

Project Title: Use Computer Vision to Design of Failure Detection System for FDM 3D Printers.

Supervisor: Prof. Yu Zou(MSE & MIE)

Disciplines Required: ME(3)

Start Date: Sep. 7, 2021

End Date: Apr. 31, 2022

Application documents: CV, transcripts, and a short summary of research experience (if available)

NDA:Yes

Project Description:

In order to increase the productivity and the quality of fused deposition modeling (FDM) 3D printing objects, this research is determined to investigate a failure detection system that is capable of monitoring, simplifying, and adjusting the additive manufacturing process. FDM printing is known to have a high failure rate of 20-25%. Due to lack of precision and hardware controllability, the misalignment and errors during extrusion stand as the main reasons contributing to this unstable printing. Many research literature and projects have been completed to tackle this problem, notably the slicing engine enhancement, pre-printing simulation, and slicing parameter optimization. All these attempts are proven ineffective as they are unable to detect and diagnose unexpected printing errors during the printing process. Hence, to boost the success rate, this research project decides to focus on developing a deep learning (DL) algorithm embedded in the close loop monitoring system, which is responsible for identifying a variety of failure types and proactively initiate print job protection mechanisms. This project composes of three different phases: infrastructure design (camera bracket), data acquisition and annotation (image collection and labeling), DL model training and evaluation.

Project Deliverables:

The developed failure detection system is responsible to self-identify various failure types, including faulty bed adhesion, under/over-extrusion, and print spaghetti. It should also incorporate the feature of altering the printing process corresponded to the identified failure. High-speed GPU cards are recommended to be used for this system to accelerate the model training and shorten the project timespan. The expected deliverables will be a functional system that can accomplish a fivefold decrease in the failure rate of printers.