Hanaa Mohammed

بسم اللّه الرحمن الرحيم

مركز الشبكات وتكنولوجيا المعلومات

قسم التوثيق الإلكتروني

Safaa Mahmoud

جامعة عين شمس

التوثيق الإلكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها

علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

Cairo University

TESTING AUTONOMOUS VEHICLES USING REINFORCEMENT LEARNING TO GENERATE FAILURE SCENARIOS IN COMPLIANCE WITH STANDARDIZED TESTS

By

Nagy Mohamed Salah Mohamed Ali Abotaleb

A Thesis Submitted to the
Faculty of Engineering at Cairo University
in Partial Fulfillment of the
Requirements for the Degree of
MASTER OF SCIENCE
in
Electronics and Communications Engineering

FACULTY OF ENGINEERING, CAIRO UNIVERSITY
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Associate Professor
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Title of Thesis:

Testing Autonomous Vehicles Using Reinforcement Learning To Generate Failure Scenarios In Compliance With Standardized Tests

Key Words:
Artificial Intelligence; Reinforcement Learning; Autonomous Vehicles; Deep Reinforcement Learning;

Summary:
This thesis proposes a design for a reinforcement learning framework to test specific autonomous vehicle components according to standardized tests of EuroNCAP. It shows how reinforcement learning algorithms are being used in real-world applications, in different testing domains outside the autonomous vehicle testing, and how to make use of reinforcement learning algorithms for autonomous vehicle testing rather than the popular topic of usage in driving autonomous vehicles. In addition, it presents a complete reinforcement learning formulation for the framework including environment description, reward function design, model training, and model testing procedures. Moreover, the proposed framework was able to generate automatic failure scenarios that were applied on autonomous vehicles covering two EuroNCAP scenarios; approaching a stationary car and approaching a slower car. The proposed framework controls parameters such as velocity, position and time, and generates more accurate failure scenarios to happen in real-life situations. Our failure scenarios are generated using q-learning and deep reinforcement learning algorithms causing real accidents for the designed scenarios. Hence, our reinforcement learning framework proves its validity to generate failure scenarios for autonomous vehicle components improving the safety of autonomous vehicle components and reducing both the costs and time required for testing autonomous vehicle components.

Disclaimer

I hereby declare that this thesis is my own original work and that no part of it has been submitted for a degree qualification at any other university or institute.

I further declare that I have appropriately acknowledged all sources used and have cited them in the references section.

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Signature:

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