# CALIFORNIA SCIENCE & ENGINEERING FAIR
# 2018 PROJECT SUMMARY

**Name(s)**

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**Project Number**

38243

**Project Title**

## Computer Vision for Detecting Errors in 3D Printing

**Abstract**

**Objectives/Goals**

This project aimed to create a computer vision system which can detect errors in real-time during 3D printing, and can pause the printer and notify the user when an error is detected. The errors that can be detected are filament running out, plastic drips, object motion, and extruder jams.

**Methods/Materials**

The materials and equipment used are a 3D printer (Prusa i3 MK2), PLA plastic filament for printing, a webcam, and a laptop or Raspberry Pi single-board computer for processing. The methods used are various image processing algorithms which were written for this project. Filament running out is detected by counting the number of pixels brighter or darker than a threshold near the top of the printer where the filament crosses contrasting light and dark bars. Plastic drips and object motion are detected by using the 3D object model to create a silhouette of how the object is supposed to look from the viewpoint of the webcam. During printing, the growing object shape is compared against the silhouette to count bad pixels (object pixels that are located where the silhouette says they should not be). Extruder jams are detected by seeing if the object is failing to grow.

**Results**

The errors that were detected were having the filament run out, an object shifting position during a print, a plastic drip such as that arising from the design having an excessive cantilever, and extruder jams. For each algorithm, when a misprint was detected, the print was paused successfully and an email was sent to the user.

**Conclusions/Discussion**

The algorithms work correctly and can be useful for preventing wastage of materials during long prints. The methods can be improved by using two cameras to observe different viewpoints, and by finding ways to detect errors in surface texture.

**Summary Statement**

I created a program that uses a webcam to detect various errors that can occur in real time during a 3D print.

**Help Received**

None, I coded the entire thing myself.