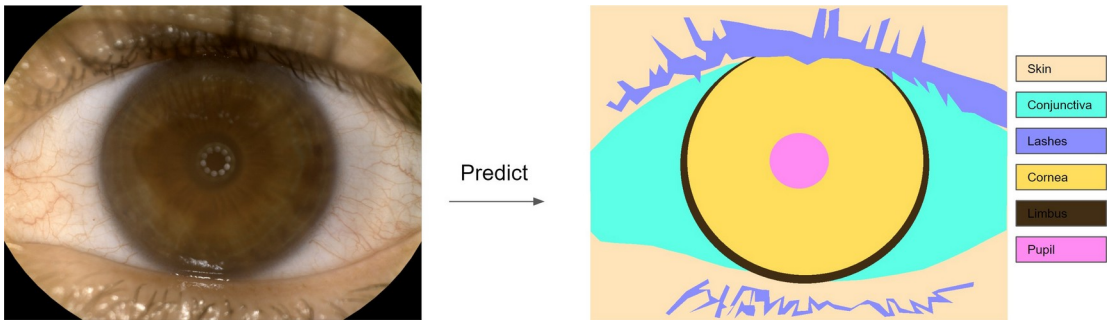
Semantic segmentation of external eye photography images

Presentation of the problem/motivation

External eye color photography is crucial for the documentation and monitoring of ocular surface diseases. Currently the lack of standardization in current imaging technology, e.g. slit-lamp based photography, inhibits the high-throughput extraction and quantification of ocular surface imaging biomarkers to support the clinical-decision making process. A novel ocular surface imaging system was developed by OCCYO with the aim of moving towards objective grading of ocular surface disease characteristics. For the robust and extraction of these parameters the semantic segmentation of the photographs is crucial in order to extract the parameters within the correct regions,
e.g. redness only of the conjunctiva. The aim of this work is to develop a method to perform a semantic segmentation of the images and label the images automatically with multiple classes such as skin, conjunctiva, lashes, etc.



Aim and leading question

In this work an approach to perform the semantic segmentation for the novel image data shall be developed. The aims are defined as the following:

1. Develop a machine learning based algorithm based on a dataset of healthy subjects to predict multiple classes such as skin, conjunctiva, etc.
2. Expand the dataset to include patient data and define sub-classes for ocular surface diseases
3. Combine the semantic segmentation with already developed feature extraction pipelines and evaluate on patient/healthy population

Method and planned strategy

Existing image data from a healthy eye study and clinical study will be used throughout this work. (1) A dataset comprising healthy eyes only needs to be defined and prepared for machine-learning based semantic image segmentation. Different deep learning architectures should be evaluated and trained for the multi-class image segmentation task and their performance must be evaluated. (2) The dataset will expanded to included patient data and the limitations of the approach are investigated. Sub-classes, e.g. birthmarks, lesions, might be defined and integrated into the model (3) The results of the segmentation should be used to evaluate different imaging biomarkers, e.g. redness, vessel density, in the defined regions and the population should be analysed.