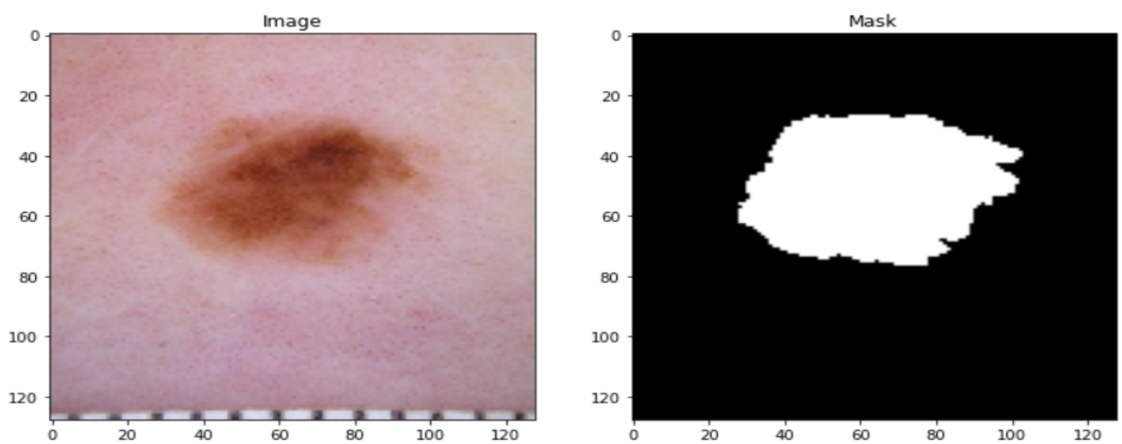
Image segmentation and detection

Introduction

In digital image processing and computer vision, image segmentation is partitioning a digital image into multiple image segments, also known as image regions or image objects (sets of pixels)[1].
Image segmentation is typically used to locate objects and boundaries (lines, curves, etc.) in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics[1]. Image segmentation and detection work well when the images passed to it are MRI scans and X-rays because it was made to be implemented in this domain and passing any other image will not provide the same quality of result as it does with medical images

Objective: The goal of segmentation is to simplify and change the representation of an image into something more meaningful and easier to analyse.

For this task, we were provided 120 skin lesion images. The 120 images comprise 60 coloured skin-coloured images and 60 corresponding masks (ground-truth segmentation).



Methods

Preprocessing: The image data were loaded into memory in a sorted manner. While the mask set was loaded and binarized to reflect classes of zero and 1, using the OpenCV package in python. The datasets were divided into two parts, 80% for training and 20% for validation. All images were resized to the same size (128 × 128) and normalized to the range [0,1].

Data Augmentation: Due to the small dataset available for training, it was paramount to do Data Augmentation. Hence, data augmentation was employed to generate larger training images and their corresponding masks.

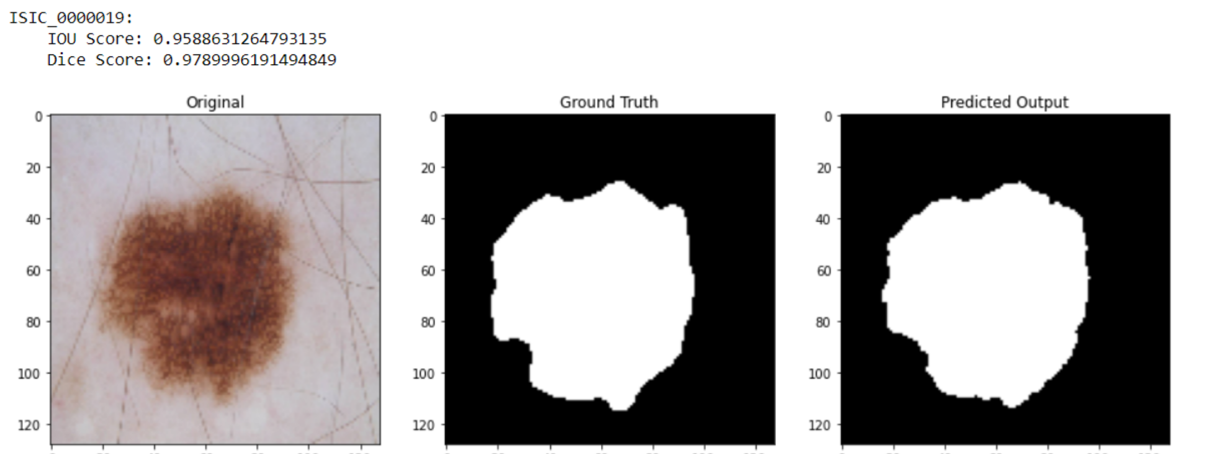
Classification models

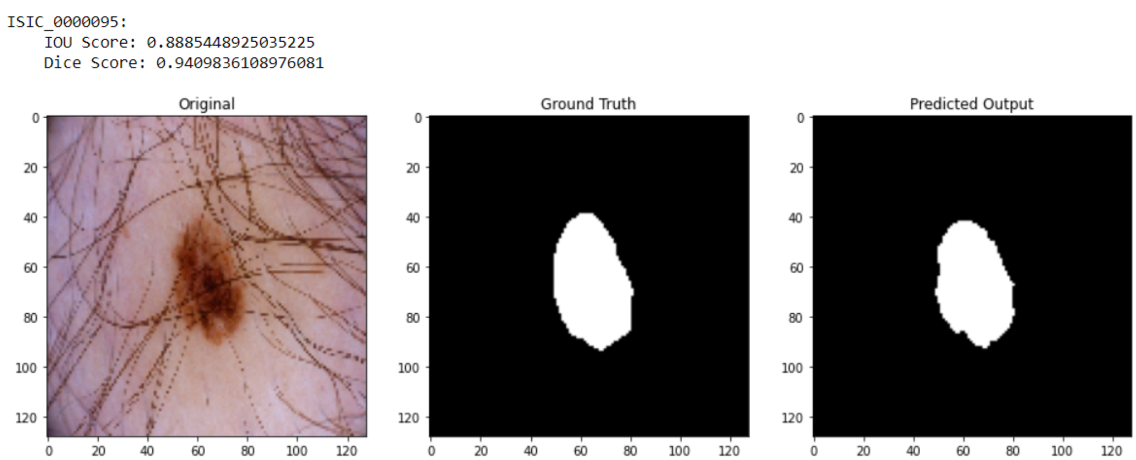
An Unet was built using the Tensorflow open-source frame. And a set of metrics were used to evaluate the model's prediction. Since the task was an image segmentation task, the conventional metrics, such as accuracy, precision, e.t.c. are not the best metrics for evaluation. Hence, the metrics used to evaluate the model's performance are, namely:

- Intersection over Union
- Dice Similarity coefficient

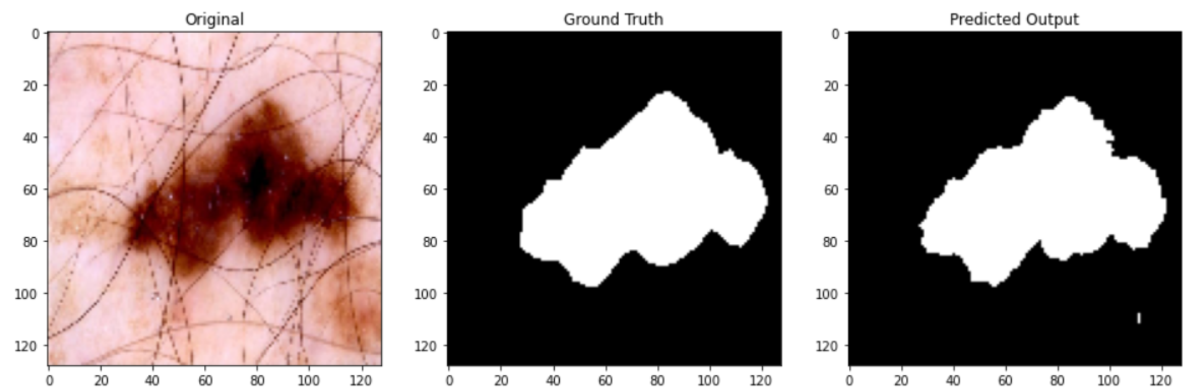
RESULTS AND DISCUSSION

The custom UNet model was trained for 50 epochs and predictions on 3 specific skin lesion images were made and evaluated:

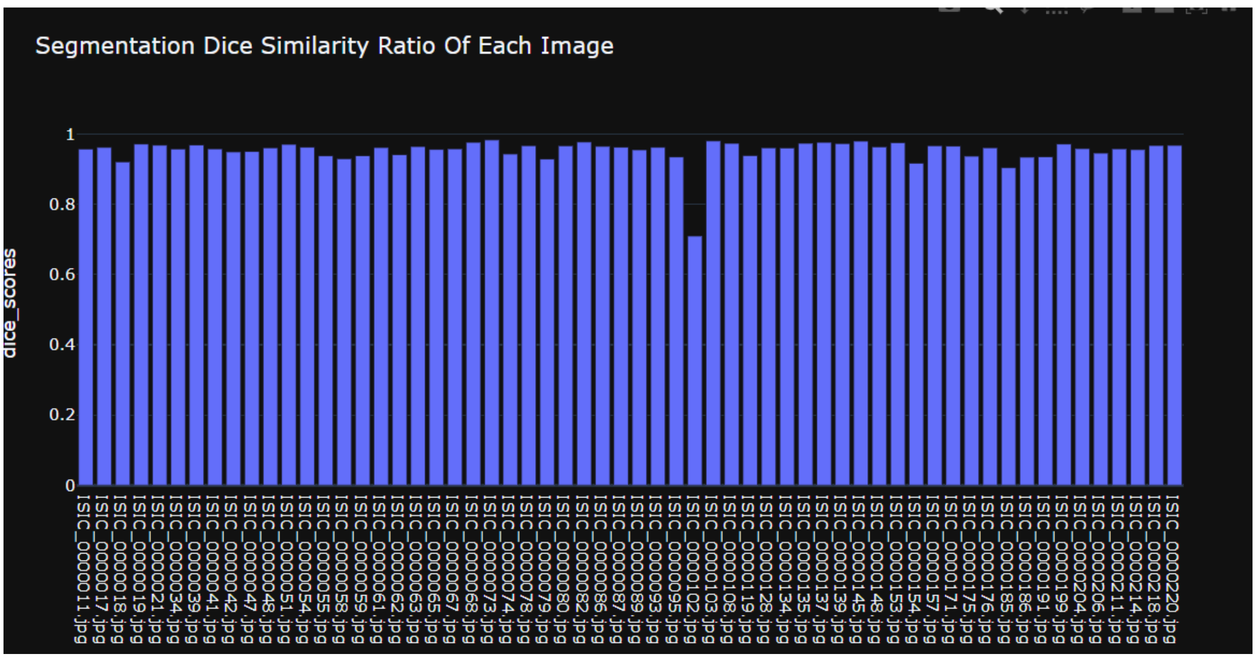




```
ISIC_0000214:
    IOU Score: 0.9247390145065818
    Dice Score: 0.9608980840553759
```



A bar plot plotly express showing the image name on the x-axis and dice-similarity coefficient on the y-axis:



The mean and variance of the dice similarity score were computed to be:

- Mean DS: 0.95
- DS variance: 0.001303199074852358

Conclusion

Given the high mean DS metric for the full dataset, we are confident that the model did a good job predicting the segmented mask for each image.