Middle-East Journal of Scientific Research 23 (Sensing, Signal Processing and Security): 352-356, 2015
ISSN 1990-9233

DOI: 10.5829/idosi.mejsr.2015.23.ssps.203

Early Detection of Skin Cancer Using Thermal Images with Hough Transformation

[1]S.S. Shanus, [1]N.G. Praveena, [1]T. Indumathy, [1]Tammineni Sreelatha and [2]Siva Prasad Lebaka

[1]Department of ECE, RMKCET, Chennai, India
[2]Department of ECE, RMDEC, Chennai, India

Abstract: In the medical field new technologies are incorporated for the sole purpose to enhance the quality of life for patients and even for the normal persons. The purpose of this research is to investigate the skin cancer affected area and detection. The functional nature of thermal IR detection constitutes the advantage and develops an objective and automated method for detection of skin cancer in a straight forward and cost effective manner. Moreover the image processing technique is used to identify the cancer affected regions in an accurate scale and MATLAB is used as a simulation tool for the detection purpose.

Key words:

INTRODUCTION

Cancer is an indication to an abnormal growth of cells due to changes in gene causing loss of control exerted normally on human cells. This leads to profound effect on cell characteristics such as proliferation rate, size, shape, etc. It is also possible that cancerous cells invade other tissues in the neighbourhood of their origin or at large distance from them. Examination of remains from ancient Egypt mummies showed evidence of bone cancer as well as breast cancer. This proves that cancer existed thousands of years ago in human beings life. As a result the search for detection, diagnosis and treatment, has never stopped.

Cancer is a term used to describe a disease in which abnormal cells divide and multiply without control and are able to invade other parts of the body. Instead of dying after a normal life cycle, cancer cells outlive normal cells and continue to form other abnormal cells. Cancer develops due to damage to the DNA of the cell that controls normal growth and division. There are five types of cancer: carcinoma, sarcoma, leukemia, lymphoma and central nervous system cancers. Carcinomas begin in the skin or in the epithelial cells that cover internal organs. Sarcoma begin in the bone, cartilage, fat, muscle, blood vessels, or other connective or supportive tissue. Leukemia begins in the bone marrow. Lymphoma cancers begin in the cells that make up the immune system. Central nervous system cancers begin the brain or spinal cord.

Skin Cancer: The three most common types of skin cancer are: basal cell carcinoma, squamous cell carcinoma, and melanoma. Melanoma is the deadliest type of skin cancer which is investigated in this work. For the remainder of this work, when the term "skin cancer" is mentioned, it refers to melanoma. The following sections will discuss the physiology, causes, risk factors and prognosis of melanoma skin cancer.

Melanoma: Melanoma is a type of cancer that originates in to melanocytes of the epidermis which often begins as non-cancerous tumours called as "nevi" or "moles." Nevi are clusters of melanocytes which are harmless but develop into cancerous melanoma through mutations in the DNA of the melanocytes. Once the melanocytes become malignant, melanoma has developed.

Melanoma is characterized by unchecked growth and replication of melanocytes. Melanoma tumours are often brown or black in colour because the extra melanocytes continue to produce melanin, darkening the area around the melanoma. The most common area for melanoma to develop is on the skin. This type of melanoma is called cutaneous melanoma. Melanoma can also develop in other tissues where melanocytes are present, such as in the eye, the meninges, the digestive tract, or the lymph nodes. These less common types of melanoma will not be discussed further in this thesis. When the term "melanoma" is used, it is referring to cutaneous melanoma.

Corresponding Author: S.S. Shanus, Department of ECE, RMKCET, Chennai, India.
E-mail: shanusssp@gmail.com.

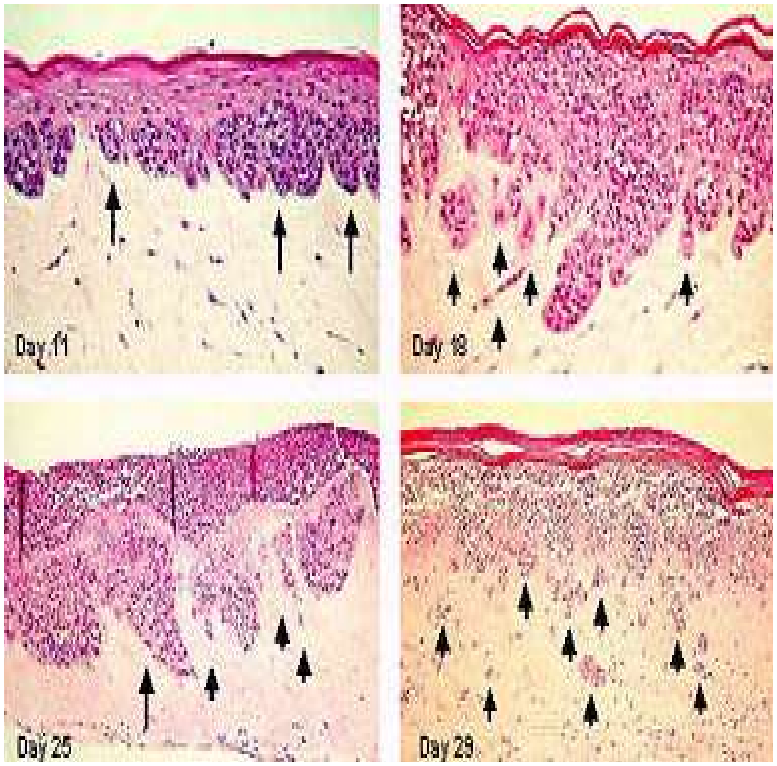

Fig. 1: Progression of Melanoma

Melanoma is more likely than other types of skin cancer to become malignant and spread to other areas of the body often to the lungs and liver. Each year, approximately 53,600 people are diagnosed with melanoma. In Western countries, the number of people diagnosed with melanoma is increasing each year. In the United States for example, the percentage of people diagnosed with melanoma has doubled in the last 30 years.

As melanoma progresses from a cancerous nevus to later stages, it invades the deeper layers of tissue below the epidermis but not in a uniform manner. Melanoma invades the dermis and subcutis and dermis with finger-like projections. The figure 1 indicates the progression of melanoma is shown

Melanoma Diagnosis: For all cancers, the early diagnosis of the disease can greatly improve the prognosis. It is important to correctly diagnose cancer early in order to start treatment and stop the disease from spreading to other tissues. If the cancer is allowed to spread to other areas of the body, it becomes harder to treat and the chance of death increases. The initial diagnosis of melanoma is done visually and then confirmed pathologically. If the melanoma is suspected after a visual inspection, excisional or incisional biopsy is performed to confirm the diagnosis. The first sign of melanoma is the change in appearance of an existing nevus or the appearance of a new nevus. ABCD method is followed for visually diagnosing melanoma. Each letter stands for a warning sign of melanoma.

They Are as Follows:

A-Asymmetry: The shape of one half of the mole does not match the other.

B-Border: The edges of the mole are ragged, blurred, or irregular.

C-Colour: The colour of the mole is uneven, or contains multiple colours.

D-Diameter: The mole increases in diameter.

After using this method if the melanoma is suspected then biopsy is send to the pathologist, who will then make a more definitive diagnosis. The pathologist will look at the tissue sample under a microscope to determine if it contains cancerous cells. The figure 2 indicates melanoma ABCDs

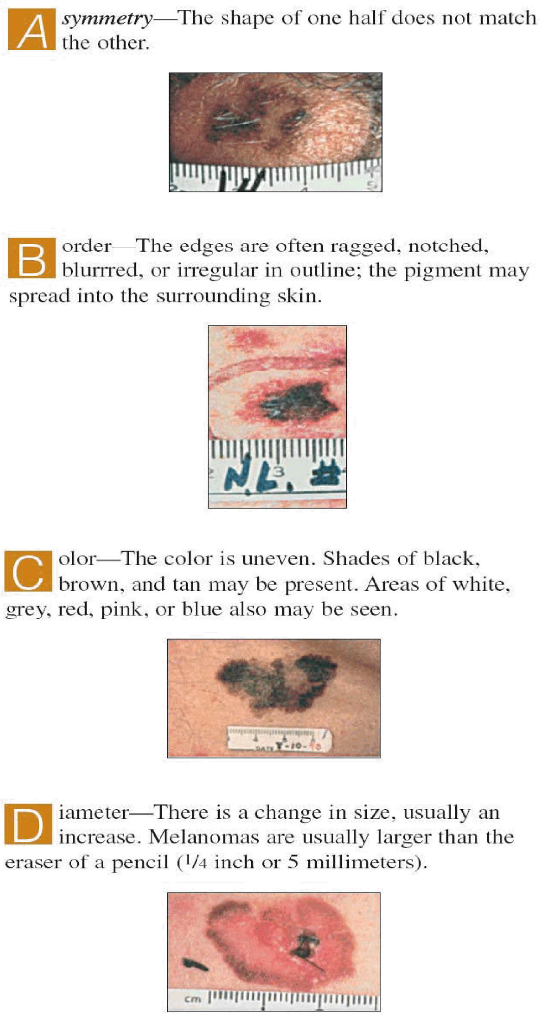

Fig. 2: Melanoma ABCDs

Existing Method: In the existing system thermal IR radiations are normally taken to reveal skin cancer regions in the human body. Temperature variation is the main key for this process. The regions which are affected by cancer cells will emit high amount of IR radiations than the normal skin. The region which is affected cannot be determined by using this method. The appropriate results is determined with the help of the graph (temperature vs time duration) and the change was detected using thermal IR radiation measurement in the wavelength Range 8-14 ìm. The cancer area was higher in temperature by roughly 0.3 –0.5°C

Proposed Method: The Hough transform is a technique which can be used to isolate features of a particular shape within an image. Because it requires that the desired features be specified in some parametric form, the classical

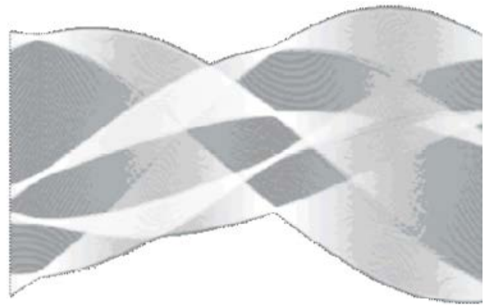

Fig. 3: Hough Transform

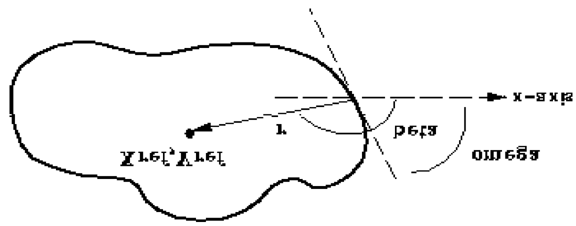

Fig. 4: Description of R-table Components.

Hough transform requires feature boundaries by regular curves. The main advantage of the Hough transform technique is that it is tolerant of gaps in feature boundary descriptions and is relatively unaffected by image noise. The figure 3 represents Hough transform.

The Hough transform can be used to identify the parameter of a curve which best fits a set of given edge points. This edge description is commonly obtained from a feature detecting operator such as the Roberts Cross which contain multiple edge fragments corresponding to a single whole feature. The output of an edge detector defines the features in an image, which determines what the features are (i.e. to detect the feature(s) for which it has a parametric (or other) description) and how many of them exist in the image.

The Hough transform is used when the shape of the feature that is isolated does not have a simple analytic equation describing its boundary. In this case, instead of using a parametric equation of the curve, a look-up table is used which defines the relationship between the boundary positions and orientations and the Hough parameters (The look-up table values must be computed during a preliminary phase using a prototype shape.) For example, if the shape and orientation of the desired feature is assumed to be known. The arbitrary reference point within the feature is specified as (x_{ref}, y_{ref}) with respect to the distance ‘r’ and angle of normal lines drawn from the boundary to this reference point ‘ω’ of the feature is defined. The look-up table consist of the distance and direction pairs, indexed by the orientation ‘ω’ of the boundary which is indicated in figure 4.

The Hough transform space is now defined in terms of the possible positions of the shape in the image, i.e. the possible ranges of (x_{ref}, y_{ref}). The transformation is defined by:

$$x_{ref} = x + r\cos\hat{a}$$

$$y_{ref} = y + r\sin\hat{a}$$

The 'r' and 'â' values are derived from the R-table for particular known orientations 'ω'.

RESULTS

Segmented Image Before Parabolic: Figure 5 represents the normal segmented regions of the image without parabola initiate.

Figure 6 represents the image which shows the normal segmented regions of the image with parabola initiate.

Figure 7 shows the thickness of the skin

Figure 8 shows the segmented area in which cancer is affected.

Fig. 5: Segmented Image Without Parabolic Initiate

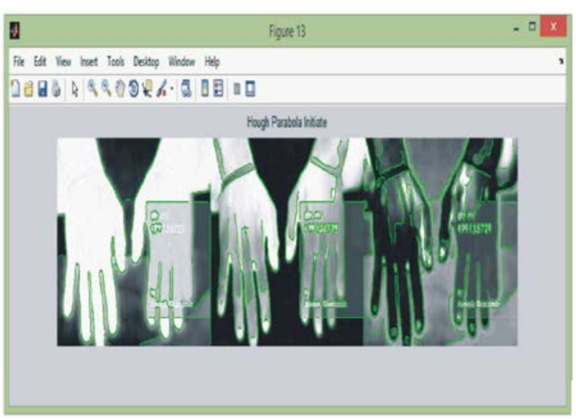

Fig. 6: Segmented Image with Parabolic Initiate

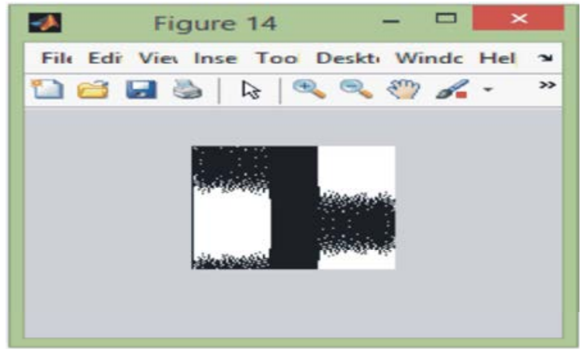

Fig. 7: Skin Thickness

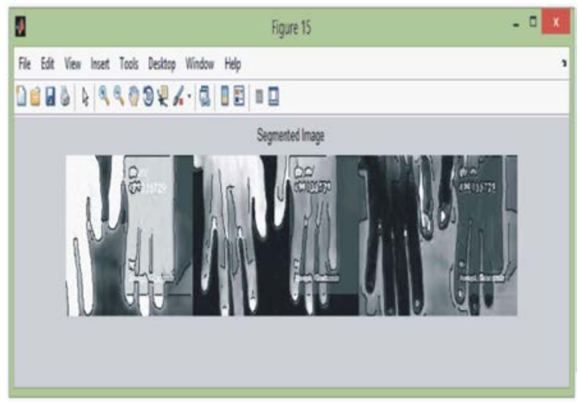

Fig. 8: Cancer Affected Area

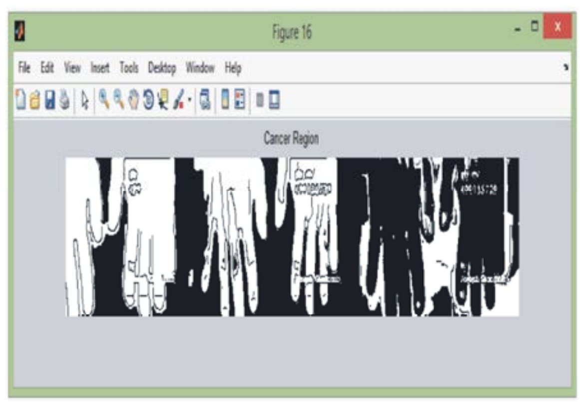

Fig. 9: Cancer Affeceted Area

Figure 9 shows the final output image which shows the cancer affected regions in three formats, the first one is segmented image, the second shows the cancer region in black color,and the third image shows the cancer region in white color

CONCLUSION

The proposed technique works efficiently and independently which develops a module for the different scale and illumination invariant detection and recognition of skin ancer disease using neural network classifier. This method is used to train the system for efficient skin cancer thermal detection and overcome the problems occur in it. The proposed system achieves, (i).less detection time (ii).higher detection accuracy.

REFERENCES

1. Ahmed M. Nasr Mustafa, Hamed Hamid Muhammed and Moustapha Hassan, 2012. Skin cancer Detection by Temperature Variation Analysis. Master of Science Thesis in Medical Engineering, Stockholm.
2. Lois J. Loescher and H. Peter Soyer, 2014. Mobile Medical Applications for Melanoma Risk Assessment. 47th Hawaii International Conference on System Science.
3. Jinhong Guo, Zhi Chen, Yong-Ling Ban and Yuejun Kang, 2014. Precise Enumeration of Circulating Tumour Cells Using Support Vector Machine Algorithm on a Microfluidic Sensor, Emerging Topics in Computing.
4. Howlader, N., A.M. Noone, M. Krapcho, *et al*. (eds). SEER Cancer Statistics Review, 1975-2011, National Cancer Institute. Bethesda, MD, http://seer.cancer.gov/csr/1975_2011/, based on November 2013 SEER data submission, posted to the SEER website, April 2014.
5. Hodi, F.S., S. Lee, D.F. McDermott, *et al*. 2014. Ipilimumab plus sargramostim vs ipilimumab alone for treatment of metastatic melanoma: A randomized clinical trial. JAMA. 312: 1744-1753.
6. Gangadhar, T.C., L.A. Fecher, C.J. Miller, *et al*. 2014. Chapter 69: Melanoma. In: Niederhuber JE, Armitage JO, Dorshow JH, Kastan MB, Tepper JE, eds. Abeloff's Clinical Oncology. 5th ed. Philadelphia, Pa. Elsevier.
7. National Comprehensive Cancer Network (NCCN). Practice Guidelines in Oncology: Melanoma. Version 1.2015. Accessed at www.nccn.org/professionals/physician_gls/PDF/melanoma.pdf on December 30, 2014.
8. National Cancer Institute. Physician Data Query (PDQ). Melanoma Treatment. 2014. Accessed at www.cancer.gov/cancertopics/pdq/treatment/melanoma/HealthProfessional on December 30, 2014.
9. Hamid, O., C. Robert and A. Daud, 2013. Safety and tumor responses with lambrolizumab (anti-PD-1) in melanoma. N. Engl. J. Med., 369: 134-144.
10. Wolchok, J.D., H. Kluger, M.K. Callahan, *et al*. 2013. Nivolumab plus ipilimumab in advanced melanoma. N. Engl. J. Med., 369: 122-133.
11. Anna Sunds, 2012. Nya behandlingar bromass av regler, Biotech Sweden, pp: 14-15.
12. Helmut Budzier & Gerald Gerlach, 2011. Thermal infrared sensors: theory,optimization and practice, John Wiley & Sons Ltd.
13. www.wikipedia.com
14. www.in.mathworks.com
15. www.cancerfonden.se