
IBFDS: Intelligent bone fracture detection system

Kamil Dimililer*

*Electrical and Electronic Engineering Department, Faculty of Engineering, Near East University, Nicosia, North Cyprus, Mersin 10 Turkey

Abstract

Rapidly developing technologies are emerging every day in different fields, especially in medical environment. However, still some old techniques are quite popular, efficient and effective in this manner. X-Rays are one of these techniques for detection of bone fractures. Nevertheless, sometimes the size of fractures is not significant and could not be detected easily. Therefore, effective and intelligent systems should be designed. This paper aims to develop an intelligent classification system that would be capable of detecting and classifying the bone fractures. The developed system comprises of two principal stages. In the first stage, the images of the fractures are processed using different image processing techniques in order to detect their location and shapes and the next stage is the classification phase, where a backpropagation neural network is trained and then tested on processed images. Experimentally, the system was tested on different bone fracture images and the results show high efficiency and a classification rate.

© 2018 The Authors. Published by Elsevier B.V.
Peer-review under responsibility of the scientific committee of the 9th International Conference on Theory and Application of Soft Computing, Computing with Words and Perception.

Keywords: Intelligent system; wavelet transform; scale invariant feature transforms; backpropagation neural networks; bone fractures.

1. Introduction

Image processing techniques have been used frequently in various medical fields. Wavelet transform is one of the applications used in the field of medical image processing, Dimililer (2012). This application is important in the medical field because the reduction in file size allows more images to be stored in each amount of disk or memory space. For such tasks, image processing techniques were used with the aid of artificial intelligence tools such as back propagation neural network in order to achieve the optimum and most accurate results, Dimililer (2013).

* Corresponding author. Tel.: +9 (0392) 444 0 983 / 380; Fax: +9 (0392) 223 64 61.
E-mail address: kamil.dimililer@neu.edu.tr
In their research, Sheikh et. al. (2017) were to present a secured digital data compression and modulation for robust data transmission in terms of voice. The main objective was to achieve higher data rates, lower bit error rate, and less utilization of the bandwidth. The performance of the proposed technique is compared with an already existing technique for data transmission over voice channel, Sheikh et al. (2017). Additionally, A Rotational Haar Wavelet Transform (RHWT) method is developed to characterize the fabric of particulate assemblies from two-dimensional images. A Maximum Energy Ratio $\Psi$ reveals the fabric direction and its intensity, Zhang and Hryciv (2017).

In any kind of picture, there are different numbers of elements that can be categorized as “feature” portrayal of that picture. There are various techniques and methods that separate and record these elements. Filter image highlights give an arrangement of the elements, Lowe (2004). In order to highlight pictures, another highly acclaimed Scale invariant feature transform (SIFT) algorithm is preferred to take a picture and changes it into a vast accumulation of neighborhood vectors, Lowe (2004). Scaling, pivot or interpretation of the images is accepted as invariance for these vectors. SIFT suggests multiple number of components for primate vision. In order to extract these components a separating approach is applied.

The developed system is designed to detect bone fractures. This can be accomplished by utilizing diverse image processing methods and techniques examined in fractured regions. Thus, any supplied images are processed, and then a fracture should be detected on the original image, using one of the highly acclaimed Wavelet transform algorithm. The proposed system uses bone fracture images obtained from the orthopedics and traumatology service of general hospital in Northern Cyprus, FGH (2013).

2. Related Works

2.1. Wavelet Transforms

Wavelets are a mathematical tool for hierarchically decomposing functions. Image compression using Wavelet Transforms is a powerful method that is preferred by scientists to get the compressed images at higher compression ratios and PSNR values, Dimililer and Kavalcioğlu (2011), Khashman and Dimililer (2008). Image processing and image analysis based on the continuous or discrete image transforms are classical techniques. The image transforms are widely used in image filtering, data description, etc. More than two decades, the wavelet theorems make up very popular methods of image processing, denoising and compression. Considering that The Haar functions are the simplest wavelets, these forms are used in many methods of discrete image transforms and processing.

Digital images need large amount of memory to store and, when retrieved from the Internet, can take a considerable amount of time to download. The Haar wavelet transform provides a method of compressing digital image data so that it takes up less memory, Dimililer and Kavalcioğlu (2011). The Haar wavelet operates on data by calculating the sums and differences of adjacent elements, that is first on horizontal elements and then on vertical elements, Khashman and Dimililer (2008). Previous works using Haar image compression include the application to adaptive data hiding for the images dividing the original image into $8 \times 8$ sub-blocks and reconstructing the images after compression with good quality, Lai and Chang (2006).

2.2. Scale-Invariant Feature Transform (SIFT) Algorithm

Scale invariant feature transform algorithm (SIFT) is another technique for feature extraction, Lowe (2014). In this algorithm, statistics of gradient directions of image intensities are used. These intensities are accumulated in image structures of each interest point. The descriptor is used to match relevant interest points between different images, Lowe (2014), Lowe (2011). In other words, the SIFT is a technique in computer vision for detecting and illustrating the local features in images, Hua et al (2017). Nevertheless, the SIFT algorithm can extract feature points with high invariance that are resilient to several issues like rotation, compression, and scaling, Hua et al (2017). Many researchers used this algorithm as a feature extractor in combination with intelligent classifiers such as neural network. The algorithm showed great efficiency in extracting the right distinguished features. For example, in their work, Zhang et. al. (2017), adopts SIFT algorithm to extract the key points of the images and performs the rough matching process, and calculates the appropriate mathematical mapping model between two images and according to the mapping.
دریافت فوری

امکان دانلود نسخه تمام متن مقالات انگلیسی
امکان دانلود نسخه ترجمه شده مقالات
پذیرش سفارش ترجمه تخصصی
امکان جستجو در آرشیو جامعی از صدها مطلب و هزاران مقاله
امکان دانلود رایگان ۲ صفحه اول هر مقاله
امکان پرداخت اینترنتی با کلیه کارت های عضو شتاب
دانلود فوری مقاله پس از پرداخت آنلاین
پشتیبانی کامل خرید با بهره مندی از سیستم هوشمند رهگیری سفارشات