National College of Ireland

Configuration Manual

MSc Research Project
Research in Computing CA1

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MSc Project Submission Sheet

School of Computing

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Programme:	Master of Science in AI for Business **Year:** 2024
Module:	MSc Research Practicum
Lecturer:	Victor del Rosal
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Project Title:	Advancements and challenges in Autonomous Vehicles: Accelerating or braking based on Image processing
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Signature: Jon-Eder Alday Vitorica

Date: 12/08/2024

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1 Selection of data and model

To be able to perform the study desired in this research it will be needed to have the appropriate equipment and platforms to be able to perform the tests. This manual will show the process performed to create an SVM model to predict if the autonomous vehicle must brake or accelerate.

The first thing that must be performed to be able to start the process is to define the model that is going to be used and how the data has been prepared to train the model. The model chosen in this case is a Support Vector Machine since most of the studies for autonomous vehicles are performed in Convolutional neural networks since this method is prepared to recognize and process images. This method was chosen for the analysis to be able to give different results than other studies already performed. Moreover, I was selected since SVM models are accurate when analysing two parameters and therefore it is ideal for the study.

To develop the SVM analysis the dataset was extracted from Kaggle. (P V , 2019)
This dataset is formed by 49000 images of different situations on the roads of India in which autonomous vehicles could be involved. This dataset has images shown frame by frame to get reliable answers. However, processing this large number of images can be difficult since the equipment needed to process them must be powerful enough. Taking into account these aspects the dataset was reduced and divided into two. From the 49000 images the dataset was reduced into the folders accelerate, which includes 144 images from the originals, and brake which counts with 228 images. These images were selected to show different situations and provide a better understanding for the researchers.

2 System and environment requirements

To proceed with the development of this model it must be taken into account that there are certain requirements to process this kind of information. The first requirement is the system that is going to be used to develop the method. In this case, the equipment used is a Lenovo Ideapad gaming 3-15ACH6 laptop. The CPU is an AMD Ryzen 5 5600h and the

GPU is an NVIDIA GeForce RTX 3050 4GB. In terms of storage, it is equipped with a 512 GB SSD PCIe, and the memory of the laptop is 8GB DDr4-3200.

In terms of environment, the study has been performed in Google Colab which is a Jupyter notebook service that allows users to access computer resources such as GPUs and TPUs. This platform allows us to perform the Python analysis. To develop the study, relevant libraries must be installed to get the correct results. The libraries that were installed in this case are cV2, os, NumPy, sklearn, and matplotlib. To be able to change the size and colour of the images we used cV2. The os library is installed to be able to retrieve documents from the computer. Numpy allows us to work with linear algebra and matrices to get accurate results. The SKlearn library is the one that allows the program to implement machine learning and statistical models. Matplotlib is used to create all the visualizations that we need to show in the research. Seaborn was also applied which is another library that provides visualizations of the results. To obtain the last results that confirm the efficiency of the model we introduced a TensorFlow which allows us to train the model in a different simpler way. This will also allow us to introduce the image generator to perform tests where the images vary in size and orientation.

3 Model configuration

After installing the necessary libraries, they must be told the steps that must be followed. First, a function that loads images from the folders and assigns labels to the images has to be introduced by applying the library cV2. Then proceed to normalize the images and define the path of the folders that must be used. The images will then be loaded and pre-processed to be able to train the data. This data is split into two, having the training data and the test data in a proportion of 80%-20%. The SVM model will then be trained by applying a linear kernel. The model is then asked to give back the accuracy and the classification of the report to see if the model is working. Finally, the model is asked to provide a visualization of the prediction of the images with the real result.

In the second part, a similar process was followed. However, this process is working over the previous results, and we provide a sample of both brake and accelerate images to see that the model is predicting the results correctly and following the process of resizing and converting the images to RGB, as well as normalizing. The model is introduced with the labels for the images “brake and “accelerate” and then asked to give feedback on the images and their results. Since one of the images given was incorrectly classified, we asked the model to give feedback with a confusion matrix and a classification report to compare and contrast with the first one.

Finally, we introduced a tensorflow and the images were reuploaded, processed, and labeled again. In this part of the study, we follow a process similar to the previous examples.

However, we use augmentation by applying an image data generator. This is supposed to give the images different sizes and allow us to compare the original images with the augmented ones. The model is then asked to perform the SVM analysis by retrieving a confusion matrix, Receiver operating characteristics, and accuracy. Then we tried to perform the comparison with the sample images, but the code gave an error.

4 Bibliography

P V , A. (2019). *Self Driving Car on Indian Roads*. Retrieved from Kaggle: https://www.kaggle.com/datasets/ananduthaman/self-driving-car-on-indian-roads/data