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ECE601
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Structured Illumination Macroscopy Sprint 1

Project Definition

Structured Illumination Microscopy (SIM) is an imaging technique that creates super-resolution images by going beyond the diffraction limit of light. It has been successfully used in the medical field for the purpose of detecting microscopic changes in cells. This project proposes modifications to this technique in order to enable the resolution of larger objects while simultaneously capturing finer details at a scale that was previously unachievable with traditional imaging methods. To achieve this, an optical sensor will need to be built alongside an algorithm that can predict the dominant frequency components of an object to efficiently use the structured illumination technique.

User Stories

- As a **radiologist** or **pathologist**, I want to use macroscopic SIM technology to non-invasively examine tissue samples and larger organs, so that I can detect both large-scale abnormalities and microscopic details in a single imaging session. This would allow me to provide a more comprehensive diagnosis, saving time and reducing the need for invasive biopsies or multiple imaging techniques.
- As a **materials scientist**, I want to inspect composite materials for micro-defects while being able to examine large structural components without sacrificing resolution. This would help me ensure the structural integrity of the materials used in aerospace, automotive, or construction industries.
- As a **quality control inspector** in manufacturing, I want to use macroscopic SIM to identify surface defects on large manufactured parts (such as engines or turbines), while also spotting smaller flaws like material fatigue or micro-cracks that could compromise performance.
- As a **forensic investigator**, I want to use macroscopic SIM to examine large crime scene objects like vehicles or walls for both large-scale damage and small, crucial forensic details (e.g., gunpowder residue, fingerprints, or tool marks).
- As a **security and surveillance operator**, I want to use macroscopic SIM to monitor large areas such as borders, airports, or sensitive facilities, while being able to zoom in on smaller, subtle details like unauthorized intrusions, hidden objects, or facial features from

a distance. This would help me improve security by identifying potential threats or suspicious activities without sacrificing coverage.

Define MVP

The minimum valued product (MVP) will be an imaging system with straightforward software for operation and reconstruction and initial training materials.

Sprint 2 Plan

- Begin prediction algorithm
- Plan to get equipment
- Plan for experiments