RÍA Acadamh Ríoga na hÉireann
Royal Irish Academy

Charlemont Grant Report

Recipient Name:	Dr Ivana Dusparic
Discipline:	Sciences
Amount and year awarded:	€1,490 in 2019
Title of Project:	AI-enabled Automated Mutation Testing for Mobile Software Applications

Summary of findings:	The collaboration started off focusing on surveying wider field of application of AI in software testing and testing of AI applications, as two complementary and distinct areas of merging these two disciplines. Initial focus was on applying AI to software testing, by improving mutants in mutation testing, however we identified that contributions there, while resulting in the improvement of testing, would be relatively minor, and larger breakthroughs can be made in the area of testing AI systems. Upon extensive literature survey, we have identified that, while testing supervised learning systems has gained some attention of the last few years, no proposals exist on how to test unsupervised learning systems, and in particular reinforcement learning (RL). We have identified metamorphic testing as a promising approach to test RL systems and are currently designing the first testing approach aimed at testing RL systems.
Plans for continuing collaboration:	Combining fields of AI and software testing is a fruitful collaboration field in both direction - using AI to improve software testing techniques, through generation and optimisation of test cases and parameters, as well as through developing new software testing techniques to test AI systems, based on particular requirements these systems have. Therefore, we plan to continue the collaboration addressing both of these directions, through joint publications, and supervision of final year projects and MSc theses in both universities in this area.
Publication plans:	Published: Nicolás Cardozo, Ivana Dusparic and Mario Linares-Vásquez, Perspectives in Testing Deep RL, 1st Workshop on Testing for Deep Learning and Deep Learning for Testing, ICSE 2019. In preparation: Nicolás Cardozo, Ivana Dusparic, Camilo Escobar and Mario Linares-Vásquez. Testing of Deep Reinforcement Learning Systems. FSE2020.
International dissemination:	Ivana Dusparic and Mario Linares-Vásquez, presentation of the paper Perspectives in Testing Deep RL, 1st Workshop on Testing for Deep Learning and Deep Learning for Testing, ICSE 2019.
National dissemination:	This particular research, as it's a new research direction for both myself and the collaborator, resulting from the merge of our expertise, has not been presented at any Irish conferences yet.

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Additional collaborations:	This particular research, as it's a new research direction for both myself and the collaborator, resulting from the merge of our expertise, has not yet been a subject of any industry collaborations. However, as software testing is an area that's highly relevant for software industry, once he prototypes are developed we will seek industry partners to validate them.
Outreach:	https://www.irishtimes.com/business/innovation/giving-smart-cities-the-greenlight-how-ai-can-make-traffic-flow-1.3958278