

Object Detection and Estimation with Thermal Imaging

Name: Yixin (Elliott) Huangfu

Supervisor: Saeid Habibi

Program: Mechanical Engineering

Level of studies: Ph.D.

Presentation Date: Apr.30, 2020

Project Description

- Application of thermal imaging in autonomous driving
- Thermal imaging
 - captures infrared radiation from pedestrians and animals.
 - are more reliable under extreme conditions such as fog, blizzard, and nighttime.
- Benefits
 - enhancing the perception of autonomous systems.
 - Improving road safety.
- (Master work of Ben Miethig)



Optical Camera

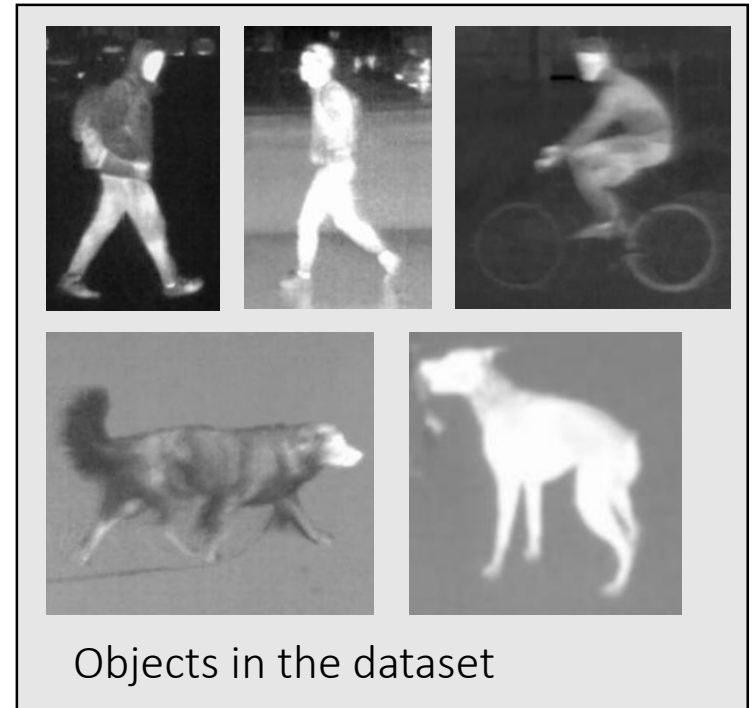
Infrared Camera

Objective(s)

- Develop an infrared camera application that
 - Detects road objects.
 - Estimates object distance and location.
 - Integrates with autonomous driving sensory framework.

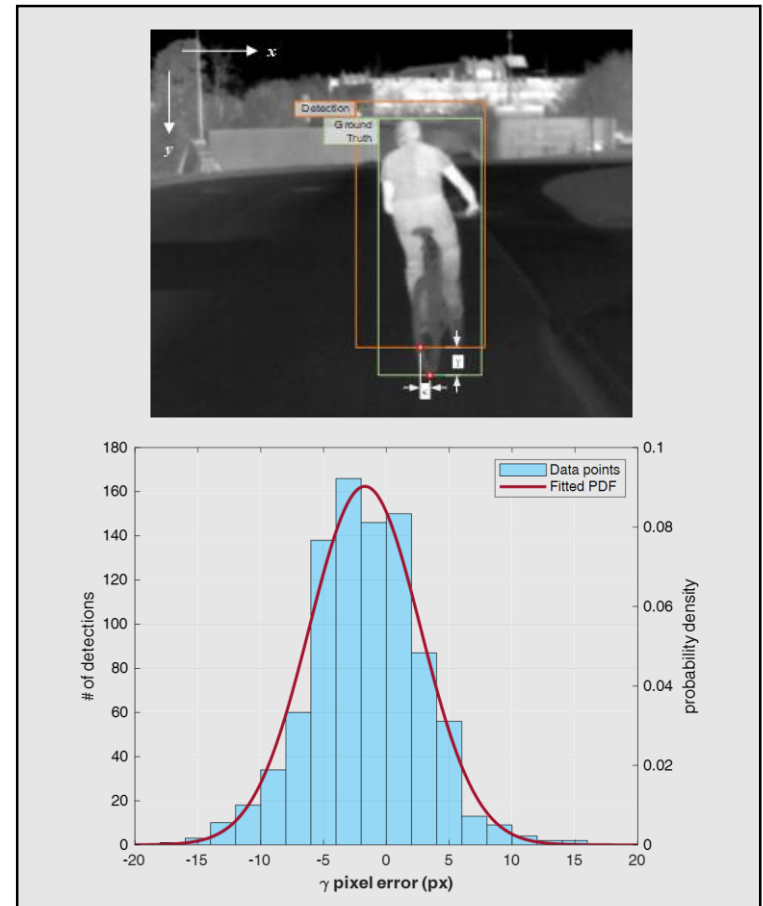
Tasks/Plan

- Hardware
 - Select a thermal imaging camera for autonomous application.
- Data
 - Collect, label videos for a variety of driving conditions.
- Detection
 - Choose a deep learning algorithm for object detection.
 - Train the neural network using infrared images.
- Estimation
 - Develop a method to estimate object location with probable error.



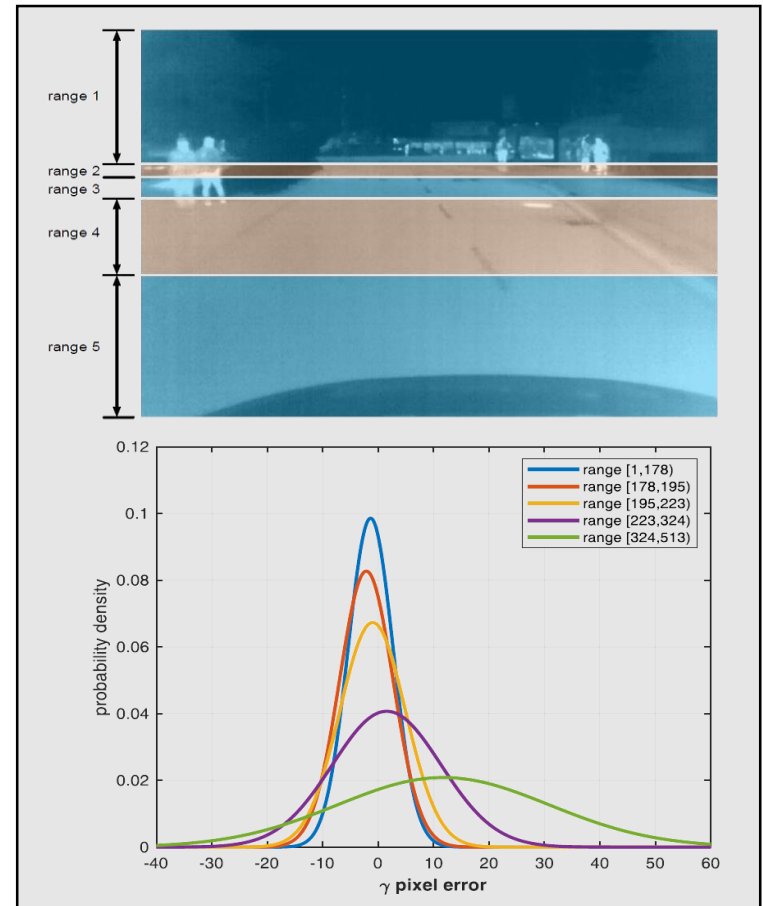
Progress Report

- Object Location Estimation
 - Predicted locations have errors compared with ground truth.
 - The errors follow certain Gaussian distributions depending on object locations, but the mean and deviation vary.



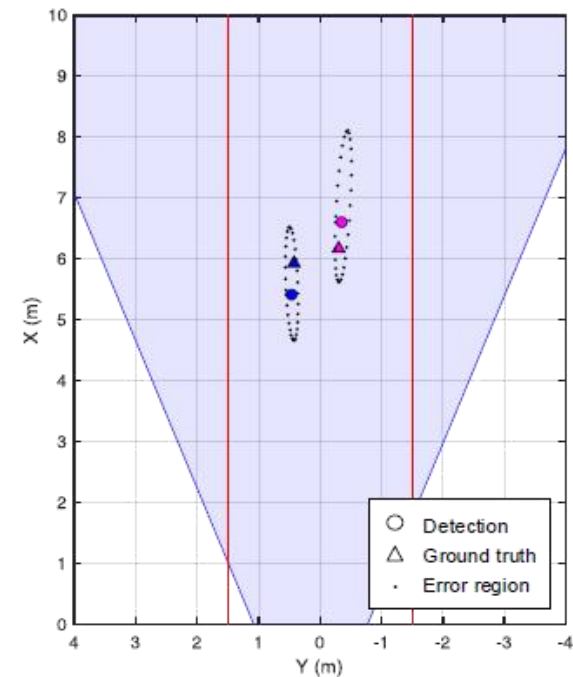
Progress Report

- Object Location Estimation
 - Predicted locations have errors compared with ground truth.
 - The errors follow certain Gaussian distributions depending on object locations, but the mean and deviation vary.
 - We identify ranges with similar distributions using z-score hypothesis test.
 - And obtained final error distribution of 5 different ranges with a high confidence level.



Progress Report

- Object Location Estimation (continued)
 - Estimate object location in World Coordinate with the error distribution.



Thank you!