Lehrstuhl für Bildverarbeitung



Jun.-Prof. Dr.-Ing. Johannes Stegmaier Juniorprofessor for Biomedical Image Processing

Prof. Dr. Gaia Tavosanis Karolina Doubkova, M.Sc. Chair of Developmental Biology

Lehrstuhl für Bildverarbeitung Kopernikusstraße 16 52074 Aachen GERMANY

Telefon: +49 241 80-22917 Fax: +49 241 80-22200

johannes.stegmaier@lfb.rwth-aachen.de

acterization of Subcellular Alterations in Photoreceptor Axons of Drosophila Melanogaster

Master's Thesis: Automatic Char-

Description

Long before symptoms of neurodegeneration emerge, neurons accumulate subtle molecular alterations which lead to early cellular and subcellular changes in axons triggering axonal degeneration, impairing neuronal communication and subsequently resulting in neuronal death. To better understand these early events, we have developed a Drosophila model of sporadic neurodegeneration, the most common form affecting neuronal networks (Richard, Doubkova et al., 2022) in which we study early-stage alterations in axonal morphology including micro-tubule organisation, synapse loss and changes in mitochondria.



Figure 1: Drosophila melanogaster R7 healthy axons labeled with cytoskeleton marker UAS-tubulinGFP (green), Anti-Chaoptin antibody visualising the membrane of photoreceptors (magenta) and UAS-bruchpilot-short-straw-berry labelling active zone puncta (red) in medulla. Scale bar: 5 µm.





Tasks

We are looking for a motivated student to help establish a reproducible and sensitive method to characterize and quantify subcellular alterations in early degenerating R7 photoreceptor axons of *Drosophila melanogaster*. Structures of interest need to be segmented automatically in 3D microscopy image data and subsequently quantified for a biologically relevant readout. We aim to develop an automatic processing pipeline that involves both classical image processing algorithms and state-of-the-art deep learning models and will customize the most suitable architectures to the envisioned task.

Requirements

- Interest in digital image processing
- Thorough programming skills (ideally in Python)
- Previous experience with image analysis and/or deep learning is advantageous.
- Interest in biology, neuroscience and microscopy data analysis

Our Offer

This project offers hands-on experience in neurobiology research in collaboration with the group of Prof. Dr. Gaia Tavosanis (Chair of Developmental Biology) and quantitative analysis of microscopy data contributing to a better understanding of neuronal resilience and vulnerability. The topic is aimed at Master's students with a technical background (e.g. electrical engineering or computer science) and is supervised in cooperation between the two institutes mentioned above. A working place can be provided at the Institute of Imaging and Computer Vision and includes access to modern IT infrastructure including a powerful GPU computing cluster.

If you're interested in neuroscience, microscopy data analysis and exploring the mechanisms of neurodegeneration, we'd love to hear from you! Please contact us with your CV and current transcript of records via email to <u>johannes.stegmaier@lfb.rwth-aachen.de</u>.

References

Richard, M., Doubková, K., Nitta, Y., Kawai, H., Sugie, A., & Tavosanis, G. (2022). A quantitative model of sporadic axonal degeneration in the Drosophila visual system. *Journal of Neuroscience*, *42*(24), 4937-4952.