

Explore Fungal Behavior through Image Analysis and Machine Learning

Main goal: To develop algorithms for quantitative analysis of mycelial architecture from microscopic images, revealing hidden traits of hyphal growth behavior.

Description:

Fungal mycelium enables fungi to explore and interact with spatially and temporally heterogeneous environments. It operates across multiple scales, where microscopic hyphal traits and cellular processes shape the macroscopic behavior of fungal colonies and networks. Recently, fungal mycelia have also emerged as promising sustainable biomaterials, offering environmentally friendly alternatives to non-renewable or polluting materials.

Understanding the rules that govern mycelial organization and how microscale properties influence macroscale mechanical performance is crucial for both fungal ecology and the development of mycelium-based materials. However, current knowledge of mycelial growth dynamics, architecture, and behavior at the hyphal level remains limited. Extracting structural information from complex mycelial networks is particularly challenging due to the dense, overlapping structures that complicate image segmentation and feature detection.

At present, image analysis is performed manually, which severely limits the throughput and reproducibility of data extraction. This project aims to establish an automated workflow that applies deep learning–based methods to segment fungal mycelial networks and quantify their architectural features.

The student will:

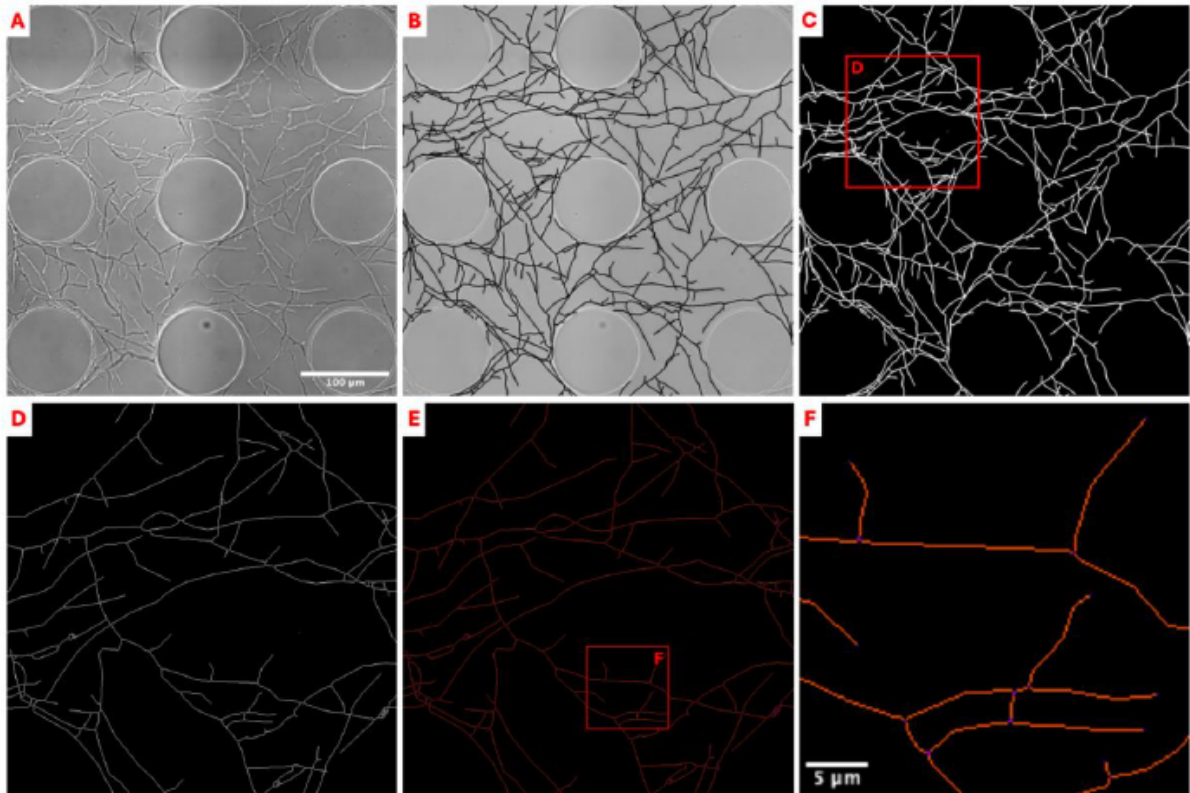
- Modify and optimize existing YOLO-based image segmentation models to detect and extract fungal mycelial structures from microscopy images.
- Develop algorithms to analyze quantitative features such as hyphal tips, total hyphal length, branching points, and overall network topology.

Requirements:

Applicants should have:

- Proficiency in Python programming and experience setting up machine learning environments.
- Basic knowledge of or interest in deep learning–based object detection (e.g., YOLO or similar frameworks).
- Curiosity and willingness to learn about fungal biology and its relevance to biomaterials.

This project is interdisciplinary task within biology and engineering. You will primarily work with Dr. Kristin Aleklett and Dr. Hanbang Zou. This project is designed for a MSc student with background in engineering/mathematics.



Start Date: Flexible

Contact information:

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