AI RC car racing

RCSnail OÜ operates a RC (remote control) car racing track in Tartu SPARK Democentre. The cars have camera attached, the view from camera is shown on monitor and the car can be controlled with driving wheel. Up to four people can race against each other simultaneously.

This setup is also ideal for creating a self-driving car. Thanks to recent advances in deep learning it is viable to drive a car based entirely on the visual input. The easiest approach would be to do behavioral cloning - train a neural network to imitate a human driver. The input to neural network would be camera image (or sequence of camera images) and outputs are driving commands - wheel turn, acceleration and brake values.

The project consists of:
1. Creating a Python API for communicating with the RC car.
2. Recording training data - camera images and driving commands - from drivers.
3. Training a deep learning model to imitate human driving commands.
4. Connecting deep learning model to actual car through Python API.

Keras\(^1\) deep learning framework could be used to train the model. Initial model could be based on one of the pretrained ImageNet models\(^2\), i.e. AlexNet, VGG or ResNet. One notable challenge is making the model fast enough so that it can produce driving commands real-time. Simplified network architectures like Yolo\(^3\) might be the solution. Or just faster GPU.

RCSnail has plans to include accelerometer sensors on the car, which would allow also using reinforcement learning. Crashing the car against the wall would count as negative reward or penalty. Distance traveled would count as positive reward. Initial training could be done with behavioral cloning and fine-tuning with reinforcement learning.

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\(^1\) https://keras.io/
\(^2\) https://keras.io/applications/
\(^3\) https://pjreddie.com/darknet/yolo/