

Automated insect farming with Machine Vision

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Introduction

Food security is a primary global concern due to ever growing population especially in era of climate change. Therefore, finding sustainable sources of food are inevitable. Since animal protein is one of major sources of food for humans, its sustainable production requires sustainable feed sources. As traditional feed resources such as soybean and fishmeal have been sources of deforestation, loss of biodiversity, etc. so it becomes imperative to find environmentally friendly and sustainable alternatives. Therefore, in 2013, the United Nations Food and Agriculture Organization (FAO) published a report about prospects of using insects as replacement for soybean and fishmeal. Since insect farming is in its infancy and to replace traditional feed resources, insect farming needs automation to make it profitable and tackle issues arising due to mass production.

The aim of the proposed research is to improve insect farming by automating data collection and analysis using the Internet of Things (IoT) and Machine Vision algorithms.

Objectives

- Detecting and counting insects
- Anomaly detection
- Size based classification
- Gender based classification

Data

Data used for model training and testing consists of:

- IoT based device developed by SciFlair (Insecto) installed at mealworm facility
- Synthetic data to automate labeling and creating anomaly



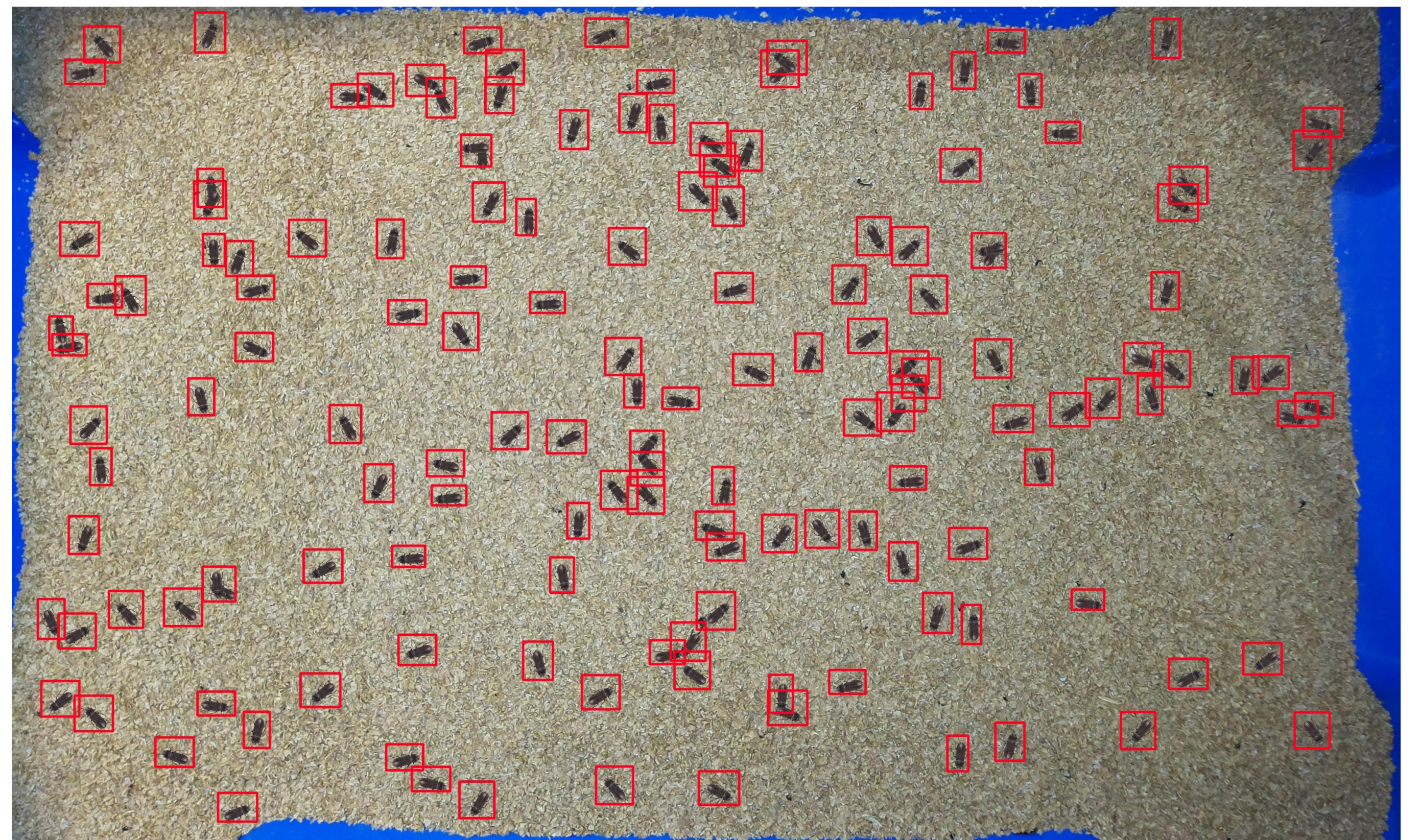
Insecto: IoT based device developed by SciFlair to capture high resolution images, videos and sensor data (temperature, humidity, CO2 etc.)

Methodology

For detection of adult mealworm beetles, three scenarios tried for training YOLO model with synthetic data

- 50 to 200 adult beetles in single tray
94 % mAP
- 500 to 1000 adult beetles in single tray
74% mAP
- 500 to 1000 adult beetles in single tray but model trained by dividing input image into small patches
93% mAP

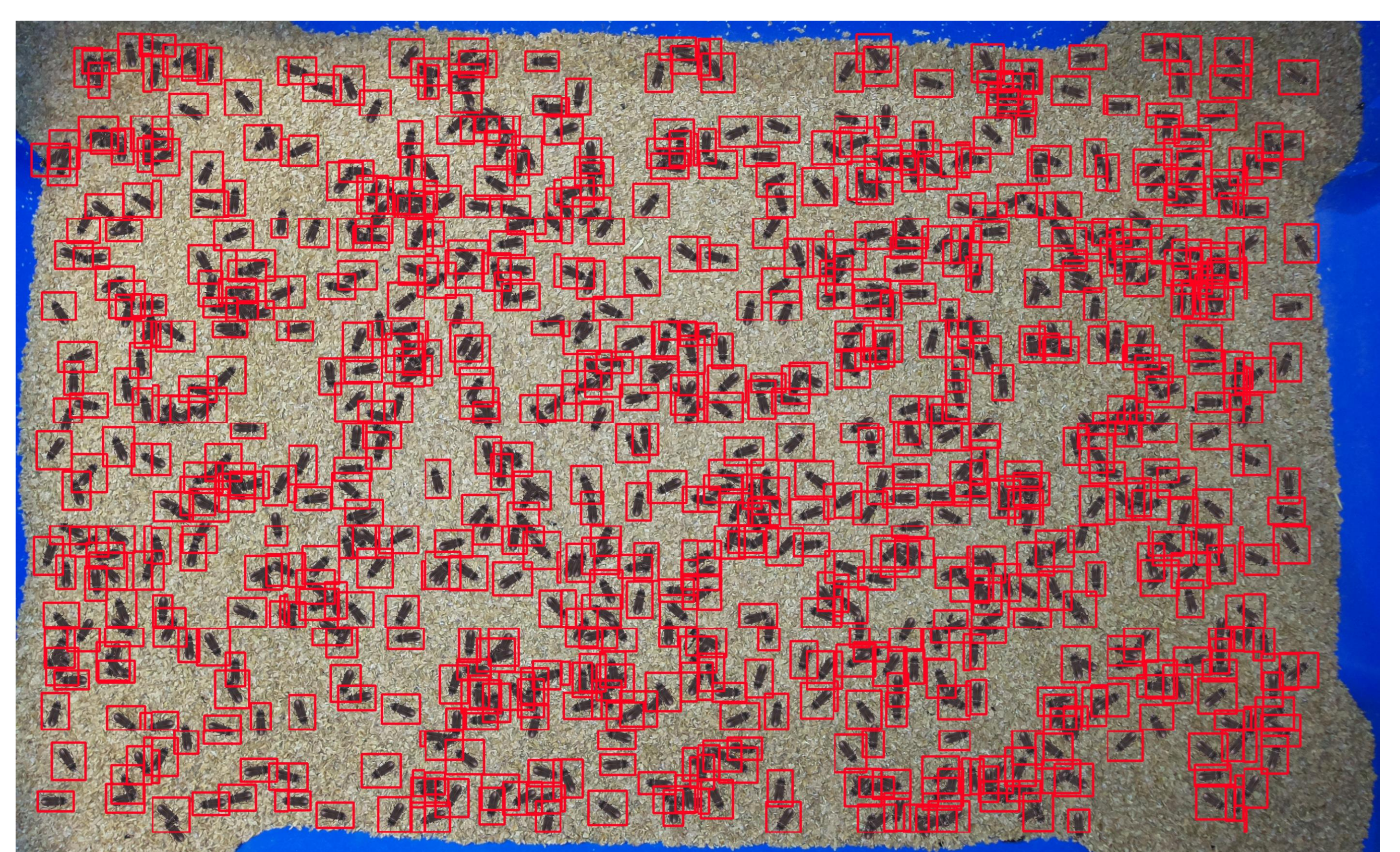
Results



Detection using YOLO (50 to 200 adult mealworm beetles in single tray)



Detection using YOLO (500 to 1000 adult mealworm beetles in single tray)



Detection using YOLO but with sliced images (500 to 1000 adult mealworm beetles in single tray)

Future Work

- Try Mask RCNN
- Detection of larvae