CSC2515 Project Proposal
Autonomous Driving: Road-Estimation

Jacob Lambert* (1001319842)
Rikky Duivenvoorden† (997455329)

1 Project Overview

The project we propose consists of a comparison of classification algorithms in their ability to accurately classsify what is road and non-road in the suggested autonomous driving: road estimation topic. The dataset is the base kit of the road/lane detection evaluation of the KITTI dataset, described in further detail below. The training data will be split into 60% for training, 10% for validation, and 30% for testing, and preprocessed so that classification is conducted on superpixels. The algorithms used for comparison are listed below, and will be compared in precision, false-positive and false-negative error rates.

2 Dataset

The data used in this project is provided by the KITTI Vision Benchmarking Suite[1] which is widely used in robotics for testing machine learning algorithms. The Road/Lane Detection Evaluation (2013) dataset contains images (with individual pixel color intensity) of urban scenes taken from the top of a vehicle, with ground truth labels for roads. There are three different scene categories, as seen in figure 1:

- urban unmarked roads (uu),
- urban marked roads (um),
- urban roads with multiple marked lanes (umm),

each with roughly 100 training images and 100 test images. The main dataset used will be the urban

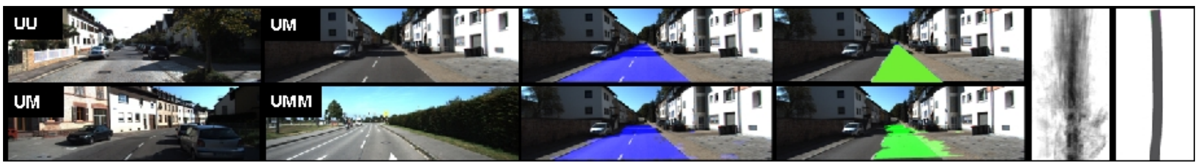

Figure 1: Example of the different scenes in this KITTI dataset with road labels.

marked road dataset as project focuses road estimation and not individual lanes. A possible extension to this project would be to analyze the impact of scene type by evaluating performance on all datasets individually, then combining them.

*jacob.lambert@mail.utoronto.ca
†rikky.duivenvoorden@mail.utoronto.ca
[1] http://www.cvlibs.net/datasets/kitti/

3 Algorithms

This project will compare three supervised learning algorithms and, if possible, a state-of-the-art technique. The three benchmarking algorithms are:

Regression: relates input and output based on a function. Several different functions will be tested (linear, logistic, polynomial, etc.).

k**NN:** classifies based on the majority vote of its k Nearest Neighbours in feature space.

SVMs: attempts to learn a map from the input to a seperable feature space used for classification.

SVMs and kNN have been compared for image classification in [1]. Otherwise, there are several possibilities for state-of-the-art techniques to test for this task but obvious choice would be Convoluted Neural Networks which, according to the KITTI leaderboard, perform very well on this task [2,3]. Further research will be required to find a more complex algorithm that remains within the scope of this course.

References

[1] Jinho Kim, Byung-Soo Kim, and Silvio Savarese. Comparing image classification methods: K-nearest-neighbor and support-vector-machines. In *Proceedings of the 2012 American Conference on Applied Mathematics*, pages 133–138, Stevens Point, Wisconsin, USA, 2012. (WSEAS).

[2] Alex Krizhevsky, Ilya Sutskever, and Geoffrey E. Hinton. Imagenet classification with deep convolutional neural networks. pages 1097–1105, 2012.

[3] Rahul Mohan. Deep deconvolutional networks for scene parsing. *arXiv:1411.4101 [stat.ML]*, 2014.