

Deep Learning

CS 7644 ML for Robotics
Groups 1 and 4

Agenda

Project Overview

- Objective 1 Formulation
- Objective 2 Formulation

Machine Learning Principles

- Building a Dataset
- Building the Network
- Training a Network

Project Outcomes

- Objective 1 Performance
- Objective 2 Performance

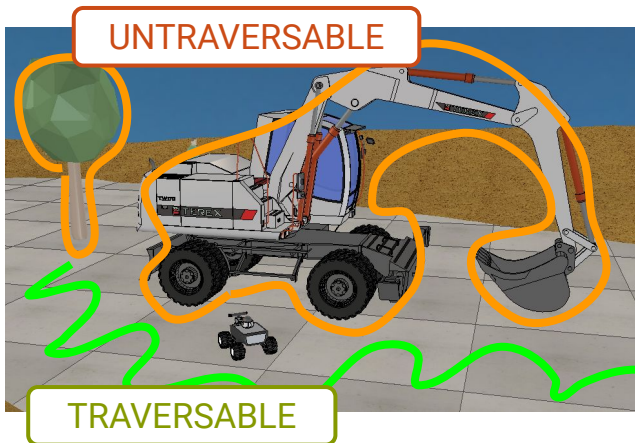
Project Overview



Objectives

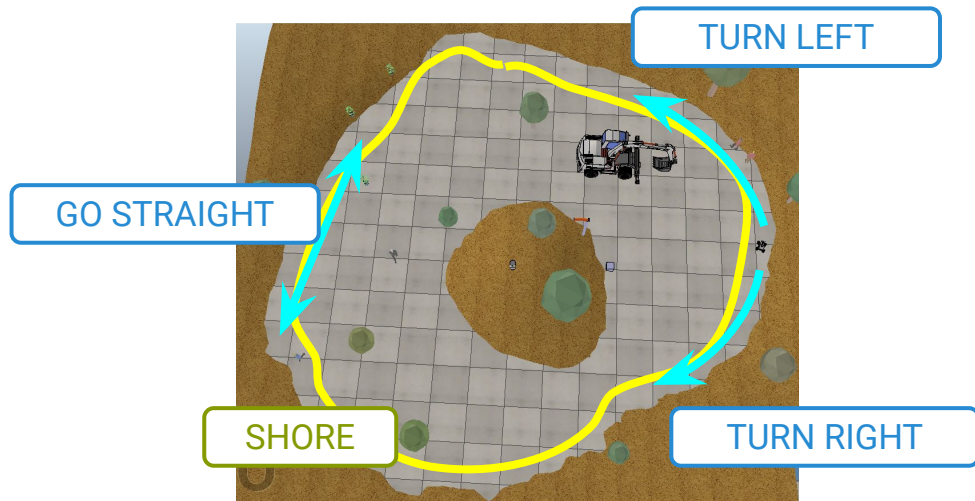
Objective 1: Traversability Identifier

- Build a good data set
- Learn how to use servers
- Train a model to identify the traversability



Objective 2: Shore Follower

- Train a model to follow the shore
- Teach the model how to find the shore



Machine Learning Principles



Building a Dataset

Collecting Good Data

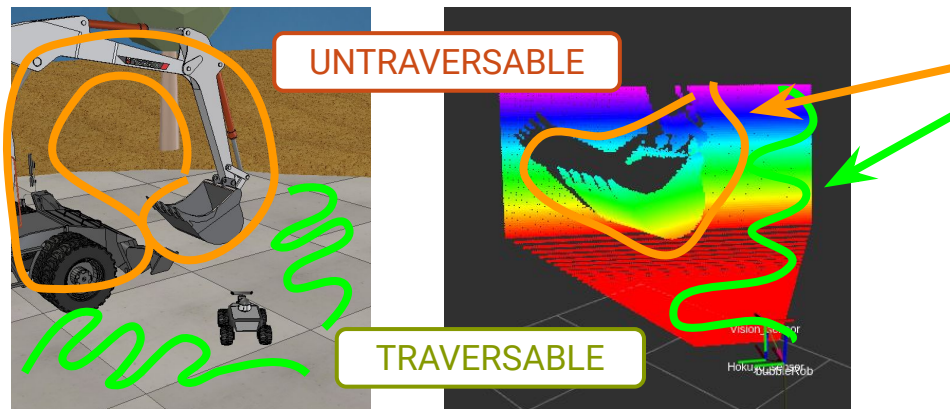
- Balance the number of samples between different labels
- Try to include all features in the dataset

Use these practices when collecting both training and validation data!

Building a Dataset

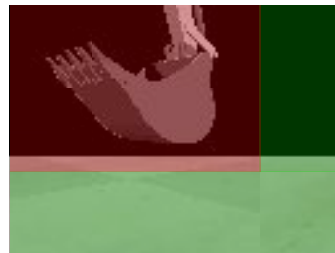
Objective 1 Context

- Show robot all the features of the map: excavator, shoreline, people, trees, cube
- Labels: TRAVERSABLE, UNTRAVERSABLE, UNUSABLE



Labelling process

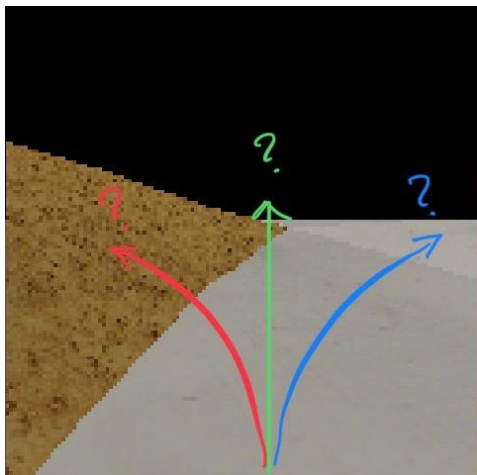
- total: total number of points from point cloud
- count: counter of traversable points
 - our metric: points with height below $z = 0.1$
- make a ratio of count / total
- if total = 0, image is UNUSABLE (error)
- if ratio < 0.25, image is UNTRAVERSABLE
- if ratio ≥ 0.25 , image is TRAVERSABLE



Building a Dataset

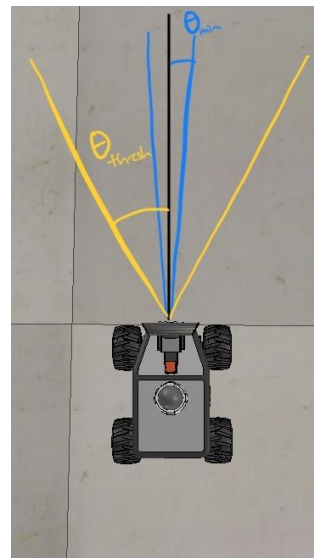
Objective 2 Context

- Drive along the shore
- Labels: **STRAIGHT**, **TURN RIGHT**, **TURN LEFT**

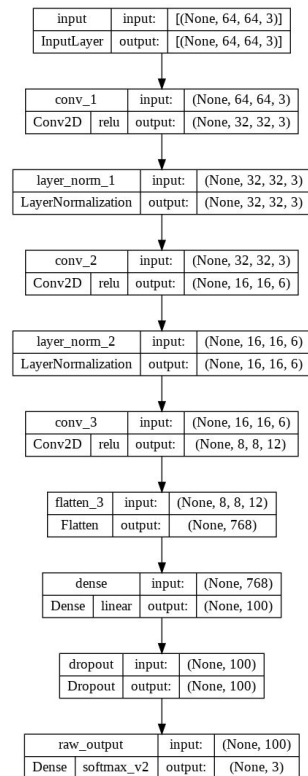
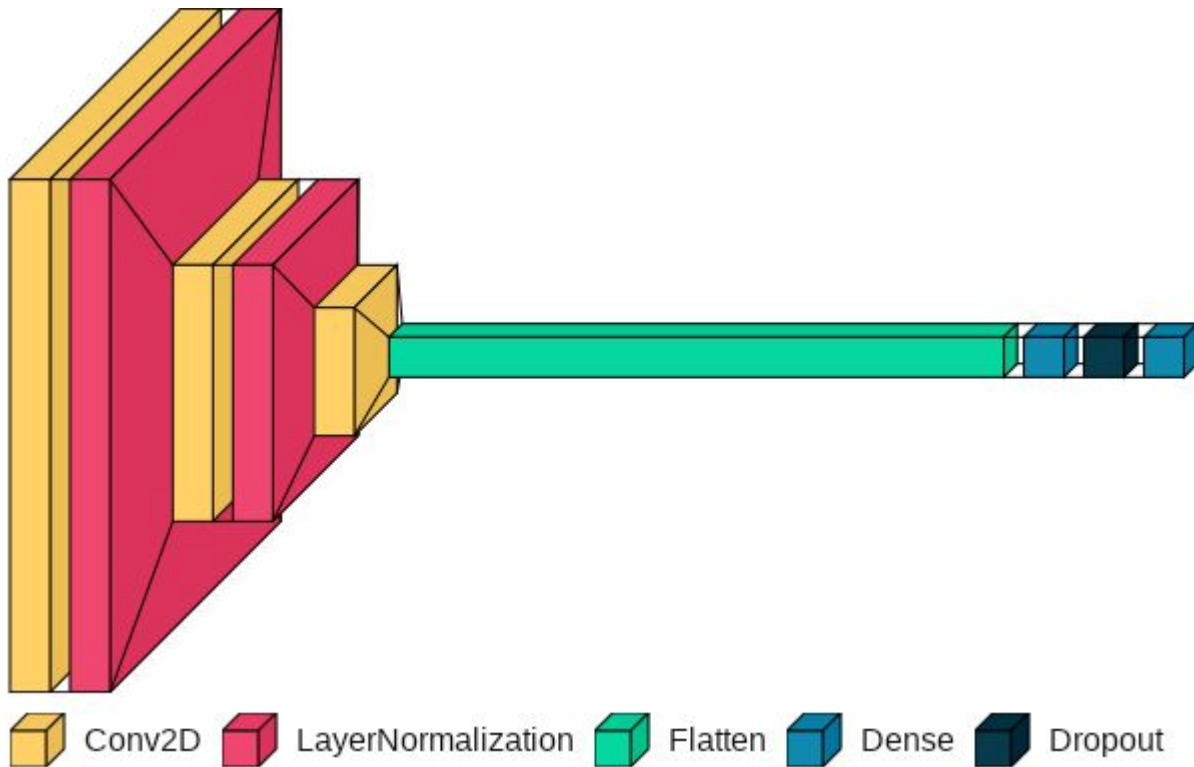


Labelling process

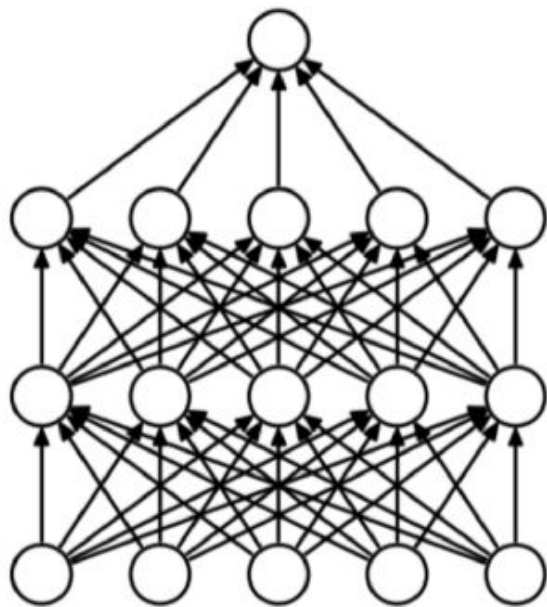
- Minimum rotation & displacement
- Rotation threshold



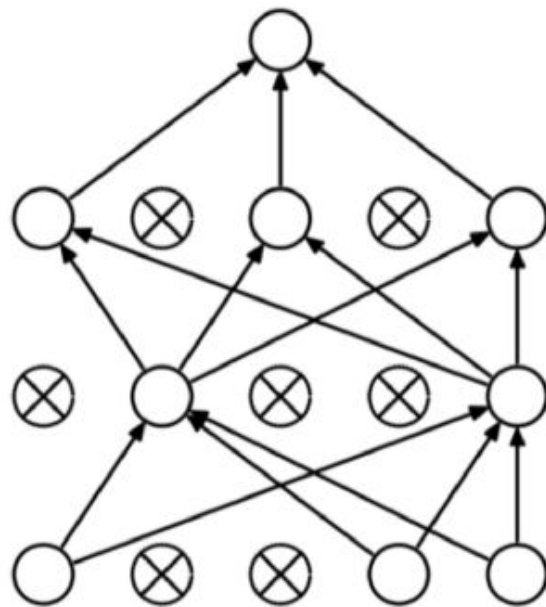
Building the Network



Dropout



(a) Standard Neural Net



(b) After applying dropout.

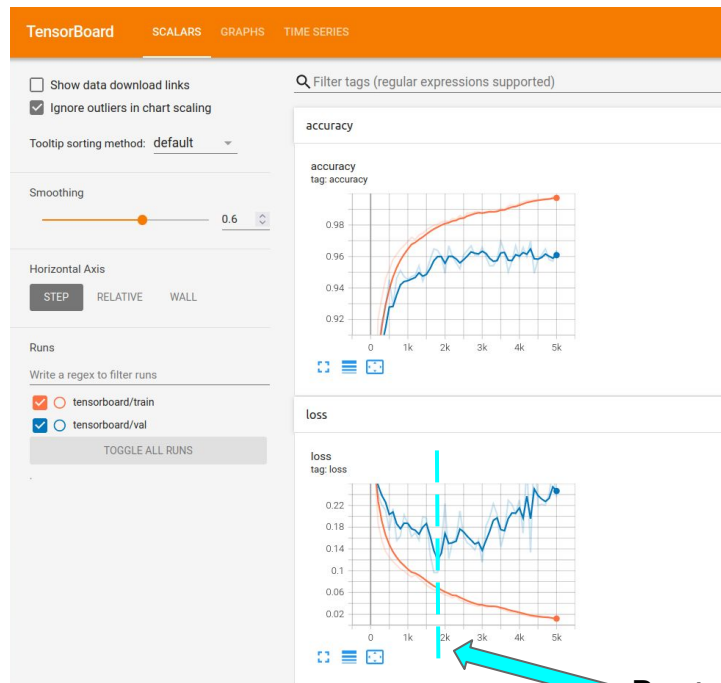
Training a Network

Take project 1 for instance, we train the network for 5000 epochs

It's important to check the loss curves:

- From the training loss curve we can know if the network is learning
- From the validation loss curve we can know if the model is overfitting

We choose step_2000 as the best model

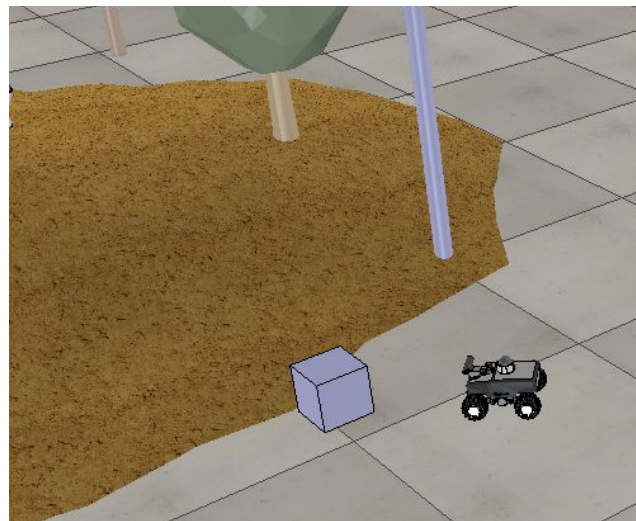
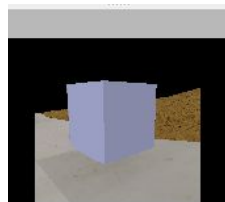


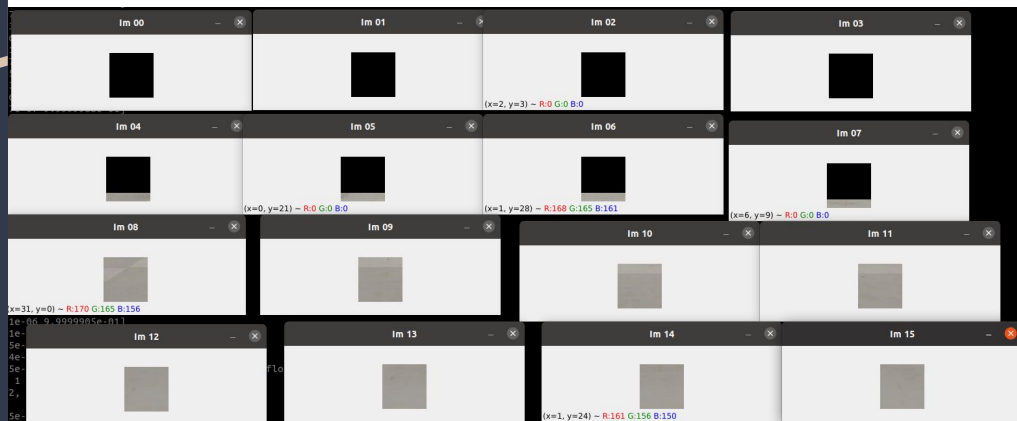
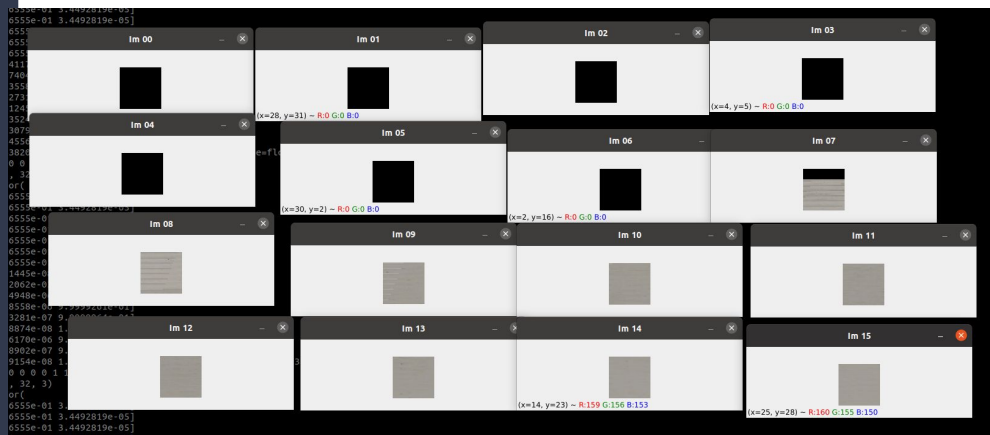
Project Performance



Objective 1

Demo of traversability identifier





Objective 2

Demo time!