STUDY OF Malignancy detection using image processing

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***Abstract*: Recently, image processing techniques are widely used in several medical areas for image improvement in earlier detection and treatment stages, where the time factor is very important to discover the abnormality issues in target images, especially in various cancers such as lung cancer, skin cancer, blood cancer etc.**
The research is divided into three different objectives. The first objective is to acquire quality images of skin and develop and evaluate computer vision methods (algorithms / program) to process, analyse and interpret for skin cancer medical images for skin cancer assessment. The proposed algorithm is based colour information and threshold. For the proposed algorithm, several colour spaces will be studied to compare the detection results.
The second objective is a multi-resolution based Lung malignancy detection method to detect the cancer affected area from the collection of CT images (normal and abnormal).

The another objective of the research proposal focuses on malignancy detection for leukemia blood cancer. Leukemia is a type of blood cancer involving white blood cells. It is a bone marrow disorder that arises when abnormal white blood cell begins to continuously replicate itself.

1. INTRODUCTION

Cancer is one of the biggest threats to human beings and is the second leading cause of death the entire world human [1]. According to the statistical data from WHO(World Health Organization) [2], cancer caused about 7.6 million people death worldwide in 2008, and it is predicted that the number of deaths caused by cancer is being increased and the number will possibly increase to 13.1 million in 2030 [2]. Based on related research, cancer will become the leading death in next 20 years [3].
Lungs cancer ranked fourth in the number of deaths related with cancer. In most cases Lung cancer does not show any symptoms in the initial stages. It is often suspected initially from chest x-ray or Computed Tomography (CT) scans done to evaluate a cough or chest pain. This research proposed a multi-resolution based Lung parenchyma segmentation method to segment the lung lobes at accuracy levels acceptable for clinical applications.
At the moment, identification of blood disorders is through visual inspection of microscopic images
of blood cells. Leukemia is a type of blood cancer, and if it is detected late, it will result in death. Leukemia occurs when a lot of abnormal white blood cells produced by bone marrow. The existence of abnormal blood can be detected when the blood sample is taken and examined by haematologists. Microscopic images will be inspected visually by haematologists and the process is time consuming and tiring. In order to know all information about blood, expensive testing and equipment of labs are required. Automatic image processing system is urgently needed and can overcome related constraints in visual inspection. The system to be developed will be based on microscopic images to recognize types of leukemia. The early and fast identification of the leukemia type greatly aids in providing the appropriate treatment for particular type of leukemia.

2. PROBLEM STATEMENT

Overview

- The aim of malignancy detection from skin is to investigate new boundary extraction algorithms. The proposed algorithm is based colour information and thresholding. In the proposed algorithm, the key problem is how to select colour space and threshold. I propose to compare different colour spaces and find the best one. For threshold selection, a distance histogram based algorithm can achieve much better performance than traditional thresholding algorithm.
- The malignancy detection from lungs proposes a noble multi-resolution based lung parenchyma segmentation method to segment the lung lobes at accuracy levels acceptable for clinical applications. The methodology proposes multi-resolution analysis technique. In this research proposal, the image quality and accuracy of detecting the cancer affected area are the key factors.
- The research for malignancy detection from blood involves detecting the types of leukemia (blast WBC) using microscopic blood sample images.

With these research questions as a basis, the single thesis statement for this work would be: “to investigate the integration of advanced imaging methods (various color spaces, classifiers and segmentation methods) into computer aided diagnosis (CAD) of

skin, lung and blood cancers to provide medical experts an automated and accurate method to diagnose skin, lung and blood cancer from images. ”

- The first goal consists of the acquisition of image information from patient skin synchronously with position and orientation.
- Classification of various cancer types with high accuracy based on the labelling provided by expert.
- Substantially important objective is to model the of visual perception of medical experts considering various cancer image dataset such as lung, skin and leukemia.
- The final Objective is the performance comparison among different state of the art models for computer-aided diagnosis system in skin, lungs and blood cancer classification / identification

3. BACKGROUND AND SIGNIFICANCE

- Currently the diagnosis of skin cancer is done mainly by a human, who is called dermatologist. During diagnosis, dermatologist exams the skin carefully by his eyes or using a device called dermascope. During this stage, dermatologists generally use “ABCD” rule to find the signs of skin cancer [4]. ABCD means Asymmetry, Borders (irregular), Colour (variegated), and Diameter (greater than 6mm) of a skin patch [4]. In order to improve the diagnosis rate, computer aided skin cancer detection techniques have been investigated to aid the dermatologists for skin cancer detection. The basic idea of computer-aided detection (CAD) is to use imaging technique, image processing technique, and pattern recognition technique to detect the suspected skin patches. It is used generally as the second opinion to a dermatologist. In this proposal I mainly study the key technique used in CAD system for skin cancer detection.

a. An approach based only on colour features is important as much of the state of the art considers colour information combined with other features, such as texture, shape and structure. This research proposal focuses only on colour information

b. This work considers various colour spaces obtained by the conventional RGB format. An extraction of features is performed in each of the colour spaces in order to conclude which colour space achieves better results in the classification process.

- Lung cancer is the most dangerous and widespread cancer in the world according to stage of discovery of the cancer cells in the lungs, so the process of early detection of the disease plays a very important and essential role to avoid serious advanced stages to reduce its percentage of distribution.
- In current practice for malignancy detection in blood, a haematologist uses a microscope to detect blast cells. Given the similarities shared by leukemia cell’s subtypes it is often difficult to distinguish between them. The haematologist performs cytogenetic analysis which can be a time-consuming process, usually lasting around five days. It is also physically tiring, causing suffering to the eyes and back. So, the development of a fully automated screening system prototype for blood cell segmentation and classification may provide the specialist with significant aid in the effort to detect and classify Leukemia cells more effectively and efficiently.

4. RESEARCH DESIGN AND METHODOLOGY

1. Malignancy Detection : Skin

My skin malignancy system consists of three main stages which are shown in Figure 1. In the first stage, noise reduction technology is used to remove the noise and hairs in the skin cancer image; In the second stage, the colour image is converted into a colour space and adaptive colour model is constructed; In the third stage, colour information and distance histogram are used to extract the border of the lesions from the skin cancer image.

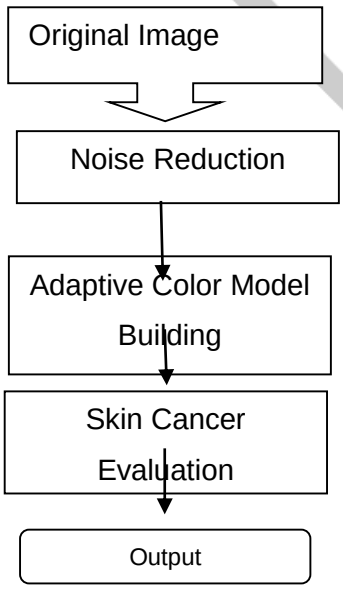

Figure 1: System Architecture

2. **Malignancy Detection : Lung**

This research proposed a multi-resolution based Lung parenchyma segmentation method to segment the lung lobes at accuracy levels acceptable for clinical applications

In this research proposal, to obtain more accurate results we divide our work into the following three stages:

1. Image Enhancement stage: to make the image better and enhance it from noising, corruption or interference. The following various methods proposed for this purpose are Gabor filter, Auto enhancement algorithm, and FFT Fast Fourier Transform.

2. Image Segmentation stage: to divide and segment the enhanced images, various segmentations approaches will be tested

3. Features Extraction stage: to obtain the general features of the enhanced segmented image using Binarization and Masking Approach.

3. **Malignancy Detection : Blood Leukemia**

The system we propose firstly individuates in the blood image the leucocytes from the others blood cells, then it extract the lymphocyte cells (the ones interested by acute leukemia), it extracts morphological indexes from those cells and finally it classifies the presence of the leukemia.

The main modules which compose the overall system are plotted in Figure 2.

- **The Single-cell Selector module** firstly enhances the input image and identifies the single cells. It has been composed by adaptive pre filtering and segmentation algorithms.
- **S**econdly, the **White-cells Identifier** module selects the white cells present into the image by separating them from others blood's components (red cells and platelets).
- The third module (the **Lymphocyte Identifier**) can recognize a lymphocyte with respect to the other selected white cells.

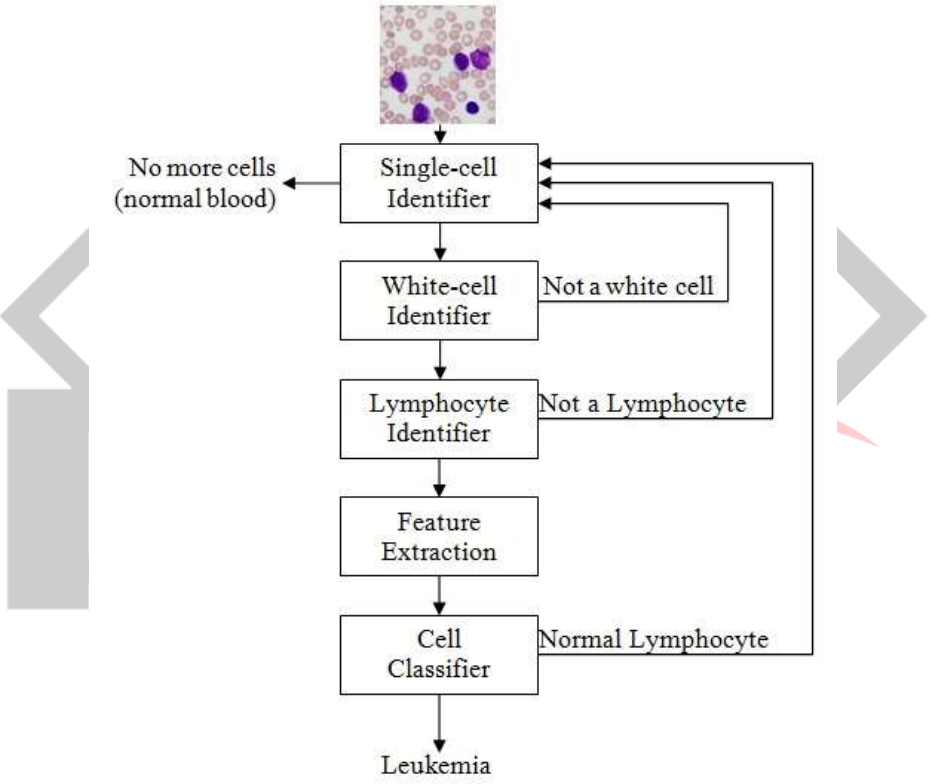

Figure 2. The leukemia detection system.

- **The Feature Extraction module** processes a sub-image containing a lymphocyte coming from the Lymphocyte Identifier module and it produces in output a set of morphological indexes.
- **The classification module** processes those indexes in order to classify the cell as blast or normal. If the system finds a blast cell, the blast cell counter is increased; otherwise a new lymphocyte will be processed.

5. WEAKNESSESS OF THE STUDY

- In some cases, the lesion in the dermatoscopic images is covered by hairs for skin cancer images. These hairs, especially the dark thick ones with a similar color hue to the lesion, occlude the lesion and may mislead the segmentation process.
- The system for lung malignancy detection deals with CT images, we can implement this technique on some more images. Increasing the number of images used for the process, can improve the accuracy. Also MRI, X ray, PET images can be

considered for this technique. Comparison can be done for all these images. So one can justify which types of images gives better result for lung cancer detection

REFERENCES

1. Cancer Research UK, "Cancer Worldwide – the global picture", http://www.cancerresearchuk.org/cancer-info/cancerstats/world/the-global-pi cture/, Sept. 2012.
2. World Health Organization, http://www.who.int/en/.
3. Science Daily, "Cancer Projected To Become Leading Cause Of Death Worldwide In 2010", http://www.sciencedaily.com/releases/2008/12/081209111516.htm, Dec 2008.
4. Sun Protection and Products Guide, "Learning the ABCDE rule for skin cancer can save your life!", http://www.sun-protection-and-products-guide.com/ABCDE-rule-for-skin-ca50 ncer.html.
5. Shobana Rajendran, University of Malaya, "Image Retrieval techniques, Analysis and Interpretation for Leukemia data sets", IEEE 2011 12th ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing
6. Thorsten Zerfa, Erik Hlmeyer, Timo Schlarb, and Matthias Elter, "Segmentation of leukocyte cells in bone marrow smears", IEEE 2010 IEEE International Symposium on Multimedia
7. Wei-Liang Tai, Rouh-Mei Hu2, Han C.W. Hsia, Rong-Ming Chen, and Jeffrey J. P. Tsa, "Blood Cell Image Classification Based on Hierarchical SVM", 2011 IEEE International Symposium on Multimedia
8. Evangelia Minga, Athanasios Gkoufas, Anna Vardi, Evangelia Stalika, Anastasia Hadzidimitriou, "Towards an Integrated Framework for Clinico-Biological Data Management and Analysis: the Case of Chronic Lymphocytic Leukemia", 978-1-4799-3163-7/13/$31.00 ©2013 IEEE
9. Athina Tsanousa, Lefteris Angelis, "A Structural Equation Modeling Approach of the Toll-like Receptor Signaling Pathway in Chronic Lymphocytic Leukemia", 2013 24th International Workshop on Database and Expert Systems Applications
10. Konstantinos Bromis, Irene S. Karanasiou, George Matsopoulos, "Resting state and task related fMRI in small cell lung cancer patients", 978-1-4799-3163-7/13/$31.00 ©2013 IEE
11. Tadashi Kondo, Junji Ueno, "Hybrid Multi-layered GMDH-type Neural Network using Principal Component-Regression Analysis and Its Application to Medical Image Diagnosis of Lung Cancer", 2012 ASE/IEEE International Conference on BioMedical Computing
12. *Anita chaudhary, Sonit Sukhraj Singh,* "LUNG CANCER DETECTION ON CT IMAGES BY USING IMAGE PROCESSING", 2012 IEEE International Conference on Computing Sciences
13. Jingjing Pan, Meiqi Shi, Jifeng Feng, "Effects of erlotinib after acquiredresistance to gefitinib in advanced non-small-cell lung cancer", 2012 International Conference on Biomedical Engineering and Biotechnology
14. Konstantinos Bromis, Irene S. Karanasiou, "Resting state and task related fMRI in small cell lung cancer patients", 978-1-4799-3163-7/13/$31.00 ©2013 IEEE
15. Duaa H. AlSaeed, Ali El-Zaart, Ahmed Bouridane, "Minimum Cross Entropy Thresholding Using Entropy-Li Based on Log-normal Distributionfor Skin Cancer Images", IEEE 2011 Seventh International Conference on Signal Image Technology & Internet-Based Systems
16. Yefen Wu, Fengying Xie, Zhiguo Jiang," Automatic skin lesion segmentation based on supervised learning", IEEE 2013 Seventh International Conference on Image and Graphics
17. Alexandros Karargyris, Orestis Karargyris," DERMA/care: An advanced image-processing mobile application for monitoring skin cancer", 2012 IEEE 24th International Conference on Tools with Artificial Intelligence
18. Xavier Chadwick, Lois J. Loescher, "Mobile Medical Applications for Melanoma Risk Assessment: False Assurance or Valuable Tool?", IEEE 2014 47th Hawaii International Conference on System Science
19. Ho Tak Lau, Adel Al-Jumaily, "Automatically Early Detection of Skin cancer: Study Based on Nueral Netwok Classification", IEEE 2009 International Conference of Soft Computing and Pattern Recognition