

Data Collection for Explanation Quality Evaluation

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1 Introduction

My name is Suhong Moon and my research colleagues are Professor John Canny and Domas Buracas from UC Berkeley. We are planning to gather autonomous driving data. We will ask you to drive the car in the simulator (CARLA) with a defensive style and aggressive style, while describing your actions and reasons. The data we gather is 1) driving videos, 2) the status of car such as speed and courses and 3) the voice record of your explanations on the actions you take while controlling the car in the simulator.

2 Install Instruction

2.1 Install CARLA

You can find CARLA 0.9.9 in this <https://github.com/carla-simulator/carla/releases/tag/0.9.9>. Please following these steps to install CARLA simulator.

1. Make directory you want to install CARLA. Here, we use `~/carla`
2. Download and unzip “CARLA_0.9.9.4.tar.gz” into `~/carla` you want to unzip
3. Download “AdditionalMaps_0.9.9.4.tar.gz” but do not unzip this file but place this file in `~/carla/Import`
4. Move to `~/carla` and run `./ImportAssets.sh`
5. Move to `~/carla/carla/PythonAPI/carla/dist` and install CARLA python package with following command,

```
easy_install carla-0.9.9-py3.7-linux-x86_64.egg
```

2.2 Install Dependencies

After setting up CARLA, clone this repository, https://github.com/SuhongMoon/Explanation_Quality_Eval.git, move to this directory and install the dependencies with the following command,

```
wget https://repo.anaconda.com/miniconda/Miniconda3-latest-Linux-x86_64.sh
bash Miniconda3-latest-Linux-x86_64.sh
conda create -n carla python=3.7
conda activate carla
git clone https://github.com/SuhongMoon/Explanation_Quality_Eval.git
pip install -r requirements.txt
```

3 Playing Instructions

Before describing how to run the controller and play with this simulator, we will give you some advice that you should keep in mind.

Explanation Example		
Scenario	Aggressive Style	Cautious Style
Driving the clear road	I am accelerating hard because the road is clear	I am maintaining the current speed because there is the speed limit
Following the leading vehicle	I am tailgating the leading vehicle because the leading vehicle is too slow.	I am maintaining the clearance distance because the leading vehicle moves forward with constant speed
The leading vehicle stops before the stop sign	I brake hard because the leading vehicle suddenly stops	I smoothly slow down because the leading vehicle stops.

Table 1: Examples of Explanation

3.1 Driving Rules

The rules you need to follow are simple: even when you drive the car aggressively, you should follow the lane correctly, not make any accidents and stay on the road.

3.2 Driving Style

There are clear differences of actions between defensive and aggressive driving styles. Defensive driving is quite intuitive. It is socially acceptable driving behavior like: keeping safe distance, maintaining proper speed and accelerating/braking smoothly. For more information about defensive driving behavior, please refer this link https://en.wikipedia.org/wiki/Defensive_driving. Aggressive driving is less straightforward. Typical aggressive driving behaviors include speeding, driving too close to the car in front, not respecting traffic regulations, improper lane changing or weaving, etc. Most people drive aggressively from time to time and many drivers are not even aware when they are doing it. National Highway Traffic Safety Administration(NHTSA) identifies the following actions as aggressive driving behavior:

- Following improperly / tailgating
- Improper or erratic lane changing
- Operating the vehicle in an erratic, reckless, careless, or negligent manner or suddenly changing speeds without changing lanes.
- Failure to yield right of way.
- Failure to obey traffic signs, traffic control devices
- Driving too fast for conditions.
- Making an improper turn.

The two driving styles should have very noticeable differences in the following characteristics: the clearance between ego vehicle and the car ahead of it, speed, acceleration, and deceleration.

3.3 Verbal Explanation

Your explanation should contain the description and counterfactual reasoning of your behavior. Also, explanations should contain language unique to the driving style it is describing. (Consider "rapid" vs "gentle" acceleration) In some scenarios like driving on a clear highway, being detailed and choosing words well is especially important for good descriptions. So we listed some examples of explanations for each driving style in Table 1.

3.4 Running the Simulator

You can execute the simulator with following steps.

1. Run `./CarlaUE4.sh -benchmark -fps=10` in `/carla`
2. Run following command to run manual controller when driving car aggressively:
`./manual_control_image_augmentation.py --style aggressive`
3. Otherwise, run following command:
`./manual_control_image_augmentation.py --style cautious`
4. If you press R after running manual controller, it starts to record your play. We recommend you practice to play with controller for a few minutes.



Figure 1: Controller UI

If you launched the simulator, you can see the screen like in Figure 1. You can control with arrow keys or WSAD to control the car. If you launch the controller, you will see the instructions for controlling the ego vehicle.

When you playing with this controller, please annotate your explanation. You can annotate your explanation in any format, such as .csv or .h5. But we prefer you to record your voice which is synced well with recorded video. After running the controller 5 minutes - 10 minutes for each driving styles, send me the data you collect via email (suhong.moon@berkeley.edu). Collected data is hdf5 format and saved in `“/_out”` subdirectory in cloned directory.