Segmentation of skin lesions and their attributes using Generative Adversarial Networks

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Abstract

This work is about the semantic segmentation of skin lesion boundary and their attributes using Image-to-Image Translation with Conditional Adversarial Nets. Melanoma is a type of skin cancer that can be cured if detected in time and the process of segmentation into dermoscopic images is an essential procedure for computer-assisted diagnosis due to its existing artifacts typical of skin images. To alleviate the image annotation process, we propose to use a modificated Pix2Pix network. The discriminator network learns the mapping from a dermal image as an input and a mask image of six channels as an output. Likewise, the output of the discriminative network called PatchGAN is varied for one channel and six output channels. The images used come from the 2018 ISIC Challenge where 500 images are used with their respective semantic map, divided into 75% for training and 35% for testing. Obtaining for 100 training epochs high jaccard indices for all attributes of the segmentation map.

1 Introduction

The work consists of three main parts, first the preparation of the data to be able to properly use the convolutional neural network. The second part is the implementation of the proposed architecture. Finally, predictions for test data are evaluated using the jaccard index as a metric.Code is available at `https://github.com/CristianLazoQuispe/skin-lesion-segmentation-using-pix2pix.git`

2 Problematics

According to [1], in 2017, 10650 cases of skin cancer were registered in Peru, and 63.8% of cancers were detected when the patients already presented the symptoms caused by the cancer. These figures are alarming for Peru because a late diagnosis of cancer in the worst case can lead to death.
The original data set of the ISIC 2018 [2] competition consists of 2594 dermoscopic images available to the public for the analysis of skin lesions.The input data are dermoscopic lesion images in JPEG format.All lesion images are named using the scheme ISIC_$image_id$.jpg, where $image\_id$ is a 7-digit unique identifier.The dermatoscopic lesion images have their respective lesion boundary segmentation and its attributes: pigment network, negative network, streaks, milia-like cysts and globules as shown in Fig.1.

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3 Proposed Method

3.1 Data preparation

First the appropriate data set is prepared for later use of the modified model Pix2pix. The output of our network will be a 6-channel image, each channel representing an attribute in a binary mask as shown in the figure 1.

3.2 Implementation algorithm

The Work [3] is taken as a reference. The figure 1 shows an example of the generative adversarial neuronal network. PatchGan taken as reference from [4] is used as discriminator in order to improve our cost function and to be able to use an intelligent discriminator that learns to differentiate if the masks generated are similar to the original masks.

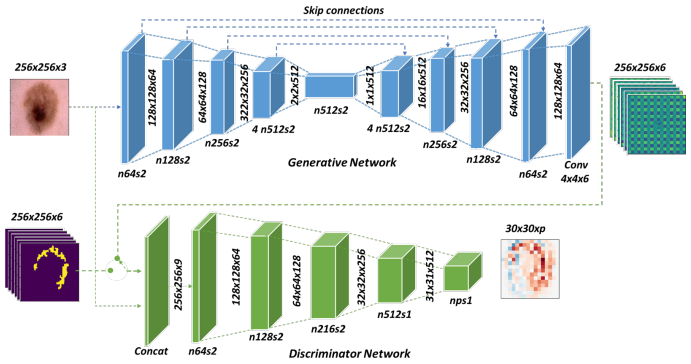

Figure 1: The arcuitecture proposed.

4 Results

For the first segmentation task it was tested having only one output channel of the discriminator. Using 100 times epochs, the jaccard indices were obtained as shown in table 1. For the second segmentation task it was tested having six output channel of the discriminator where the results were inferior.

Table 1: Results for the first training

Atributte	Jaccard index
Lesion boundary	0.85
pigment network	0.82
negative network	0.81
streaks	0.75
milia-like cysts	0.76
globules	0.83

5 Conclusions

This article shows an efficient system for the task of segmentation, using few input images. Using only one output channel for the discriminator is better than using six, agreeing as mentioned in the paper of Pix2pix, putting more channels on the output imposes more restrictions that encourage sharp high-frequency detail. Likewise, it can be observed that the generative network manages to map from the original lesion image to the segmented mask map.Finally, since the algorithm developed uses free software, its use is accessible and there would be no restriction on its use.

References

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