

Skin Cancer Diagnosis based on Weighted Gabor Filter and Optimization Algorithm

Abstract

Diagnosis of melanoma in the early stages of the disease can significantly prevent death from this fatal cancer. Therefore, providing a method to make the diagnosis of melanoma at an early stage is very useful and valuable. Skin cancer includes pre-processing, lesion segmentation, feature extraction, feature selection and classification. In this research, a new algorithm for classifying skin images into two types of malignant and benign is presented. First, a pre-processing step is applied to remove noise and artificial effects as well as enhance image quality. The lesion is then separated from the healthy areas using the threshold method. Next, the weighted Gabor filter is implemented to extract the feature. Then the PSO algorithm is presented to obtain useful and effective features. Finally, the K-NN classifier is used to detect malignant or benign skin. The proposed method for diagnosing melanoma skin cancer as the most malignant type of skin lesions with other benign lesions has an accuracy of about 89%. Experimental results show that the use of weighted Gabor filter increases the accuracy of skin lesion detection. It also shows that the proposed method is a safe, accessible, effective way of detecting skin cancer.

1- Proposed method

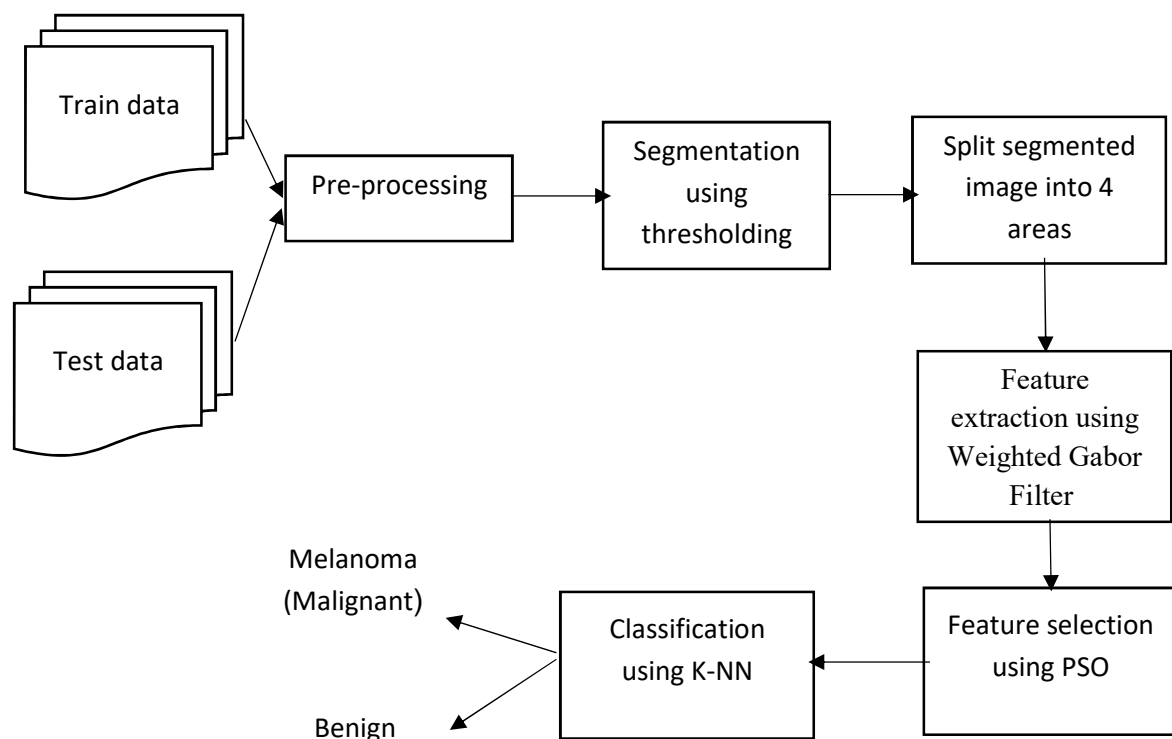


Figure 1. Proposed diagram

1-1-Pre-processing

- Convert image to grayscale
- Winner filter
- Median filter

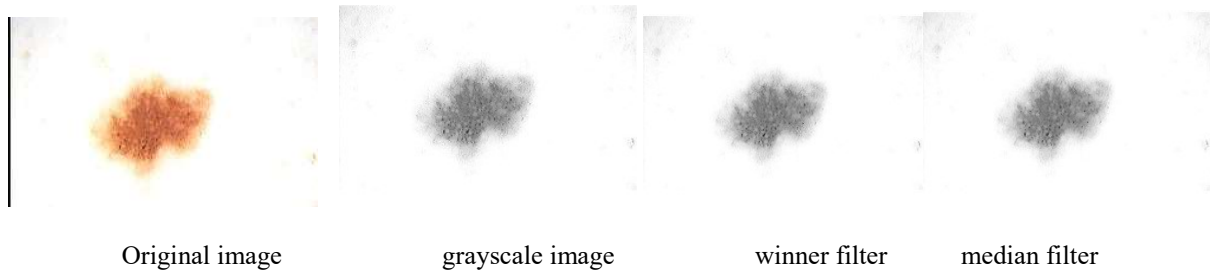


Figure 2. Pre-processing steps

1-2- segmentation using thresholding method

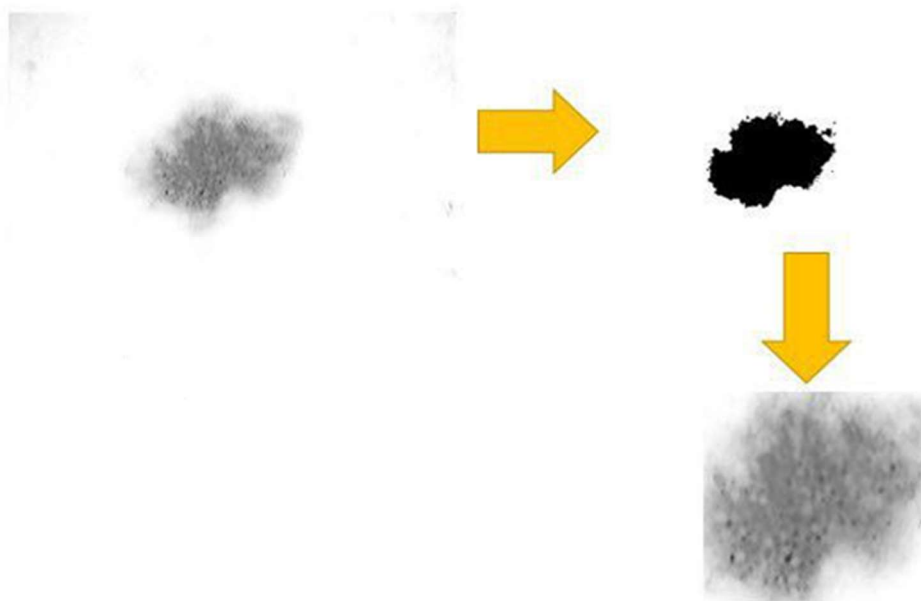


Figure 3. Segmentation steps

1-3- Split image into 4 areas

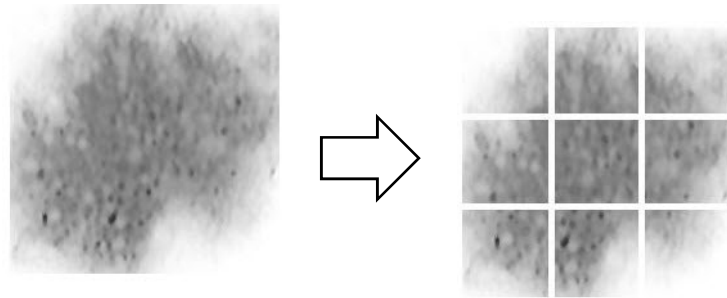


Figure 4. Split data into 4 areas

1-4-Gabor filter

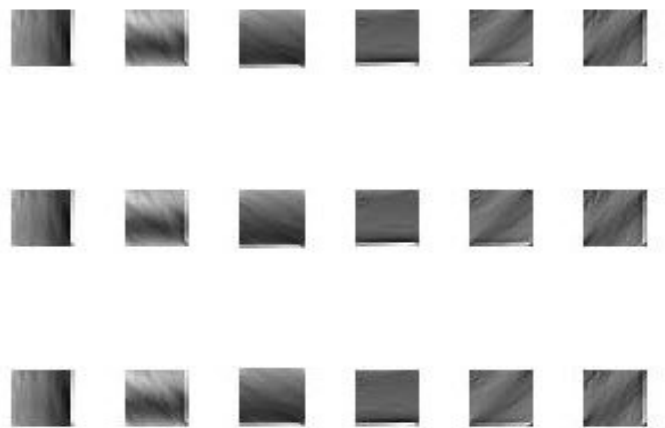


Figure 5. Apply Gabor filter on one of the segmented image areas

1-5- Weighting of different areas of the image

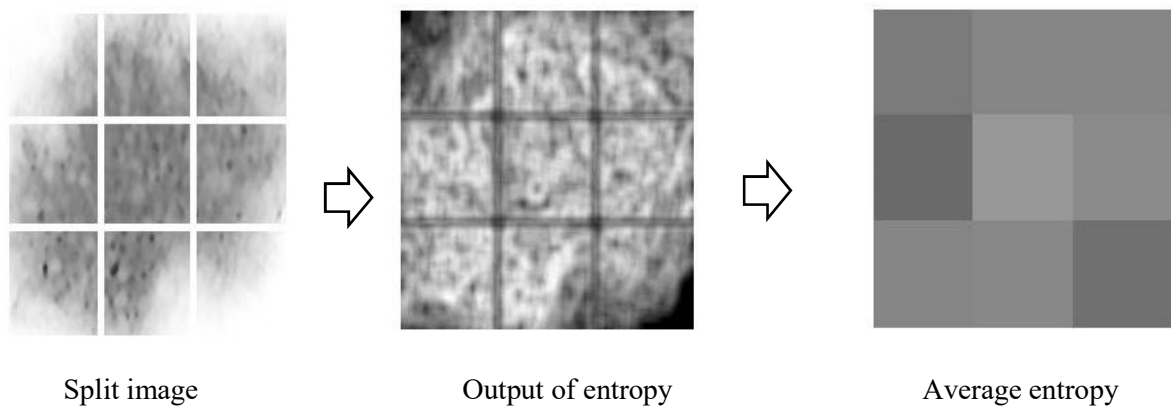


Figure 6. Weighting of different areas of the image

1-6- Feature selection using principal swarm optimization (PSO)

1-7- Classification using K-NN

2- Experimental results

- Dataset available: <https://www.kaggle.com/datasets/hasnainjaved/melanoma-skin-cancer-dataset-of-10000-images>

Table1. Evaluation metrics of the proposed method

	Benign	Melanoma
Benign	TP=4435	FN=565
Melanoma	FP=4332	TN=668

Table2. Evaluation metrics of the proposed method

Sensitivity	Specificity	Accuracy
%88.70	%86.64	%87.67

Table 3. Comparing the evaluation of the proposed method with different feature extraction methods and different classification

	Sensitivity	Specificity	Accuracy
Gabor+PSO+K-NN	%80.05	%78.33	%79.19
Weighted Gabor Filter+PSO+K-NN (proposed method)	%88.70	%86.64	%87.67

Table 4. Comparing the detection accuracy of the proposed method with the proposed method without PSO

	Sensitivity	Specificity	Accuracy
Proposed method +PSO	%88.70	%86.64	%87.67
Proposed method+without PSO	%86.35	%82.40	%84.42