Image classification

Final assignment

This is a real world example, taken from ongoing research but with a simplified data set.

Goal: you want to automate optic disc grading.

Ophthalmologistsuse optic disc classification is used by or the diagnosis and treatment evaluation of glaucoma. Glaucoma is a disease of the eyes that causes blindness if not detected and treated timely and appropriately. Optic disc grading by ophthalmologists is time consuming and there is considerable inter-observer variability (two ophthalmologists often do not agree) and intra-observer variability (a single ophthalmologists often disagrees with him/herself if presented a week later with the same optic disc).

Instead of indirect ophthalmoscopy, a fixed based stereo camera can also be used to take stereo photographs of the optic disc. You are asked to classify stereo optic disc

The optic disc is at the back of the eye. Probably you have heard about the blind spot, which is the area in your visual field that you cannot see because the optic disc itself occludes your view. Ophthalmologists use indirect stereo ophthalmoscopy to grade the optic disc. The result is a number called the cup/disc ratio. One common way to define the cup/disc ratio is the area of the level part of the optic disc divided by the area of the deep ('cup') part of the optic disc. The higher the number the more likely that person is to have glaucoma. Usually ophthalmologists give only ten grades to the cup disc ratio, i.e.  $\{0.1, 0.2 \dots 1.0\}$  and no fractions in between.



You will be given 15 optic disc stereo pairs, as TIFF files with the left and right stereo images combined in one image and the ground truth, i.e. all pixels classified as either background, rum or cup, just as in the Figure.

You are asked to build the classifier using the stereo pairs as input with the highest possible correspondence of its output to the ground truth cup/disc ratio.

(Milan I can also give them a stereo classification if that is not really part of this course)

To help you along, there are two approaches to this problem, indirect and direct. You can build a classifier that classifies each pixel and then calculate the cup disk ratio from those pixels counts, or you can build a classifier that directly learns the cup disk ratio. In the real world, the indirect method is preferable. Ophthalmologists prefer to compare the quality of the output image to what they think is reasonable. Rather than being given a number of which they cannot verify how it was derived. But you are free to use either.