A review of wave-net identical learning & filling-in in a decomposition space of (JPG-JPEG) sampled images

Alaa Khamees Al-Azzawi · M. Iqbal Saripan · Adznan Jantan · Rahmita Wirza O. K. Rahmat

Published online: 19 August 2010
© Springer Science+Business Media B.V. 2010

Abstract Continuous flow to send images via encrypted wireless channels may reduce the efficiency of transmission. This is due to the damage or loss of the numerous macro-blocks from these images. Therefore, it is difficult to rebuild these patches from the point of reception. Many algorithms have been proposed in the past decade, particularly error concealment (EC) algorithms. In this paper, we focus on the algorithms that have high efficiency to fill-in the corrupted patches. On the other hand, we also present a new way of detecting the horizontal and vertical gradients especially, in the un-smooth patches. This improves the edge detector filter. Ultimately, a novel scheme for vertical and horizontal interpolation between the corrupted pixels and the non-corrupted adjacent pixels is achieved by improving the efficiency of filling-in. We used a new technique known as the wave-net model. This model combines the wavelet with the neural network classifier (NNC). The neural network was trained in advance to reduce the error extent for the pixels that may occur in the error. The experimental results were convincing and close to the desired. The proposed method is able to enhance image quality in term of both visual perception and the blurriness effects (BE).

Keywords Error concealment (EC) · Blurry effects (BE) · Sampled images (SI) · Neural network classifier (NNC)
1 Introduction

Algorithms that have been suggested to fill-in the regions with available information from their surrounding neighbors is very important topic in the processing of digital images, especially applications which including image encoding and wireless image transmission (e.g., reconstructing missing blocks), especial influences (e.g., removal of objects), and image restoration (e.g., scratch removal) Bertalmio et al. (2003a).

Many interpolation based spatial EC schemes have been proposed in the past 10 years Park and Lee (1999). They do work better than traditional spatial EC methods Hsia (2004). However, most of them are time-consuming and complex. Therefore, a simple way is presented to coarsely predict the possible edge in the lost area. Subsequently, an adaptive directional interpolation is applied to refine the edge Suh and Ho (1997), which mainly doing the interpolation of the pixels on the estimated direction or the fixed direction, NURBS interpolation Park and Lee (1999), and block matching interpolation Hsia (2004) for consecutive blocks loss pattern. Arafiotis et al. (2006), proposed a novel switching algorithm which uses the directional entropy of neighboring edges chooses between two interpolation methods, a directional along detected edges or a bilinear using the nearest neighboring pixels. Meanwhile, a spatial error concealment method that uses edge-related information in order not only to preserve existing edges but also to avoid introducing new strong ones by switching to a smooth approximation of missing information where necessary. Hsia (2004), developed a new error concealment technique based on edge-oriented interpolation for still image or intra-frame correction. The first step involves finding the edge direction of a lost block by using one-dimensional matching techniques from two boundaries of neighboring blocks. Then, the error pixels are recovered by weighting linear interpolation along the estimated edge direction. Afterwards, the median filter is used to recover residual damaged-pixels.

Song et al. (2007), proposed an adaptive pixel interpolation technique is presented for spatial error concealment. This interpolation technique recovers the missing pixel in a corrupted block by interpolating the pixel prediction values with different weights, including the predictions derived from available neighbor regions of the corrupted block and the average pixel value of the pixels in a $3 \times 3$ slide window centered at the missing pixel.

A new technique called wavelet networks combines wavelet theory decomposition and the computational neural network software. In this paper, we review the wave-net 3-level “Haar” decomposition and applying the adaptation techniques based on the LMS algorithms. The partaken techniques to reconstruct missing blocks are grouped under Automatic Retransmission Query protocols (ARQ). The decomposing reconstruction pragmatism can introduce substantially an aliasing distortion. The problem has been studied in many papers and solved by the use of quadrature mirror filters (QMFs) Smith and Barnwell (1986), or conjugate quadrature filters (CQFs) (Smith and Barnwell 1986; Skodras et al. 2001).

In partaken wireless scenarios; the image is transmitted over the wireless channel block by block. Due to severe fading out, all the image blocks might be lost. The packet loss medial rate in a wireless ambiance is 3.6% and occurs in a segmented rigs Chang (1998). For compression encoded video bit streams, there were many attempt abilities to hiding missing data. Many approaches of error concealment have been assumed that both the encoding and decoding happen instantaneously Wada (1989). The decoder communicating to the encoder the location of destroyed image blocks, theses with high practical executing programs techniques are not realistic with real time applications since they require retransmission of data blocks. Preference approaches to block wastage concealment have been proposed (Ghanbari and Sferidis 1993; Pancha and El Zarki 1994).