

Masters-Thesis

Automated Corneal Endothelium Evaluation with Machine Learning

Univ.-Prof. Dr.-Ing. Volkmar Schulz
Institutes Head

Henning Konermann
Scientific Staff

*In cooperation with the ophthalmology
department of the RWTH Aachen University
hospital*

Raum 107
Kopernikusstr. 16
52074 Aachen

Telefon: +49 241 80-27862
konermann@lfb.rwth-aachen.de
08.01.2025

Background

Using keratoplasty (corneal transplantation) you can restore vision for blind or vision impaired patients. As basis for this procedure there is the need for healthy corneal donor tissue. Donor corneas are released based on endothelial cell density and morphology (e.g., polymegatism, pleomorphism, granulation, vacuolization). In our workflow, ophthalmologists assess microscopy images against German Medical Association guidance. This is time-consuming and resource-intensive. The goal is to develop and validate a machine-learning pipeline that automatically evaluates donor corneal endothelium on a large, private dataset of 10,000+ images.

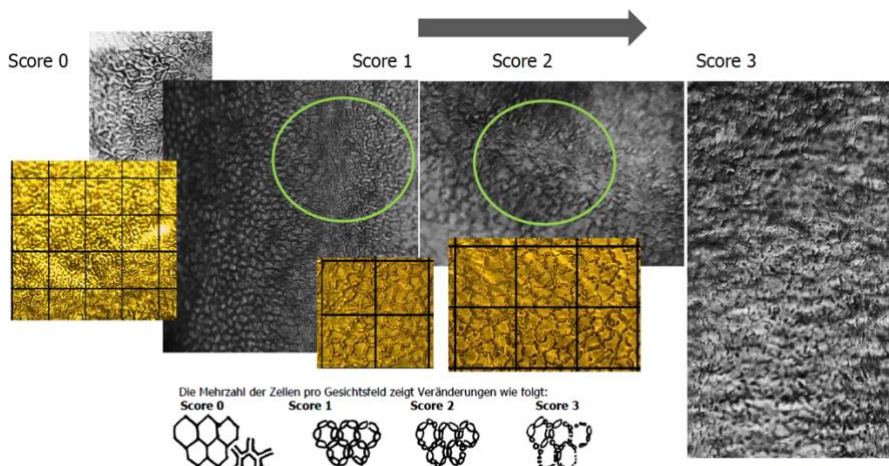


Figure 1 Medical staff training example of cornea segmentation from "Schulung Hornhautendothel-Evaluierung", Sabine Salla 05/2019

Tasks

- Curate and preprocess the dataset; define patient-level splits.
- Literature research on SOTA in the domain.
- Implementation of multiple baselines including hyperparameter optimization.
- Evaluation of the results using common domain specific criteriums.
- Assess robustness of the developed method.

Your Profile

- Solid programming experience, ideally Python.
- Structured approach to work.
- Experience with basic image processing techniques.
- Completed coursework in machine learning.
- (Optional) Prior experience with training neural networks.
- (Optional) Experience with libraries such as PyTorch, Lightning, Hydra, Optuna, OpenCV, Pillow, ...

Interested?

E-Mail konermann@lfb.rwth-aachen.de. We can discuss details or alternative research questions in a short meeting.