

# Improving diabetes classification from retina images

**Introduction:** Images of the retina contain information about systemic diseases and can be used to identify Type 2 diabetes (T2D). This can be useful in an easily accessible screening setting, such as an optician, to discover individuals with an increased change of having or developing T2D. We use machine learning techniques to classify T2D for so called ‘color fundus images’ from the Maastricht Study.

However, T2D classification from fundus images is a challenging task and the performance of our models still needs to be improved before the technique can be implemented in a screening setting. The improvement of T2D classification is what your challenge (Bachelor-assignment) will be about.

We offer two assignments that focus on different aspects of the diabetes classification process.

## Ba- Assignment 1

At this moment, classification is done for each image individually. However, for a clinically relevant setting, we would like to have classification on a patient-level (Fig 1). For some patients we only have a single image, while for others we have many. Also, we have images of the left or right eye, focused on the fovea or optic disc. We will use the machine learning model to give us an estimated probability  $P(T2D)$  that a fundus image is linked to T2D and a measure for the uncertainty of that probability:  $Var(T2D)$ . Your job is to come up with a smart way to combine all this information.

## Ba- Assignment 2

Not every image will be useful for diabetes classification. Some of the images are of poor quality and for some the uncertainty of the classification by the model is very high. Your first job is to write a Python tool to analyze the quality of the images and automatically remove outliers. Your second job is to use a technique called ‘test-time augmentation’ to identify and remove the images that the model is uncertain about. A tool to augment the fundus images is already available, but you will have to find the right parameters. Finally, you will evaluate how these strategies improve the overall T2D classification.

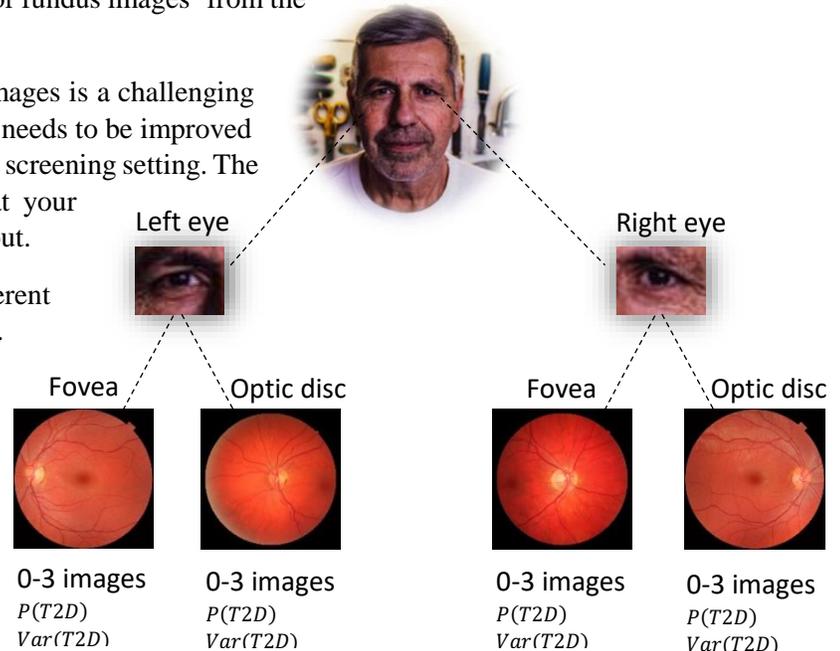


Figure 1: Diabetes classification based on multiple fundus images

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## Research topics

- Deep learning
- Multi-task learning
- Transfer learning
- Weakly labeled data
- Diabetes prediction