NANYANG TECHNOLOGICAL UNIVERSITY SINGAPORE

School of Computer Science and Engineering
College of Engineering

# Out-of-Distribution Lane Detector

## on a Low-Cost Cyber-Physical AV Test Bed

Student: Gan Shyan

Supervisor: Associate Professor Arvind Easwaran

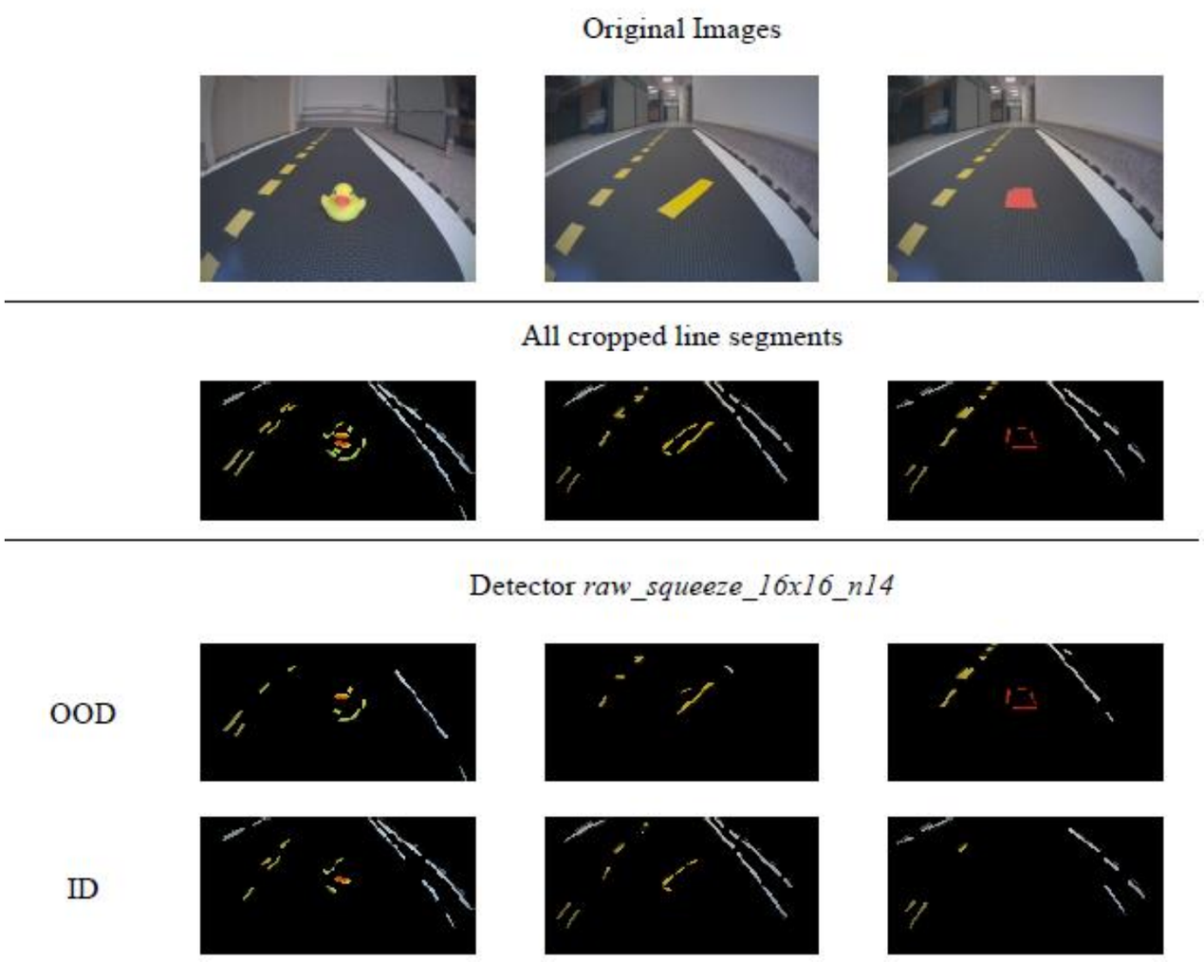
### Project Objectives:

Novel Out-of-Distribution (OOD) lane markings could cause computer vision-based lane following algorithms to output unsafe steering inputs. In this project, a Convolution Neural Network (CNN) Variational Autoencoder (VAE) based OOD detector is integrated into a lane detection pipeline to perform OOD detection on lane markings. Different ways to integrate the detector are explored, and their performances compared. The best performing detector is deployed on a Jetson Nano powered low-cost robotic testbed, and a real-life demonstration is used to show that our proposed detector can successfully stop the robot in the presence of previously unseen lane markings.

### Evaluating Performance of OOD Detector

OOD detection was done on small sections of a background image cropped using the detected Hough line segments. 72 different detectors were trained on datasets created using different background images, cropping technique, resize dimension, and number of latent dimensions.

Performance was compared using AUROC metric. The best detector (right) had a score of 0.89.




### Emergency Braking Demonstration

A single frame can have dozens of individual cropped segments. If the percentage of segments classified as OOD exceeds a threshold, an alert is triggered and the robot is stopped.
We placed an obstacle to generate OOD line segments and had the robot travel down the lane towards the obstacle autonomously. Over 12 runs, our proposed system was able to successfully stop the robot before it collied with the obstacle.