SKIN CANCER DETECTION SYSTEM

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A thesis submitted in fulfillment of the
requirement for the award of the degree of
Bachelor of Computer Science

Faculty of Systems Computer & Software Engineering
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April, 2010

ABSTRAK

Skin Cancer Detection System (SCDC) is pengesanan tertutup untuk mengesan kanser kulit dari kulit manusia. Skin Cancer Detection System menggunakan Matlab sebagai landasan untuk memproses dan mengenali kanser kulit. Objektif utama projek ini adalah untuk membangunkan prototaip sistem pengesanan kanser kulit untuk menganalisa melanoma dalam tahap awal dan melaksanakan pemprosesan imej untuk membuat suatu sistem yang dapat mengenali gejala-gejala kanser kulit. Skin Cancer Detection System (SCDS) berguna kepada bagi doktor untuk memeriksa pesakit dengan menggunakan masa yang singkat untuk mengetahui hasilnya.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

In skin health, diagnosis or diagnostics is the process of identifying a skin texture or problem by its signs, symptoms and the result of various diagnosis procedures. The conclusion reached through this process is called a diagnosis. The diagnosis system is a system that can be used to analyze any problem by answering some questions that lead to a solution to the problem.

Skin cancer is a malignant tumor that grows in the skin cells and accounts for more than 50 percent of all cancers. In the US alone, more than 1 million Americans will be diagnosed in 2007 with non melanoma skin cancer, and 59,940 will be diagnosed with melanoma, according to the American Cancer Society. Fortunately, skin cancers (basal cell and squamous cell carcinoma, and malignant melanoma) are rare in children. When melanomas occur, they usually arise from pigmented nevi (moles) that are large (diameter greater than 6 mm), asymmetric, with irregular borders and coloration. Bleeding, itching, and a mass under the skin are other signs of cancerous change. If a child has had radiation treatment for cancer, nevi in the radiated area are at increased risk of becoming cancerous.

Skin Cancer Detection System (SCDS) is the system to identify and recognize skin cancer symptoms and diagnose melanoma in early stages. The user can take early prevention of their healthy. Skin Cancer Detection System (SCDS) will help save lots of doctor's time and could help to diagnose more accurate. It also can easily assess the future development of skin via dialysis today's age of the skin and put forward the best characteristic skin cancer project to client.

1.1 Problem Statement

The current problem that always happened is the peoples do not know several things about their skin care. The peoples only know their problem from their naked eye but the actually happen in their skin is more serious from that.

Doctor's diagnosis is reliable, but this procedure takes lots of time, efforts. These routines can be automated. It could save lots of doctor's time and could help to diagnose more accurate. Besides using computerized means there are good opportunity to store information with diagnostic information in order to use it for further investigations or creation of new methods of diagnosis. It is only a few minutes that the patients can wait without doing anything until images and other patient's information are all inputted at the store and the analysis results are outputted. Investigations shows, that early diagnosis is more than 90% curable and late is less than 50%[13].

1.2 Objective

The objectives of this project are:

i. To develop a prototype of skin cancer detection system for diagnoses melanoma in early stages.
ii. To implement image processing to make a system that can recognize skin cancer symptoms.
iii. To help patients to prevent the melanoma in early stage.

1.3 Scope

The scopes of the project:

i. User
   a. Who is responsible about healthy like doctor.
   b. Only diagnosis a skin that have the melanoma symptoms.

ii. Technology
   a. MATLAB R2009a – is used to analyze the image to recognize the melanoma in early stages

iii. System function
   a. Perform to identify the symptoms of melanoma
   b. Offline detection system by using skin images
   c. Only diagnosis a skin that have the melanoma symptoms.

1.4 Thesis Organization

This thesis consists of 6 Chapters ranging from Chapter1 until Chapter6. Chapter1 gives an overview of the study conducted. Chapter1 has comprised of the introduction of skin cancer detection system which gives a brief idea on what is a skin cancer and diagnosis is about. It also supply with the problem statement, objective and the scope of the study. Meanwhile, Chapter2 reviews the previous research works that was conducted by other researches. All the relevant technical paper, journals, and books taken from those researches will be discussed in detail. Chapter3 reveals the techniques and the algorithms that will be used in performing this study. The best method and techniques used for this system is described in detail. One of the software processes is chosen as methodology. Implementation of process that is involved during development of this system is explained in detail in Chapter4. The result that obtained from the implementation of the system is discussed thoroughly in Chapter5. The constraints of this project are also stated clearly in Chapter5. The last chapter is consisting of the conclusion. The summary on the overall system is can be found here.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction to Skin Cancer

Skin cancer is the most common of all human cancers. Some form of skin cancer is diagnosed in more than 1 million people in the United States each year.

Cancer occurs when normal cells undergo a transformation during which they grow and multiply without normal controls.

i. As the cells multiply, they form a mass called a tumor. Tumors of the skin are often referred to as lesions.
ii. Tumors are cancerous only if they are malignant. This means that they encroach on and invade neighboring tissues because of their uncontrolled growth.
iii. Tumors may also travel to remote organs via the bloodstream or lymphatic system.
iv. This process of invading and spreading to other organs is called metastasis.

v. Tumors overwhelm surrounding tissues by invading their space and taking the oxygen and nutrients they need to survive and function[14].

Skin cancers are of three major types: basal cell carcinoma (BCC), squamous cell carcinoma (SCC), and melanoma.

i. The vast majority of skin cancers are BCCs or SCCs. While malignant, these are unlikely to spread to other parts of the body. They may be locally disfiguring if not treated early.

ii. A small but significant number of skin cancers are malignant melanomas. Malignant melanoma is a highly aggressive cancer that tends to spread to other parts of the body. These cancers may be fatal if not treated early.

Like many cancers, skin cancers start as precancerous lesions. These precancerous lesions are changes in skin that are not cancer but could become cancer over time. Medical professionals often refer to these changes as dysplasia. Some specific dysplastic changes that occur in skin are as follows:

i. Actinic keratosis is a patch of red or brown, scaly, rough skin, which can develop into squamous cell carcinoma.

ii. A nevus is a mole, and dysplastic nevi are abnormal moles. These can develop into melanoma over time[14].

Moles (nevi) are simply growths on the skin. They are very common. Very few moles become cancer.

i. Most people have 10-40 moles on their body.

ii. Moles can be flat or raised; some begin as flat and become raised over time.

iii. The surface is usually smooth.

iv. Moles are round or oval and no larger than ¼-inch across.

v. Moles are usually pink, tan, brown, or the same color as the skin. Other colors are sometimes noted.

vi. An individual's moles usually look pretty much alike. A mole that looks different from the others should be examined by your health-care provider.

Dysplastic nevi are not cancer, but they can become cancer.

i. People with dysplastic nevi often have a lot of them, perhaps as many as 100 or more.

ii. People with many dysplastic nevi are more likely to develop melanoma, either within an existing nevus or on an area of normal skin.

iii. Dysplastic nevi are usually irregular in shape, with notched or fading borders.

iv. Dysplastic nevi may be flat or raised, and the surface may be smooth or rough ("pebbly").

v. Dysplastic nevi are often large, ¼-inch across or even larger.

vi. Dysplastic nevi are typically of mixed color, including pink, red, tan, and brown.

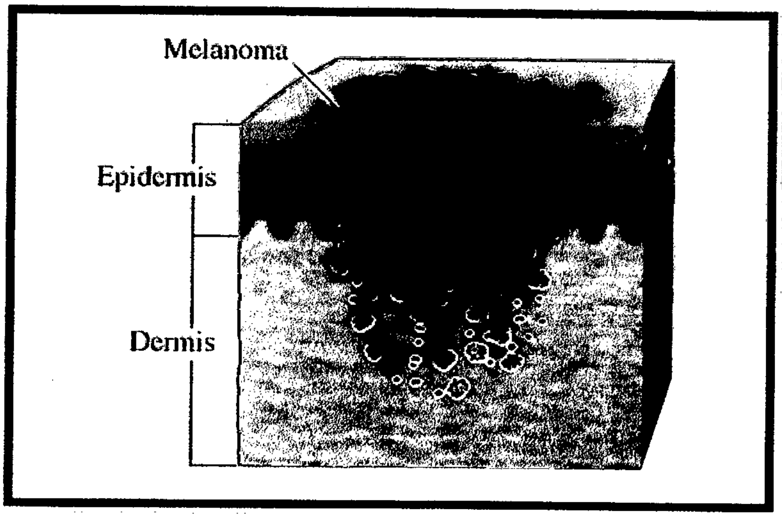

Figure 2.1 Structure of Skin Cancer.

2.1 Introduction to Skin detection

Skin detection is the process of finding skin-colored pixels and regions in an image or a video. This process is typically used as a preprocessing step to find regions that potentially have human faces and limbs in images. Several computer vision approaches have been developed for skin detection. A skin detector typically transforms a given pixel into an appropriate color space and then uses a skin classifier to label the pixel whether it is a skin or a non-skin pixel. A skin classifier defines a decision boundary of the skin color class in the color space based on a training database of skin-colored pixels. Skin color and textures are important cues that people use consciously or unconsciously to infer variety of culture-related aspects about each other. Skin color and texture can be an indication of race, health, age, wealth and beauty.

Skin detection means detecting image pixels and regions that contain skin-tone color. Detecting skin-colored pixels, although seems a straightforward easy task, has proven quite challenging for many reasons. The appearance of skin in an image depends on the illumination conditions (illumination geometry and color) where the image was captured. The important challenge in skin detection is to represent the color in a way that is invariant or at least insensitive to changes in illumination. The choice of the color space affects greatly the performance of any skin detector and its sensitivity to change in illumination conditions. Another challenge comes from the fact that many objects in the real world might have skin-tone colors. For example, wood, leather, skin-colored clothing and hair. This causes any skin detector to have much false detection in the background if the environment is not controlled[3].

2.1.1 A Framework for Skin Detection.

Skin detection process has two phases: a training phase and a detection phase.

Training a skin detector involves three basic steps:
i. Collecting a database of skin patches from different images. Such a database typically contains skin-colored patches from a variety of people under different illumination conditions.
ii. Choosing a suitable color space.
iii. Learning the parameters of a skin classifier.

Given a trained skin detector, identifying skin pixels in a given image or video frame involves:
i. Converting the image into the same color space that was used in the training phase.
ii. Classifying each pixel using the skin classifier to either a skin or non-skin.
iii. Typically post processing is needed using morphology to impose spatial homogeneity on the detected regions.

2.1.2 Skin Classifier.

A variety of classification techniques have been used in the literature for the task of skin classification. A skin classifier is a one-class classifier that defines a decision boundary of the skin color class in a feature space. The feature space in the context of skin detection is simply the color space chosen. Any pixel which color falls inside the skin color class boundary is labeled as skin. Therefore, the choice of the skin classifier is directly induced by the shape of the skin class in the color space chosen by a skin detector. The more compact and regularly shaped the skin color class, the more simple the classifier[3].

2.2 Techniques Used In Image Processing

In the midst of a visually enchanting world, which manifest itself with a variety of form and shapes, color and textures, motion and tranquility. The human perception has the capability to a machine in order to interpret the visual information embedded in still images, graphics and video or moving images in our sensory world. It is thus important to understand the techniques of storage, processing, transmission, recognition and finally interpretation of such visual scenes. Image processing is a many step process. Several steps must be performed one after another until the data of interest could be extracted from the observed scene.

The first step towards designing an image analysis system is digital image acquisition using sensors in optical or thermal wavelengths. Most of the time people will receive noisy images that are degraded by optical lens system in a digital camera. Thus, brightness and contrast of the image required improvement.

Segmentation is a technique refers to subdivision an image into its constituent regions. The goal of segmentation is to simplify or change the representation of an image into something that is more meaningful and easier to analyze. Image segmentation is typically used to locate objects and boundaries in images. There are many techniques in segmentation so the subdivision is carried depends on the problem being solved. The result of image segmentation is a set of regions that collectively cover the entire image or a set of contours extracted from the images.

After extracting each segment, the next task is to extract a set of meaningful features such as texture, color and shape. These are important measurable entities which give measures of various properties of image segments. Some of the texture properties are coarseness, smoothness, regularity, while the common shape descriptors are length, breadth, aspect ratio, area, location, parameter, compactness and etc. Each segmented region in a scene may be characterized by a set of such features.

Finally, each segmented object is classified to one of a set of meaningful classes based on the set of those extracted features. Skin Cancer Detection System (SCDS) use the texture and color techniques to classifier the result. A texture technique is a texture measures look for visual patterns in images and how they are spatially defined. Textures are represented by texels which are then placed into a number of sets, depending on how many textures are detected in the image. These sets not only define the texture, but also where in the image the texture is located. Texture is a difficult concept to represent. The identification of specific textures in an image is achieved primarily by modeling texture as a two-dimensional gray level variation. The relative brightness of pairs of pixels is computed such that degree of contrast, regularity, coarseness and directionality may be estimated (Tamura, Mori & Yamawaki, 1978). However, the problem is in identifying patterns of co-pixel variation and associating them with particular classes of textures such as silky, or rough[12].

A color pattern is a retrieving images based on color similarity is achieved by computing a color histogram for each image that identifies the proportion of pixels within an image holding specific values (that humans express as colors). Current research is attempting to segment color proportion by region and by spatial relationship among several color regions. Examining images based on the colors they contain is one of the most widely used techniques because it does not depend on image size or orientation. Color searches will usually involve comparing color histograms, though this is not the only technique in practice[12].

2.2.1 Components of an Image Processing System.

A general purpose image acquisition and processing system typically consists of the essential components:

i. An image acquisition system. In the simplest case, this could be a sample pictures, webcam, a flatbed scanner or a video recorder.

ii. A device known as a frame grabber to convert the electrical signal (normally an analog video signal) of the image acquisition system into a digital image that can be stored.

iii. A personal computer or a workstation that provides the processing power.

iv. Image processing software that provides the tools to manipulate and analyze the images.

2.2.2 Image Acquisition

When implementing a vision system, nothing is more important than image acquisition. Any deficiencies or the initial images can cause great problems with image analysis and interpretation. An obvious example is that of lack of detail owing to insufficient contrast or poor focusing of the camera. This can have the effect, at best, that the dimensions of objects will not be accurately measureable form the images, and at worst that the objects will not even be recognizable, so the purpose of vision cannot be fulfilled.

The following steps in image processing can only be proceeding after the image has been acquired. A simple arrangement of image acquisitions shown in figure 2.2:

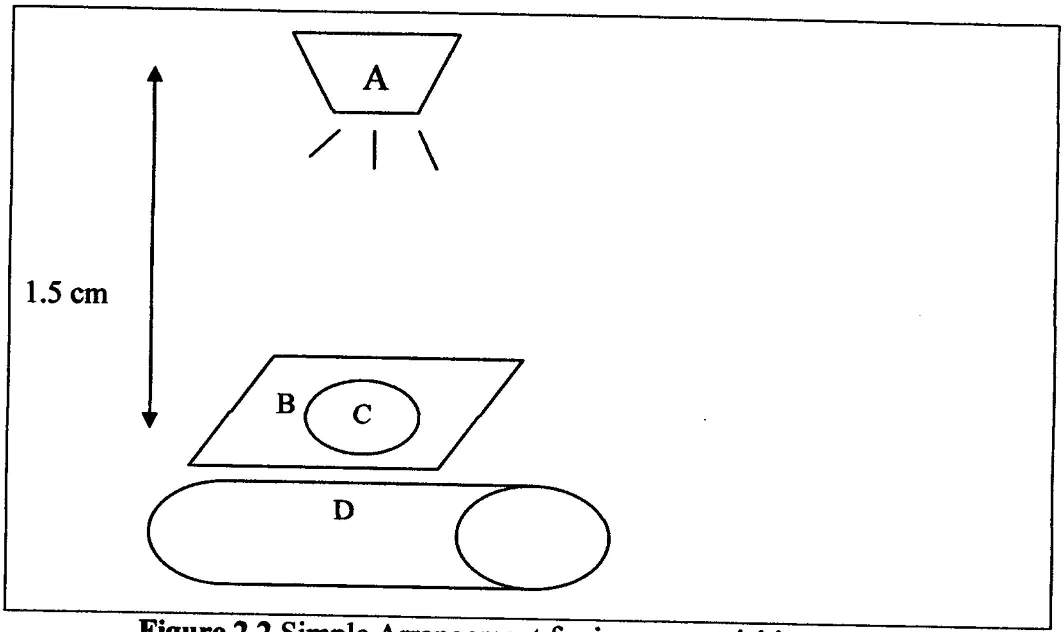

Figure 2.2 Simple Arrangement for image acquisition.

In figure 2.2 arrangement, A represents webcam or camera, B represents cardbox or table, C represents as circle (skin cancer) 6mm and D represents a human skin.

2.2.3 Image Enhancement

Image enhancement is steps in image processing to make an image result to be more suitable for a particular application. The examples include:

i. Sharpening or deblurring an out-of-focus image.

ii. Highlighting edges.

iii. Improving image contrast or brightening an image.

iv. Removing noise.

2.2.4 Feature Extraction

Feature extraction involves subdividing an image into constituent parts or isolating certain aspects of an image to extract various images for identifying or interpreting meaningful physical objects form images, these including:

i. Finding lines, circles and particular shapes in an image.

ii. Identifying pimple, oil, white heads or black heads in aerial photograph.