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بسم اللّه الرحمن الرحيم

مركز الشبكات وتكنولوجيا المعلومات

قسم التوثيق الإلكتروني

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جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها

علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

Ain Shams University

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Skin Lesion Image Segmentation Using Machine Learning

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Abstract

Melanoma is a sort of skin disease that represents more than seventy-five percent of all skin diseases connected to all fatalities. Nonetheless, doctors have demonstrated that the probability rate of patients improves radically with early analysis and diagnosis. This motivated researchers to seek automated techniques that facilitate early diagnosis of skin cancer. Skin lesion segmentation is a significant advance in the analysis and the resulting treatment of melanoma. Automatic lesion segmentation is of major interest for early detection and treatment of skin cancer, because it provides better accuracy and speed, compared to manual analysis. Lately, deep neural networks have provided better results for medical image segmentation, compared to classical approaches based on machine learning.

In this thesis, first an extensive a review of existing deep network architectures that have been suggested to segment skin lesions, pre-processing and post-processing methods with the available datasets that can be used for research in this area, also presented a comparison between the results of different methods used for skin lesion segmentation showing the strengths and weaknesses of each method.

In this thesis, checked the applicability of deep learning approaches: U-NET, Deep RESU-NET, VGG16UNET, U-Net DENSENET121, U-Net EfficientNet-B0, Deeplabv3plus, Inception-ResNet-v2-unet, mobilenetv2_unet, Resnet50_unet, and vgg19_unet to the segmentation of skin lesions to detect lesion boundaries by developing deep learning models that have never been used for skin lesions and producing comparative results that will help detect melanoma and successfully define the lesion boundaries.

The architectures have been trained on four different datasets. The architectures were trained on the original data set, and then the four datasets were pre-processed to be used for training the architectures. Utilized different kinds of original image transformations, such as center crop, random rotation 90, grid distortion, horizontal flip, and vertical flip which resulted in an increasing number of images corresponding to the training set. Utilized different standard evaluation metrics such as Jaccard Index, accuracy, recall, precision, and F-measure to evaluate the acquired results. The results show that out of these architectures, the U-Net DENSENET121 architecture outperforms with segmentation Accuracy as high as 97.23% and F1 as 95.96% and Jaccard as 92.42% and Recall as 96.33% in the PH2 dataset. In general, the architecture of U-Net DENSENET121 showed a significant superiority over the rest of the architectures. Even when comparing the architectures that we used in this study with the rest of the other methods, we found that U-Net DENSENET121 architecture gave higher results than the rest of the architectures.

This thesis is a comprehensive study that tries to evaluate the segmentation step in skin lesions using deep learning approaches.

List of Publications

1) Z. E. Diame, M. N. Al-Berry, M. A. . -M. Salem and M. Roushdy, “Deep Learning Architiectures For Aided Melanoma Skin Disease Recognition: A Review,” 2021 International Mobile, Intelligent, and Ubiquitous Computing Conference (MIUCC), 2021, pp. 324-329, doi: 10.1109/MIUCC52538.2021.9447615. (Indexed in Scopus)

2) Zahraa E. Diame Maryam N. Al-Berry , Mohammed A.-M. Salem, Mohamed Roushdy, “Autoencoder Performance Analysis Of Skin Lesion Detection”, Journal Of Southwest Jiaotong University, Volume 56 (6), 2021 (Indexed in Scopus)

3) Zahraa E. Diame Maryam N. Al-Berry , Mohammed A.-M. Salem, Mohamed Roushdy, “Experimental Comparative Study on Autoencoder Performance for Aided Melanoma Skin Disease Recognition”, International Journal of Intelligent Computing and Information Sciences, Volume 22(1), pp. 88-97, 2022.

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List of Abbreviations

Abbreviation	Stands for
ABCD	Asymmetry, Border, Color, Diameter
AC	Accuracy
ANFC	Adaptive Neural Fuzzy Classifier
ANN	Artificial Neural Networks
ASPP	Atrous Spatial Pyramid Pooling
BAT	Boundary-Aware Transformer
BN	Batch Normalization
CNN	Convolutional Neural Networks
DI	Dice Coefficient
FCN	Fully Convolutional Network
FCRN	Fully Convolutional Residual Network
FN	False Negatives
FP	False Positives
GAN	Generative Adversarial Networks
PH^2	Hospital Pedro Hispano
ISBI	International Symposium on Biomedical Imaging
ISIC	International Skin Imaging Collaboration
LFN	Lesion Feature Network
LICU	Lesion Index Calculation Unit

LIN	Lesion Index Network
PCA	Principle Component Analysis
RGBH	Red, Green, Blue And Hue Planes
ROI	Region Of Interest
SE	Sensitivity
SP	Specificity
SVM	Support Vector Machine
TN	True Negatives
TP	True Positives
U-Net	Autoencoder Networks