AARHUS UNIVERSITY
DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINERING

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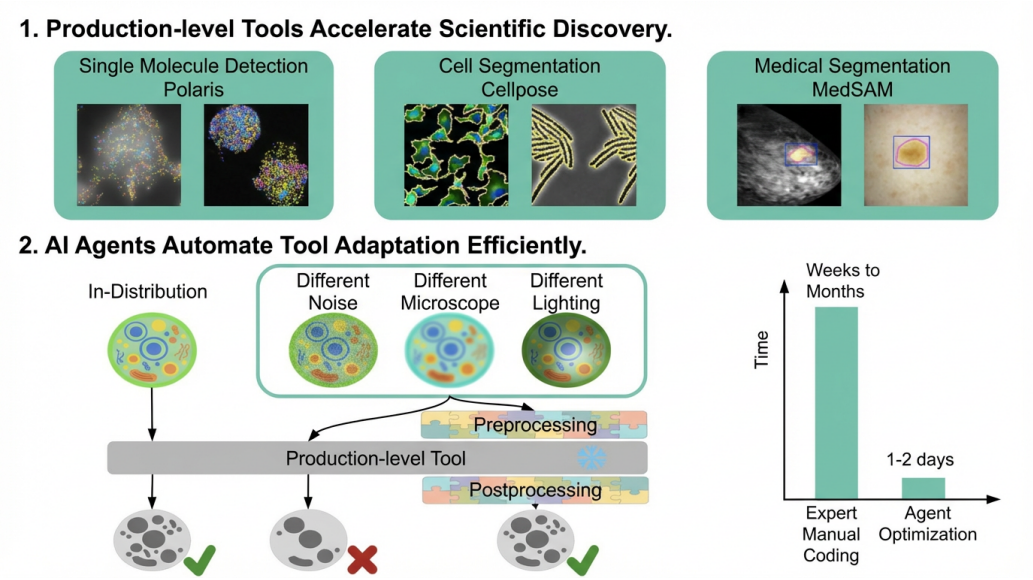
A3 Lab

MASTER'S PROJECT AVAILABLE

Agentic AI for Scientific Discovery



Motivation

Automated computer vision tools are fundamentally reshaping scientific discovery in biomedical imaging. However, when scientists apply pretrained foundation models (like MedSAM) to bespoke scientific datasets, the models frequently underperform due to domain shifts. While **Agentic AI** (LLM-based "Code-Writing Agents") can automate the adaptation of these tools in just a few days, it faces a critical limitation: **Overfitting**. When agents utilize automated search loops to find optimal hyperparameters based on small validation sets, their performance on unseen test data often degrades drastically.

Objective & Methodology

This Master's thesis aims to solve this critical limitation. The student will utilize and expand upon modern open-source agent frameworks (e.g., *simple-agent-opt* [1,2]) to develop robust, "anti-overfitting" mechanisms for self-coding agents.

Key Tasks:

- Familiarize with baseline agentic frameworks for Python code generation.
- Implement novel strategies to prevent overfitting, such as an "LLM-as-a-Critic" agent to penalize overly complex code, or dynamic cross-validation prompt loops.
- Benchmark the robust agent against expert baselines on molecular, cellular, and macroscopic biomedical datasets.

Requirements

- Strong programming skills in Python (OpenCV, skimage, PyTorch).
- Concrete knowledge of Machine Learning and Computer Vision.
- Familiarity with LLM API integration is a strong plus.

References

[1] X. Wang *et al.*, "Simple Agents Outperform Experts in Biomedical Imaging Workflow Optimization," *arXiv*, 2025.
[2] Z. Jiang *et al.*, "AIDE: AI-driven exploration in the space of code," *arXiv*, 2025.

Application

If you are interested in this project, please email your CV and a brief transcript to:

Dr. Behzad Bozorgtabar at **behzad@ece.au.dk**.