

FOD Object Detector Project Proposal

Foreign Object Debris (FOD) on runways cause billions of dollars in damage annually. FOD is any object that shouldn't be on a taxiway or runway. Turbines on planes ingest air in front of the prop and the most conservative guidelines suggest absolutely nothing should be within 40 meters in front of the turbine as to avoid debris from entering the turbine and causing damage to the plane. Common types of debris include rocks, tools, pieces of metal and destroyed plastic, and wire. This debris is commonly found to have fallen from the various utility vehicles that roam around the airports.

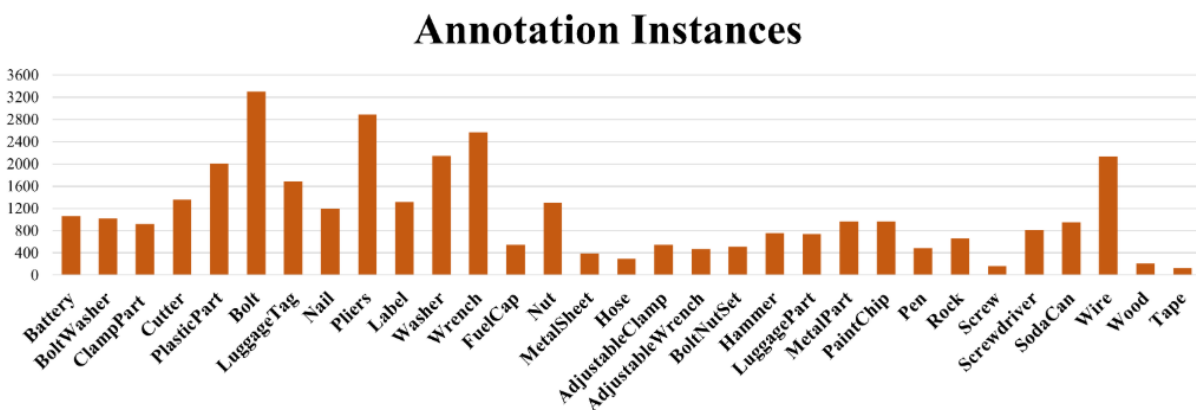


Fig. 1. Number of categories and image instances.

The FOD-UNOmaha dataset is a large image dataset that consists of over 8000 images of common types of debris. The images were taken with a pavement background to emulate a runway. These images were taken in many types of conditions such as daytime/nighttime and wet/dry. The goal is to make an object detection model for FOD specific applications.

In a real-world environment, the machine learning model can be deployed on an IoT camera device using TensorFlow Lite that faces downwards on the airstrip. This model would be used to determine the severity level of the FOD by determining the type of FOD and the distance of the suspected debris to a ground aircraft. This information would be sent to air traffic control so that they can command the pilots to avoid FOD that may go unseen.

The scope of this project is to 1) create an object detection model for FOD that labels the correct debris 2) create a script that takes the result of the machine learning model and combines it with the calculated distance of that debris to an aircraft on a map.

Initial tasks are to start with a couple pre-trained image detection models and transfer the learning to the FOD specific application using TensorFlow and Keras. By finetuning the best model, the accuracy score should be above 60% for the smallest objects i.e. hardware, bolts, and washers, and over 90% for bigger, defined objects like tools.

The data source for the project is located at: <https://github.com/FOD-UNOmaha/FOD-data>