Dream-like simulation abilities
for automated cars

DREAMS4CARS

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0.1	15/November/2019	Mauro Da Lio	Initial Draft and TOC.
0.2	19/November/2019	Mauro Da Lio	Inherited materials from D5.3 (after D5.3 was restructured, see notes on D5.3 version 0.5).
0.3	22/November/2019	Nicola Poerio	Integrated contribution in section 1.3.2, originally written for D5.3
0.4	3/December/2019	Mauro Da Lio	Restructuring organization of sections. Rewriting of section 1. Rewriting section 2 intro.
0.5	4/December/2019	Mauro Da Lio	Section 3 introduction and section 3.1 introduction. Extended Table of Contents
0.6	10/December/2019	Mauro Da Lio	Section 4.1. Completed Appendix 1 and table of datasets for the Jeep Renegade.
0.7	11/December/2019	Mauro Da Lio	Section 4.1.3 and 4.1.4
0.8	18/December/2019	Elmar Berghöfer	Section 4.2 (initial contribution) and Section 5 initial draft.

0.9	18/December/2019	Mauro Da Lio	Sections 3.5 to 3.5.2
1.0	20/December/2019	Elmar Berghöfer	Adding Subsection 4.2, 5.1 and Appendix 2
1.1	24/December/2019	Mauro Da Lio	Improved text. Section 3.5.3.
1.2	25/December/2019	Elmar Berghöfer	Integrated section 5.3.
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1.6	29/December/2019	Mauro Da Lio	General revisions and improvements.
1.7	30/December/2019	Henrik Svensson, Rafael Math	Internal review comments.
1.8	31/December/2019 04/January/2020	Mauro Da Lio	Revision. Integration with Figure 58 and related text, Figure 62 and related text, Figure 70 and related text, Figures 65 and 66 and related text, Figure 75 and related text. Final version for submission.

Executive Summary

This deliverable presents the project findings. It collects the data analysis carried out in WP5.

The document deals with the evaluation of both the agent abilities (D2.2) and of the learning methods (D3.2). For this the document follows the approach of D3.2, namely learning forward models first, and then using them for the synthesis of higher and higher-level abilities via mental imagery (a cross reference with the planned experiments is given in section 1 and the list of the collected datasets in appendices 1 and 2).

Section 2 indulges on the building block of forward model learning, explaining with examples and data the main key ideas of the theory developed in D3.2. In particular how to learn sample-efficient and interpretable (physically inspired) neural network models and how to scale and evaluate them. The Open Data pilot is referenced as an open access example.

Section 3, then, proceeds to the higher-level abilities, which are all obtained via offline mental imagery. We first present progress in motor control via inverse models of progressively more complex problems (from compensating the steering actuator to adaptive-robust vehicle control). We also provide evidence of how efficient learning via model manipulation can be compared to other approaches (e.g., section 3.2). A comparison with traditional trajectory planning and control is also carried out. Concerning the highest behavioural levels, we present experimental results for the Safe Pedestrian Speed function. Finally, we introduce Adaptive Control as the latest evolution of the agent (could be considered an extension of D2.2).

Experimental data of the tests that were included in the test plan (D5.1) are given in section 4. Worth to be recalled are the experiments for the validation of the CarMaker simulation environment (section 4.1). The experiments with the MIA car are given in section 4.2. Other experimental data and test results off the mainstream of the project are finally given in section 5.