SIMULTANEOUS SEGMENTATION OF BLOOD VESSELS, OPTIC DISC AND EXUDATES IN FUNDAL IMAGES USING DEEP NEURAL NETWORKS

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ABSTRACT

Fundal imaging is the most commonly used non-invasive technique for early detection of many retinal diseases like diabetic retinopathy. An initial step in automatic processing of fundal images for detecting diseases is to identify the various landmark regions in the retinal image. The most important structures visible in a fundal image are the optic disc, blood vessels and fovea. In addition to these, various abnormalities like exudates, micro-aneurysm and haemorrhages that help in pathological analysis is visible in fundal images. In this work, we propose a multi-tasking deep learning architecture for segmenting optic disc and blood vessels, fovea and exudates simultaneously. Our experimental results show that combined predictions of all these structures simultaenously gives in significant improvement in the prediction of each structures.

We achieved an F1 score of 0.78 for blood vessels segmentation, on the DRIVE test dataset, with multi-tasking using a simple U-Net architecture. When the same architecture is used without multi-tasking, i.e. for blood vessel segmentation alone, the F1 score was 0.72 which is significantly less compared to the multi-tasking model performance. Similarly for optic disc segmentation, we obtained an F1 score of 0.76 using multi-tasking which is a significant improvement over 0.7 without multi-tasking. We also performed experiments on HRF dataset. We got an F1 score of 0.79 with multi-tasking and 0.78 without multi-tasking on HRF dataset for blood vessel segmentation. Using a more complex architecture, like Laddernet, it is possible to further improve the results.

***Index Terms*—** One, two, three, four, five

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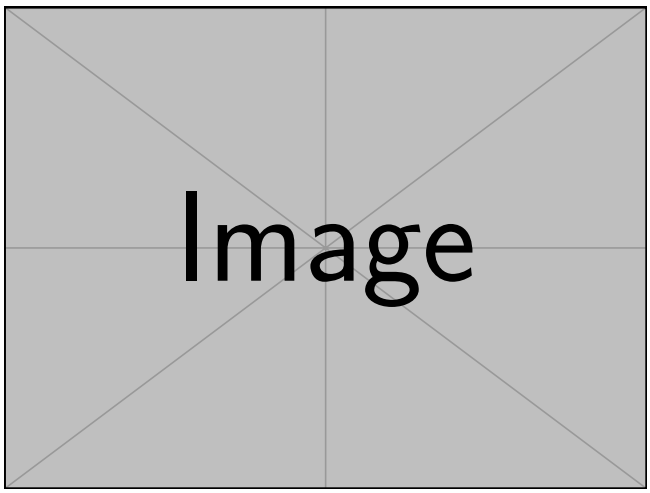
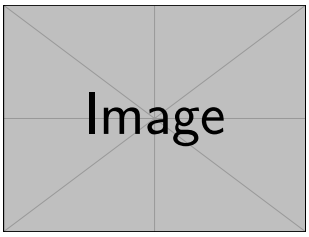
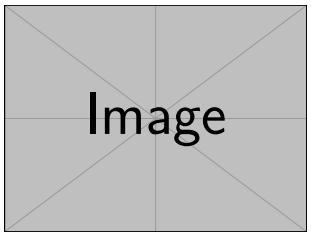


(a) Result 1



(b) Results 3



(c) Result 4

Fig. 1. Example of placing a figure with experimental results.

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