Chapter 69
Border Detection in Skin Lesion Images Using an Improved Clustering Algorithm

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ABSTRACT

The incidence of skin cancer has been increasing in recent years and it can become dangerous if not detected early. Computer-aided diagnosis systems can help the dermatologists in assisting with skin cancer detection by examining the features more critically. In this article, a detailed review of pre-processing and segmentation methods is done on skin lesion images by investigating existing and prevalent segmentation methods for the diagnosis of skin cancer. The pre-processing stage is divided into two phases, in the first phase, a median filter is used to remove the artifact; and in the second phase, an improved K-means clustering with outlier removal (KMOR) algorithm is suggested. The proposed method was tested in a publicly available Danderm database. The improved cluster-based algorithm gives an accuracy of 92.8% with a sensitivity of 93% and specificity of 90% with an AUC value of 0.90435. From the experimental results, it is evident that the clustering algorithm has performed well in detecting the border of the lesion and is suitable for pre-processing dermoscopic images.

1. INTRODUCTION

The large and intense organ of the human body that protects the flesh, bones and vain is skin. It provides protection, sensation and regulating the thermal equilibrium of the body. The skin contains a well-organized structure of layers as epidermis, dermis, and hypodermis. The outer most layer of the skin epidermis which consists of keratinocytes, melanocytes, and other inflammatory cells, is the primary portion affected by skin cancer. R. L. Siegel et al. (2018), discuss the skin cancer is considered the most

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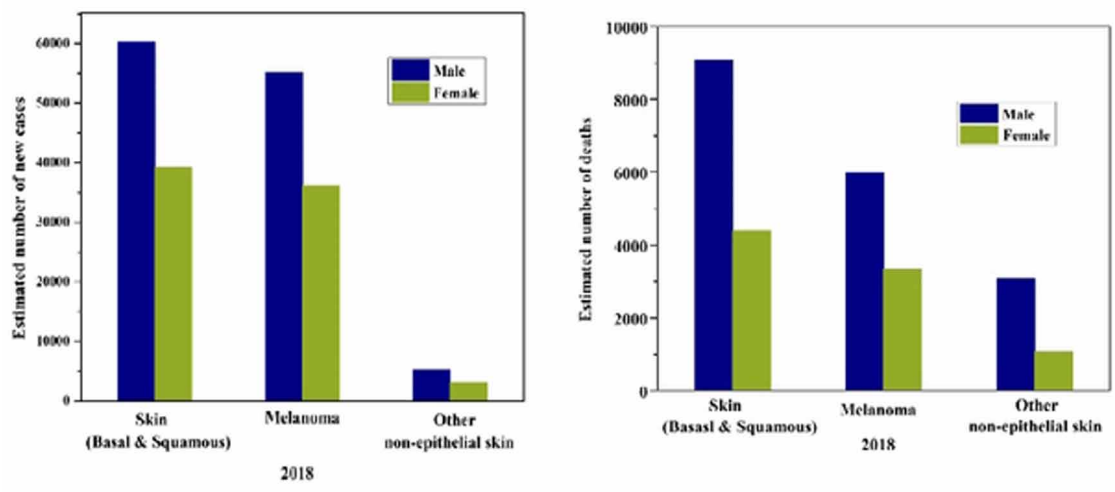
aggressive form of cancer found in the human body and they can be either malignant melanoma or non-melanoma. Melanoma skin cancer, caused by the uncontrolled or unsuppressed growth in the melanocyte cells is more dangerous, compared to non-melanoma as they spread easily and deeply into the skin and cause death. In the United States, melanoma is a common form of cancer among both men and women who are often exposed to the sun. The estimated new cases of malignant melanoma are 91,270 in the year 2018. As reported by the American cancer society the estimated number of deaths because of melanoma is 9,320 in the year 2018. The statistical data for both men and women on skin cancers is shown in Figure 1. The significance of early detection with treatment of malignant melanoma for the survival of patients is shown below.

Figure 1. Statistical data for Skin cancer in the year 2018 according to American Cancer Society: (a) Estimated new cases of skin cancer; (b) Estimated death of skin cancer



Skin cancers are detected with the help of dermoscopic images or with the help of images taken with an ordinary camera, which is a non-invasive imaging modality. The dermatologist looks for various abnormal signs in the images like Basal Cell Carcinoma (BCC), Squamous Cell Carcinoma (SCC) and malignant melanoma. BCC and SCC are curable, while malignant melanoma is a serious type of skin cancer and has to be detected early. Initially, malignant melanoma looks like moles, later they gradually progress in size and change in color.

The symptoms to be analyzed for melanoma are (i) Asymmetrical Shape, to check if one portion of the mole match the other, (ii) Irregular Border, to check if edges are smooth and not jagged, (iii) color, to check if the mole is even shape of a single color and not combined with several colors, (iv) Diameter, to check if the spot is larger than 6 millimeters. Figure 2 shows the sample skin lesion images of human.

Detecting skin lesion is a challenging task as the lesion margin is not visible and is subtle. Interpreting dermoscopic images depends on the observer and his expertise and it will have inter- and intra- operator variability while analysis. The main motivation in using a CAD system is to enhance the diagnosis accuracy by providing the dermatologist a second opinion. The CAD system will mark the potential areas of abnormalities and the experts can make a closer observation of those areas so that the abnormality is