

Project Title: Image-Based Bioengineering Data Analysis and Query Tool Development

Deadline: February 1st, 2025

Project Description:

This project focuses on the analysis of a dataset comprising images obtained from a bioengineering experiment. Each image in the dataset contains a group of cells (as shown in the provided sample screenshot). The project aims to automate the extraction and transformation of data from these images into a structured, tabular format, facilitating efficient analysis and querying. The steps involved in the project are outlined below:

1. Image Analysis and Feature Extraction:

- Develop image processing pipelines to analyze each image.
- Identify and segment individual cells in the images.
- Extract key attributes for each cell, such as size, shape, position, density, and other relevant metrics.
- Capture summary statistics for each image, if applicable (e.g., average cell size, distribution patterns).

2. Data Transformation and Tabular Format:

- Organize the extracted cell-level and image-level data into a well-structured tabular format.
- Ensure the tabular dataset is comprehensive, containing both individual cell attributes and summary-level information for each image.

3. Interactive Query and Analysis Tool:

- Build an intuitive tool that enables users to query the dataset in the tabular format.
- Implement functionalities to support natural language or SQL-like queries, allowing researchers to ask complex questions about the data (e.g., "What is the average cell size in image X?" or "Show all images where cell density exceeds a certain threshold").
- Provide options for data visualization, such as histograms, scatter plots, or heatmaps, to represent query results effectively.

Objectives:

- Automate the conversion of unstructured image data into structured, analyzable formats.
- Enable bioengineers and researchers to perform detailed analyses and derive insights from the dataset efficiently.
- Offer a flexible tool for querying, summarizing, and visualizing key information derived from the images.