Bone Fracture Detection System using Image processing

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Abstract - *Medical image segmentation, as an application of image segmentation, is to extract anatomical structures from medical images. Existing methods for medical image segmentation are reviewed and so proposed methods like anisotropic discrete dual-tree wavelet transform (ADDTWT) to characterize the anisotropy of bone texture. More specifically, a way to increase the standard discrete dual-tree wavelet transform (DDTWT) by using the anisotropic basis functions related to the hyperbolic wavelet transform rather than isotropic spectrum supports. A texture classification framework is proposed supported support vector machine. Key Words: (Size 10 & Bold) Key word1, Key word2, Key word3, etc. (Minimum 5 to 8 key words)…*

1. INTRODUCTION

There are 700,000 of rheumatoid arthritis (RA) patients in Japan, and therefore the number of patients is increased by 30,000annually. The RA damages joints, the joint destruction and joint deformity causes the pain, and reduces the joint function. The prognosis is improved by early treatment, but it's necessary to accurately evaluate the degree of RA progression and to require appropriate treatment. The hand or foot X-ray images are used for the RA diagnosis. The modified Total Sharp (mTS) score evaluates the erosion and joint space narrowing (JSN) on 32 hand joints and 12 foot joints. The 5 grades of abrasion score and 4 grades of JSN score are manually given for every joint by ortho-paedicians. The RA progression is calculated by the sum of the calculated scores.

However, X-ray images should be taken several times a year for correct assessment, and also the mTS score measurement takes huge labor and is time-consuming method because there are many evaluation points and it's difficult to convey the score. Also, the mTSscore is subjective because it is scored manually by orthopaedicians. Thus, it requires an automatic mTS score calculation system supported X-ray image analysis. The fully automated mTS score calculation system requires an automatic finger joint detection method. Ref. [2] proposes a deep learning based finger joint detection method. it's applied to children whose finger joint is growing, and can't be applied RA patients directly. Other method is predicated on X-ray image intensity difference within the joint space [3]. It cannot analyze severe RA patients because their collapsed finger joint has no joint space. The mTS score evaluates the erosion score and JSN score for every finger joints. Ref. [3] automatically estimates the JSN score of the mild RA patient.

The method cannot evaluate the JSN score of severe RA patient whose joint doesn't have enough joint space. Previously, we proposed a totally automated finger joint detection method and mTS score estimation method for the mild-to-severe RA patients using hand X-ray image [4].However, the performance of the tactic has not been evaluated sufficiently..

This paper aims to judge the performance of a totally automated finger joint detection and mTS score estimation method. Additionally, we investigate a clear stage of improving the performance by artificially rotating and gamma correction of the training image. We also evaluate details of estimated scores, and total mTS within the sake of clinical application.

2. RELATED WORKS

O. Abuzaghleh et al[1], designed a true time image analysis system to help within the melanoma prevention and early detection which proposes an innovative and fully functional smart-phone based application to help in melanoma early detection and prevention. The applying has two major components; the primary component could be a real-time tuned in to help users prevent skin burn caused by sunlight; a completely unique equation to compute the time for skin to burn is thereby introduced. The second component is an automatic image analysis module which contains image acquisition, hair detection and exclusion, lesion segmentation, feature extraction, and classification. The proposed system exploits PH2 Dermoscopy image database from Pedro Hispano Hospital for development and testing purposes. The image database contains a complete of 200 dermoscopy images of lesions, including normal, atypical, and melanoma cases.The experimental results show that the proposed system is efficient, achieving classification of the conventional, a typical and melanoma images with accuracy of 96.3%, 95.7% and 97.5%, respectively

R. P. Braun et al[2], designed Global distributions of UV-absorbing aerosols are obtained using measured differences between the 340 and therefore the 380 nm radiances from the Nimbus 7 Total Ozone Mapping Spectrometer (TOMS) for the years 1979-1993. Statistic are shown for major sources of biomass burning and desert dust giving the frequency of occurrence and areal coverage over land and oceans. Minor sources of UV-absorbing aerosols within the atmosphere are discussed (volcanic ash and oil fires). Relative values of year-to-year variability of UV-absorbing aerosol amounts are shown for major aerosol source regions: (1) central South America (Brazil) near 10°S latitude; (2) Africa near 0°-20°S and 0° to 10°N latitude; (3) Saharan Desert and sub-Saharan region (Sahel), Arabian Peninsula, and therefore the northern border region of India; (4) agricultural burning in Indonesia, Eastern China, and Indochina, and near the mouth of the Amazon River; and (5) coal burning and mud in northeastern China he first three of those regions dominate the injection of UV-absorbing aerosols into the atmosphere annually and canopy areas far outside of their source regions from advection of UV-absorbing particulates by atmospheric wind systems. During the height months, smoke and mud from these sources are transported at altitudes above 1 km with an optical depth of a minimum of 0.1 and may cover about 10% of the Earth's surface. physical phenomenon absorbing aerosols aren't readily seen by TOMS because the tiny amount of underlying Rayleigh scattering ends up in alittle signal. Significant portions of the observed dust originate from agricultural regions frequently within arid areas, like within the Sahel region of Africa, especially from the dry lake-bed near Chad (13.5°N, 14°E), and intermittently dry drainage areas and streams. Additionally to drought cycle effects, this implies there could also be an anthropogenic component to the quantity of dust injected into the atmosphere annually. Detection of absorbing aerosols and calculation of optical depths are littered with the presence of large-scale and subpixel clouds within the TOMS field of view.

C. Doukas et al[3], proposed algorithm includes two steps: firstly, light and dark hairs and ruler marking are segmented through adaptive canny edge detector and refinement by morphological operators. Secondly, the hairs are repaired supported multi-resolution coherence transport in painting. The algorithm was applied to 50 dermoscopy images. To estimate the accuracy of the proposed hair detection algorithm, measure was performed using TDR, FPR, and DA metrics. Moreover, to judge the performance of the proposed hair repaired algorithm, three statistical metrics namely entropy, variance, and co-occurrence matrix were used. thanks to air bubbles and non uniform lighting conditions during image acquisition step, dermoscopic image can have non-uniform background moreover as low contrast. To cut back the effect of above factors, several enhancement techniques are often utilized in to boost the low contrast of the image and for removing artifacts.

A. Karargyris et al[4], designed Accurate segmentation and repair of hair-occluded information from dermoscopy images are challenging tasks for computer-aided detection (CAD) of melanoma. Currently, many hair-restoration algorithms are developed, but most of those fail to spot hairs accurately and their removal technique is slow and disturbs the lesion's pattern. During this article, a completely unique hair-restoration algorithm is presented, which contains a capability to preserve the skin lesion features like color and texture and ready to segment both dark and lightweight hairs. Our algorithm is predicated on three major steps: the rough hairs are segmented employing a matched filtering with derived function of gaussian (MF-FDOG) with thresholding that generate strong responses for both dark and lightweight hairs, refinement of hairs by morphological edge-based techniques, which are repaired through a quick marching inpainting method. Diagnostic accuracy (DA) and texture-quality measure (TQM) metrics are utilized supported dermatologist-drawn manual hair masks that were used as a ground truth to guage the performance of the system. The hair-restoration algorithm is tested on 100 dermoscopy images.

C. Massone et al[5], proposed a conveyable library for melanoma detection on handheld devices, for automated detection of melanoma termed SkinScan that may be used on smartphones and other handheld devices. Compared to desktop computers, embedded processors have limited processing speed, memory, and power, but they need the advantage of portability and low cost. During this study we explored the feasibility of running a complicated application for automated carcinoma detection on an Apple iPhone 4. Our results demonstrate that the proposed library with the advanced image processing and analysis algorithms has excellent performance on handheld and desktop computers. Therefore, deployment of smartphones as screening devices for carcinoma and other skin diseases can have a big impact on health provision in underserved and remote areas In this paper system presented the SkinScan© library, which implements several image processing and image analysis algorithms for melanoma detection, and evaluated whether these algorithm can run on processors used on smartphone devices, which usually have lower computing power and memory. The library is written in C/C++ and it's therefore like minded for Apple iOS-based devices (iPhone, iPad, and iPod Touch) yet as Android-based devices. However, during this paper we tested only an iPhone 4 implementation.

Pragati Rajendra et al[6], designed The artifacts removal step in dermoscopic images mainly focuses on hair removal. The foremost interfering factor that degrades the image quality is hair pixels. Most dermoscopic images have hair covering lesion. These segments of hair which are darker than lesionas well as skin, can cause wrong segmentation results. So hair removal step is extremely important. Variety of methodshave been developed for hair removal on dermoscopic images. A number of them use mathematical morphology methods, Flemming has applied curvi linear structure detection with different parameters; Zhou have enhanced Flemming method by introducing an in painting based method approach. Dull Razor software performs dark thick hair removal dermoscopic image can have non-uniform background still as low contrast. To scale back the effect of above factors, several enhancement techniques may be employed in to boost the low contrast of the image and for removing artifacts.

M. Rademaker et al[7], designed, digital monitoring by whole body photography and sequential digital dermoscopy detects thinner melanomas, The value of digital epiluminescence microscopy (DELM) for the long-term follow-up of atypical nevi. Patients (n=530) were prospectively categorized into defined melanoma risk groups and followed by clinical and epiluminescence microscopy (ELM) examinations. Atypical nevi (n=7001) were additionally followed by DELM. During follow-up (median 32.2 months), we detected 53 melanomas among 637 excised lesions (8.3% overall chance of success). The prospect of success for melanoma detection among lesions suspicious by ELM criteria was increased to 17% when additional DELM-documented changes were present. Moreover, 18 of the 53 melanomas were exclusively identified by DELM-documented changes, indicating that DELM increased the sensitivity of the ELM analysis by identifying additional melanomas. However, for lesions exclusively excised because of DELM changes, the prospect of success was under for ELM (5.2 vs 11.8%). Excisions because of mere DELM changes detected 66.7% of melanomas in familial atypical mole and multiple melanoma (FAMMM) and 32.5% of melanomas in atypical mole syndrome (AMS) patients. We conclude that DELM could be a valuable tool for the long-term follow-up of atypical nevi, especially within the high-risk groups of FAMMM and AMS patients. Randomized controlled trials are needed to validate the information from this run. Melanomas detected by self-referred, whole-body photography with sequential digital dermoscopy service are thinner than melanomas detected by traditional diagnostic methods. It remains to be determined whether earlier diagnosis ends up in improved survival.

S. Suer et al[8], launched an improved border detection in dermoscopy images for density based clustering, Dermoscopy is one amongst the foremost imaging modalities employed in the diagnosis of melanoma and other pigmented skin lesions. In current practice, dermatologists determine lesion area by manually drawing lesion borders. Therefore, automated assessment tools for dermoscopy images became a very important research field mainly due to inter- and intra-observer variations in human interpretation. One in every of the foremost important steps in dermoscopy image analysis is automated detection of lesion borders. To our knowledge, in our 2010 study we achieved one in every of the best accuracy rates within the automated lesion border detection field by using modified density based clustering algorithm. Within the previous study, we proposed a unique method which removes redundant computations in well-known spatial density based clustering algorithm, DBSCAN; thus, successively it races clustering process considerably.

3. PROPOSED SYSTEM

The fracture can occur in any bone of our body like wrist, ankle, hip, rib, leg, chest etc. The Fracture cannot detect easily by the naked eye, so it is seen in the x-ray images. This Paper represents the fracture detection of the bone x-ray images by using the segmentation based on the digital image processing method, using the anisotropic discrete dual-tree wavelet transform (ADDTWT) and morphological for segmentation in the medical imaging system. An efficient algorithm is proposed for bone feature based on pattern extraction and classification based on the multi SVM classifier. Experimental results on 90 RApatients' hand X-ray images showed that the proposed method detected finger joints with accuracy of 91.8%, and estimated the erosion and JSN score with accuracy of 53.3% and 60.8%, respectively. Fine segmentation will be achieved by this method. The classification mismatches will be avoided and achieve high performances in classification.

4. MATERIALS AND METHODS

The stages used in the proposed detection algorithm are image pre-processing, image segmentation, feature extraction, classification and estimation. The details for the methods used in each stage are explained on the following sections.

A. Image Acquisition:

The first stage of our automated skin lesion analysis system is image acquisition. This stage is crucial for the remainder of the system; hence, if the image isn't acquired satisfactorily, then the remaining components of the system might not be achievable, or the results won't be reasonable, even with the help of some style of image enhancement. In order to capture top quality images, the iPhone 5S camera is employed, equipped with 8 megapixels and 1.5 pixels

B. Preprocessing:

Image Resize:

When scaling a vector graphic image, the graphic primitives that conjure the image may be scaled using geometric transformations, with no loss of image quality. When scaling a raster graphics image, a replacement image with the next or lower number of pixels must be generated. Within the case of decreasing the pixel number (scaling down) this usually ends up in a visual quality loss. From the standpoint of digital signal processing, the scaling of raster graphics may be a two-dimensional example of sample rate conversion, the conversion of a discrete signal from a rate (in this case the local sampling rate) to a different.

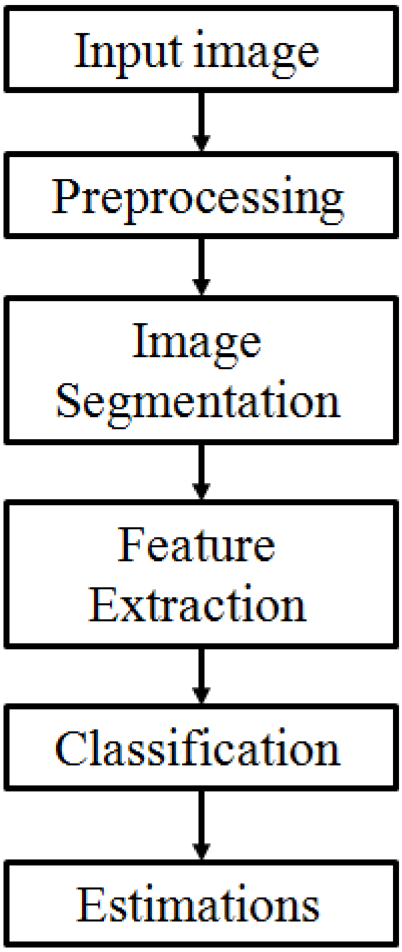

Fig.1 Phases of feature detection method

C. Segmentation:

This paper deals with a replacement anisotropic discrete dual-tree wavelet transform (ADDTWT) to characterize the anisotropy of bone texture. More specifically, we propose to increase the traditional discrete dual-tree wavelet transform (DDTWT) by using the anisotropic basis functions related to the hyperbolic wavelet transform rather than isotropic spectrum supports. A texture classification framework is adopted to assess the performance of the proposed transform…

D. KFCM:

Fuzzy c-means (FCM) is one of the most promising fuzzy clustering methods. Although this Fuzzy C Means is well accepted clustering method it is unsuccessful for large spherical cluster. The main idea of this FCM is to alter perfectly the input data into a higher dimensional feature space, and then it will increases the possibility of linear seperability of the patterns in the feature space, then perform FCM in the feature space. The FCM also determines the number of clusters in the dataset which is another good quality of FCM.

E. Feature extraction:

A pattern consists of multiple instances of a feature. Select a pattern type and define dimensions, placement points, or a fill area and shape to place the pattern members. The result of the operation is a feature pattern.

F. Classification:

In machine learning, support-vector machines (SVMs, also support-vector networks) are supervised learning models with associated learning algorithms that analyze data used for classification and regression analysis. An SVM model is a representation of the examples as points in space, mapped so that the examples of the separate categories are divided by a clear gap that is as wide as possible.

G. Estimations:

Sensitivity and specificity are statistical measures of the performance of a binary classification test, also known in statistics as classification function

5. RESULTS AND DISCUSSIONS

The proposed system detects the bone fractures by getting an input image. An image is a rectangular array of values (pixels). Each pixel represents the measurement of some property of a scene measured over a finite area. The property could be many things, but we usually measure either the average brightness (one value) or the bright nesses of the image filtered through red, green and blue filters (three values). The values are normally represented by an eight bit integer, giving a range of 256 levels of brightness.

Fig.2 input image

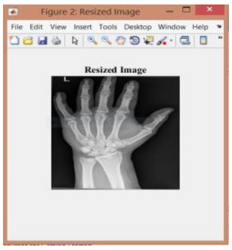

Fig.3 Resized image

Fig.4 Filtered Image

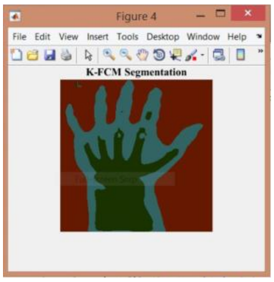

Fig.5 k-fcm segmentation

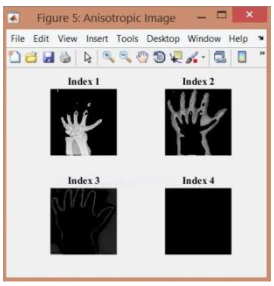

Fig.6 ANISOTROPIC IMAGE

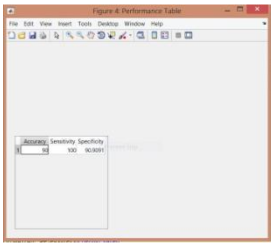

Fig.7 ACCURACY

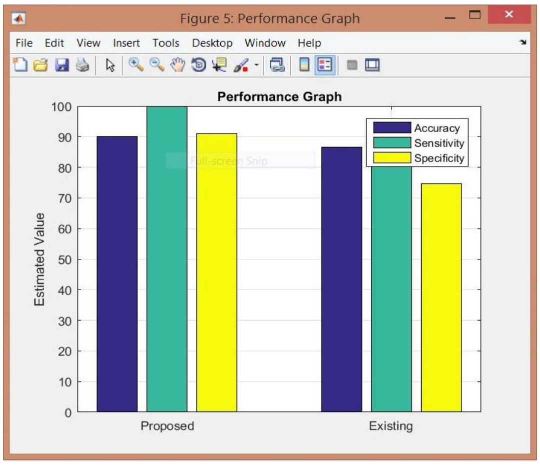

Fig.8 PERFORMANCE TABLE

6. CONCLUSION

In this paper, the proposed system has two components. The first component is a real-time alert to help the users to prevent skin burn caused by sunlight. A novel equation to compute the time-to-skin-burn was introduced in this component. The second component is an automated image analysis module where the user will be able to capture the images of skin moles and this image processing module classifies under which category the moles fall into; benign, atypical, or melanoma. An alert will be provided to the user to seek medical help if the mole belongs to the atypical or melanoma category. The proposed automated image analysis process included image acquisition, hair detection and exclusion, lesion segmentation, feature extraction, and classification. The proposed system used a state of the art for the dermoscopy image acquisition, which ensures capturing sharp dermoscopy images with a fixed distance to the skin and consistent picture quality. The image processing technique is introduced to detect and exclude the hair from the dermoscopy images, preparing it for further segmentation and analysis, resulting in satisfactory classification results. This system proposes an automated segmentation algorithm and novel features. It is able to classify the dermoscopy images into benign, atypical and melanoma with high accuracy.

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