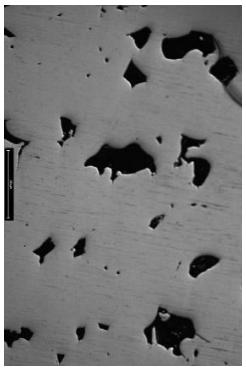
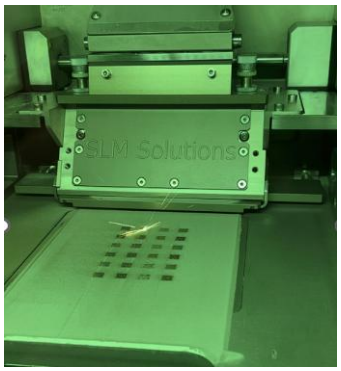
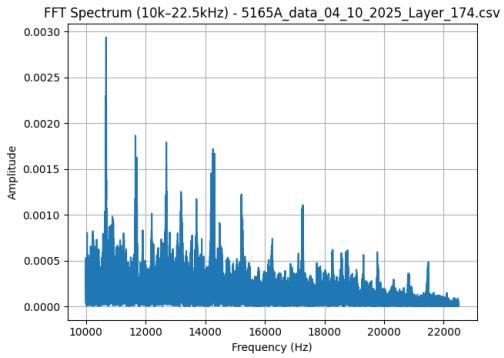
Defect Detection System in Selective Laser Melting using Convolutional Neural Networks

Presented By: Ethan Gaigalas

Committee Members: Dr. Ramanan Sritharan (Chair, ME), Dr. Xuan Wang (IME),
Dr. Simon Xing (ME)







Additive manufacturing, or 3D printing, has gained widespread popularity as a rapidly advancing manufacturing technique. Selective laser melting (SLM) stands out for its ability to produce high-quality metallic parts, specifically for critical applications in the biomedical and aerospace industries. SLM's versatility enables fabrication of complex and completely unique geometries for specific applications. However, significant challenges remain regarding part quality, with defects such as cracks, porosity, warping and distortions compromising structural integrity and reliability. Efforts to improve SLM focus on quality monitoring during the build process, aiming to detect defects early in the manufacturing process. Identifying defects before a part is complete can save substantial time, money and resources. Artificial intelligence has emerged as a valuable tool for quality monitoring, allowing models to learn common defect types, their formation mechanisms, and patterns. This thesis utilizes acoustic sensing to develop and train a convolutional neural network (CNN) to identify keyhole and lack of fusion pores in SLM layers, validating the model's accuracy using microscopy images and relative density measurements.

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