Pivot Robotics Computer Vision Challenge

Criteria

This take-home aims to assess your ability to:

- Understand CV papers and implement their algorithms, especially for defect detection.
- Train ML algorithms.
- Demonstrate proficiency in working with 3D point cloud data.
- Correctness, clarity and cleanliness of your code / robustness / reproducibility (how easy can someone else on the team pick up where you left off).

Task

You will be implementing the 3D Student-Teacher (3D-ST) method for anomaly detection of 3D data as described in this paper.

1. [Synthetic Data Generation]
    a. Generate a synthetic dataset using the method described in page 9 of the paper consisting of a training and validation set of 500 and 25 point clouds using the ModelNet10 dataset.
2. [Implementation]
    a. Implement the teacher model T, decoder model D and student model S as described in section 3 of the paper in the framework of your choice (PyTorch / TensorFlow/ JAX). Set d = 64.
3. [Training]
    a. Train the teacher and decoder model in a self-supervised fashion with the reconstruction loss as defined in section 3.1. Utilize data normalization and store the value of s. Show training curve the model.
    b. Train the student model with knowledge distillation objective from section 3.2, using the value of s from above using the training split of the anomaly-free data from the MVTec 3D-AD dataset. Show training curve for the student model.
4. [Evaluation]
    a. Utilize the Teacher and Student models to create visualizations of the anomalous points for any object of your choice from the anomaly data in MVTec 3D-AD dataset. Similar to Figure 8. in the paper.