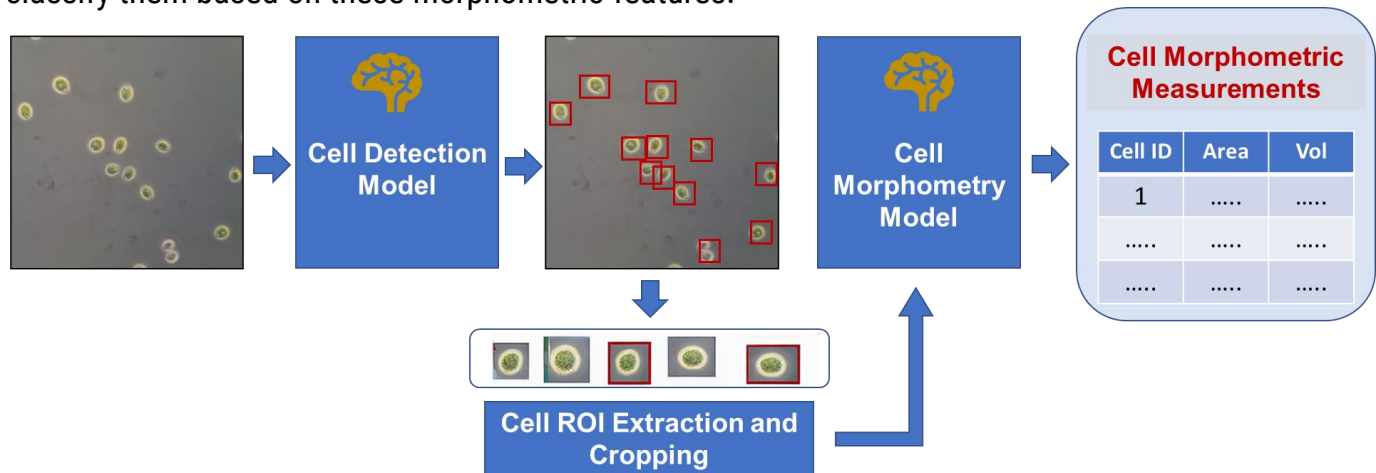


## Master Thesis

### Computer Vision-Enhanced Modeling for Microalgae Populations Monitoring

Microalgae are photosynthetic microorganisms with increasing commercial interest. Despite their potential, commercial cultivation is often limited by challenges such as contamination and the need for reliable continuous monitoring, as traditional assessment methods are time-consuming and laborious. Recent studies demonstrated that computer vision and deep learning can automate species identification and cell health tracking, offering a scalable solution for process monitoring and optimization.

The objective of this project is to develop a computer vision-based model for real-time monitoring of microalgae cultivation and population dynamics, aiming to enhance accuracy, reduce reliance on manual sampling. The expected outcome is a model reliably detecting different microalgal cells, able to estimate their morphometric characteristics such as length, width, area and volume, then classify them based on these morphometric features.



#### Task description

- Literature research on existing computer vision-based modeling approaches applied to microalgae
- Data annotation and classification based on cells' morphometric features (e.g. length, width, area and volume)
- Model training and validation of size-based cell differentiation within each microalgal species
- Integration of features for culture health monitoring (e.g. dead cells detection)
- Expanding model applicability to a broader range of species

**Requirements:** Background in deep learning and computer vision (hands-on experience using PyTorch and scikit-learn)

**Start:** As soon as possible

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**What to expect:** During your research you can expect close guidance, while also maintaining freedom in how you approach the tasks. Through intermediate presentations you can prepare for your final defense and gather feedback from multiple team members throughout your project. The thesis can be written and supervised both in English or German, if your study regulations allow.