



Cairo University

Automatic Imaging System for Inspection of Pigmented Skin Lesions and Melanoma Diagnosis

By

Eng. Mariam Ahmed Mohamed Ismael Sheha

A Thesis Submitted to the
Faculty of Engineering at Cairo University
In Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE

In

SYSTEMS AND BIOMEDICAL DEPARTMENT

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“This thesis is dedicated to all those who scarify for others happiness”

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List of Abbreviations

CAD	Computer Aided Diagnosis
ANN	Artificial Neural Network
KNN	K-Nearest Neighbor
SVM	Support Vector Machine
TDV	Total Dermoscopic Value
UV	Ultraviolet
BCC	Basal cell carcinoma
SCC	Squamous Cell Carcinoma
ELM	Epiluminescence microscopy
GUI	Graphical User Interface
JPEG	JPEG joint photographic experts group
ROI	Region of Interest
PSL	Pigmented skin lesion
GLCMs	Gray level Co-occurrence Matrices
IDM	Inverse difference moment normalized
MLP	Multilayer Perceptron
MSE	Mean square error
SSE	Sum square error

Abstract

Skin cancer appears to be one of the most dangerous types among others by the presence of malignant melanoma as one of its forms. Malignant melanoma is the deadliest type of skin cancer and its incidence and mortality rates have been steadily increasing worldwide over the past decades. Clinicians usually found difficulties to differentiate between malignant melanoma and melanocytic nevus. A lot of effort has been made in the last two decades to enhance the clinical diagnosis of melanoma. Dermoscopy was the first non-invasive technique introduced for that purpose, where it allows magnified and clear visualization of skin morphological structure in vivo clinical examination. Depending on that other several clinical diagnosis algorithms were proposed such as pattern analysis, ABCD rule of dermoscopy, Menzies method, and 7-points checklist. Computerized monitoring of these algorithms improves the diagnosis of melanoma compared to simple naked-eye examination.

This thesis proposes computer-aided diagnosis of melanoma to provide quantitative and objective evaluation of skin lesion as opposed to visual assessment, which is subjective in nature. For the aim of globalizing that work, two different image sets are used to examine the system, a set of images acquired by standard camera represented by clinical images and another set of dermoscopic images captured from the magnified dermoscope. Images are enhanced and segmented to separate the lesion out of the background. Different features type such as geometric, chromatic, and texture features are extracted from the region of interest resulted from segmentation. Then, the most prominent features that can cause an effect are selected by different selection methods; which are F-test, T-test and the Fisher score method. Selected features are fed into three different classifiers, the Artificial Neural Network (ANN) that presented through two different techniques of classification, the K-Nearest Neighbor (KNN) and Support Vector Machine (SVM); which also presented by three different techniques of classification.

Adding to previously mentioned system; it had been interesting to design automated software for one of the applicable clinical diagnosis algorithm. The ABCD diagnosis system is a multiple model implementing different types of features, and classified by the

proposed classification methods and also by calculating Total Dermoscopic Value (TDV). The Performances of all those algorithms were measured by means of sensitivity, specificity, and accuracy. As data charts were displayed out of those terms to clarify the result comparison.

According to the different methods used for feature extraction, selection and classification, multiple experiments are conducted that makes the result field hard and complex. To simplify the process of result determination and discussion, experiments were categorized into single and multiplied models that present different approaches according to the features used for each. Results are analyzed for each approach then accuracy is compared. Finally, The approach achieved the best results is recommended for the purpose of melanoma diagnosis.