Delta Force
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Professor Amir Jafari

Group 5 Proposal

Machine Learning II Project: **Predicting Vehicle Speed from Live-Action Driving Footage Using Deep Learning**

Participant Presenters: **Luis Ahumada, Sam Cohen, Rich Gude**

Purpose Statement:
The autonomous car industry is on the cusp of transforming the way people drive. More and more companies such as Waymo and Tesla are investing heavily in R&D to develop a safe self-driving car. Yet, to allow cars to be fully autonomous, massive datasets with live-action driving footage from a variety of angles are needed to train machine learning models to perform routine activities such as stop, speed up, merge, and more. This study aims to create a deep learning model to predict the speed of a vehicle. Models like the one developed in the study can be used to help cars recognize their speed and figure out how much a car will need to increase or decrease its speed to perform functions such as stopping.

Dataset:
The training dataset under consideration is a 17 minute video of a live-action car driving through different environments (city and highway). There are 20,400 frames in the training video, with 20 frames per second. The camera is positioned directly inside the car's windshield and can view the roadway in front of the car and the surroundings of the car. In addition, a text file accompanies the training video which identifies the speed at each frame. The test dataset is a 9 minute video with similar live-action footage and the same camera position. There are 10,798 frames in the test dataset, with 20 frames per second. The dataset originates from an autonomous vehicle software company called comma.ai. Comma.ai uses the dataset to create a programming challenge for job applicants to the company.
The data is located at:
https://github.com/commaai/speedchallenge

Approach:
This study will first perform object detection to identify objects in each image frame. These objects will be used to calculate distance from the car, which will be an input into the machine learning model. The team will perform additional pre-processing to make object detection easier and to eliminate unnecessary elements in the frames. The study will primarily examine Recurrent Neural Networks (RNNs), specifically LSTM models, to predict the speed of the car, as RNNs have the ability to "remember" previous frames. The team will train their own models but will also experiment with pre-trained models, such as VCG16. The deep learning frameworks used will be Keras and Pytorch.

Metric for Success:
The main performance metric to evaluate success will be Mean Squared Error (MSE). The team chose this performance metric because the comma.ai challenge uses MSE to judge the quality of the predictions.

Project Schedule:
In order to meet the needs of the presentation schedule, this project will be completed within four (4) weeks time, by December 8, 2020.