Master DAC PLDAC 2023: Blood Vessel Detection upon Brain tumor histological images

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1 Introduction

Blood vessel segmentation & detection is one of the hot topics in the current time of AI. Especially, multiple datasets have been proposed in the Kaggle competitions in order to aid Doctors and medical research groups. Pr. Isabelle Bloch's team has developed a collaboration with the neurologists at the Paris Brain Institute. Neurologists have produced large images (2-3 Gigabytes) of brain tumors using zen microscope. The goal of this M1 project is to detect blood vessel in this images using a pre-established tool called BVD (Blood Vessel Detection) and propose (if possible) some enhancements for the current version of this tool.

2 Methodology

Adamo, A and collaborators have developed and evaluated a tool to detect blood vessel from a RGB input image (stained histological images). It achieves a precision rate, in terms of detection, more than 0.8 upon multiple datasets (Random phantom dataset, Rat Abdominal Wall Defect Model Dataset and Rat Infarction Model Dataset). The first part of this work to search and make a bibliography about blood vessel detection. The second part is to implement this methodology in python (using skimage, openCV & others packages if necessary) based on its original implementation in Matlab. The third part is to compare the performance of both implementations on different datasets proposed in the paper. The final part is to apply the python implementation upon our images issued from Paris brain institute in order to detect the blood vessels.

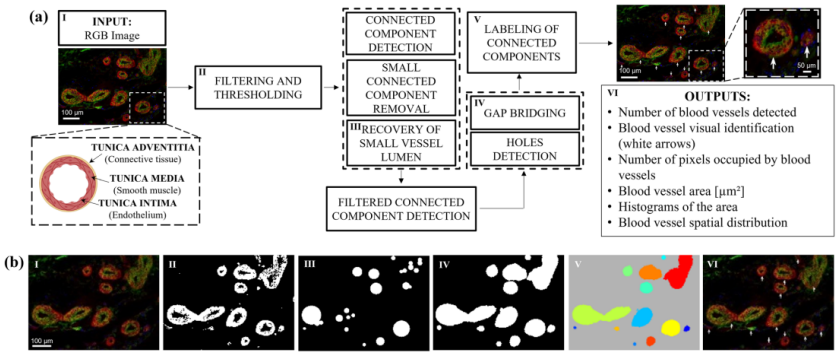

FIGURE 1. Workflow for blood vessel detection - BVD algorithm. (a) General block diagram of BVD algorithm workflow and its graphical illustration. (b) Representative rat cardiac tissue section co-stained with CD31 + αSMA, scale bar is equal to 100μm, different stages of the processing are illustrated in images (I–VI). (I) Starting RGB input image; (II) image equalized by 3 by 3 averaging spatial filtering and local thresholding; (III–IV) detection of connected components; (V–VI) labeling and extraction of morphological descriptors for the BVs, their location is highlighted with white arrows. The outputs of the analysis (VI) include: number, area (μm^2 and pixels), spatial distribution, vascular area, and diameter histograms.

3 References

Adamo, A., et al. "Blood Vessel Detection Algorithm for Tissue Engineering and Quantitative Histology." Annals of Biomed Enginr, Apr 2022 https://doi.org/10.1007/s10439-022-02923-2.