

Term Paper Proposal

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Question 1:

Identify a paper that discusses the basic pipeline of medical image analysis: preprocessing of the images, segmentation of Region of Interest (RoI), and classification

- a. Paper1: An adaptive threshold-based algorithm for optic disc and cup segmentation in fundus images
<https://drive.google.com/file/d/11I0CGQvOoWLqn-PGAbN3wtYoVyWdJwlf/view?usp=sharing>
- b. Paper2: Optic Disc and Cup Segmentation Methods for Glaucoma Detection with Modification of U-Net Convolutional Neural Network
<https://drive.google.com/file/d/1RjieZKj-xGgPluG43wjRTVm6J5aNSwKq/view?usp=sharing>

Question 2:

To implement the methods discussed in the paper, identify an appropriate dataset

- c. **Drishti-GS1**: dataset consists of a total of 101 images. These have been divided into 50 training and 51 testing images. All the images have been marked by 4 eye experts with varying clinical experience. All images were collected at Aravind eye hospital, Madurai from visitors to the hospital, with their consent. Glaucoma patient selection was done by clinical investigators based on clinical findings during the visit. Selected patients were between 40-80 years of age with roughly equal numbers of males and females. The data collection protocol was as follows.
- d. All images were taken centered on OD with a Field-Of-View(FOV) of 30-degrees and of dimensions 2896 X 1944 pixels and PNG uncompressed image format.
- e. Groundtruth was collected from data experts with varying clinical experiences of 3,5,9 and 20 years respectively.
- f. For the ground-truth collection, a dedicated marking tool was created to allow for precise boundary marking.
- g. <https://drive.google.com/file/d/1hGk2RdudftuxC3U8O3VcNaL67G2CTeDQ/view?usp=sharing>
- h. The ground-truth consists of the following information.
 - i. **Segmentation Soft Map**: It has been obtained by fusing the markings of all the 4 medical experts.

- ii. **Average OD and Cup boundaries:** These are obtained by averaging the manual markings over many angular sectors.
- iii. **CDR Values:** Since CDR is an important parameter for glaucoma assessment, hence CDR values corresponding to 4 expert markings are also provided.
- iv. **Image-level Decisions:** A binary image-level decision on whether each image is normal or glaucomatous is provided based on the majority opinion (3 out of 4) of experts
- v. **Notching:** Decision on the occurrence of notching in the superior, inferior, nasal, and temporal sectors, assessed by a single expert is provided

Question 3:

Work Plan for Paper 1:

1. To extract images and cdr values from each folder of the image in the Dhristi dataset.
2. To segment the cup and disc region from each of the fundus images using the methods discussed in the paper
3. Function: Calculate the cdr values from these segmentations.
4. segmented images are fed to these functions and corresponding cdr values are calculated and are stored in a CSV file.
5. Training of classification model and the output of results.

Work Plan for Paper 2:

Optic Cup Segmentation:

1. Crop the images by bounding the box of the optic disc (with margin from each side), which can be acquired from a trained algorithm for the optic disc.
2. Contrast Limited Adaptive Histogram Equalization (CLAHE) is used as a pre-processing

Optic Disc Segmentation:

1. Contrast Limited Adaptive Histogram Equalization (CLAHE) is used as a pre-processing

The core component of the method is a convolutional neural network built upon U-Net [21]. It is a neural network for image segmentation that accepts an image as an input and returns probability map as an output.

Potential Improvements:

- Try to experiment with different neural networks for segmentation purposes
- Compare the segmentation and classification accuracy between the 2 different methods proposed in the above papers using various metrics
- Try to use different machine learning algorithms for classification.