardt algorithm (*trainlm*) in MATLAB. From the preliminary simulation, a promising output result was obtained indicated by good performance metrics results and good regression fitting.**

***Index Terms*—**Image Quality Metrics, Levenberg-Marquardt, Neural Network, hybrid

I. INTRODUCTION

Image quality analysis is the science of analyzing and comparing the characteristics and features of an image with reference to the original image of predetermined/preset standards. Image quality analysis measures should be employed to determine the usability of images after they have undergone any kind of manipulation, for example, compression, transmission or conversion. Therefore, studying the various approaches to image quality analysis will provide information on method of image quality assessment that can be efficiently employed under any circumstances.

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Method of image quality assessment can be classified into subjective and objective methods. The subjective method requires the use of human discretion to decide the level of the image's quality [1-2]. This method is subject to bias in the form of the tester's taste and preferences. However, the result of the subjective analysis is very often a trusted method as it is only natural for people to judge with their own eyes. The demerit of subjective assessment is that it is time and labour consuming. The objective method is unbiased and automated therefore it provides a result that is faithful to all assigned parameters [1-2]. The demerit of objective assessment is that it may not be reliable.

Most of digital image analysis processes trying to simulate the human visual cortex as the human eye remains a very superior judge of image quality. For example, if the computer saying the image is of a good quality but a human saying it is of a bad quality, the image will most likely be scrapped. Therefore, the computer's reliability and accuracy will be considered low if there is a poor correlation between its results and the human eye's judgment.

Depending on the existence of reference images, there are three categories of objective image quality metrics (IQMs); full-reference (FR), reduced reference (RR) and non reference (NR) [3-5]. These IQMs are developed based on color appearance, blur assessment, wavelet, pixels comparison, hue saturation and many others. Among the available image quality metrics, the widely known metrics are Peak Signal-to-Noise Ratio (PSNR), Mean Squared Error (MSE) and Structural Similarity (SSIM) [6-7].

The objective of this paper is to investigate the potential of combining multiple metrics with artificial neural network (ANN) in order to achieve image quality score that similar to human visual measure. Another objective is to evaluate the performance of LMBP as a hybrid IQM. To achieve these objectives, a number of objective assessments was conducted and compared to a corresponding subjective assessment. Afterward, this measurement data were combined and used as the input vectors to Levenberg-Marquardt Back-propagation network.

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