



Trinity College Dublin Coláiste na Tríonóide, Baile Átha Cliath The University of Dublin



Trinity College Dublin's Complex Software Lab

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¹ MUTATION ANALYSIS:

Mutation Analysis consists in inserting artificial bugs to assess the quality of test suites – **testing the tests** – to make software applications more robust.



2 EXPANDING THE SCOPE OF MUTATION ANALYSIS:

Database Systems:

- Created a mutation engine for RDBMS procedures
- Improved testing practices through feedback to QA engineers

UI testing: assessed the quality of UI tests by mutating the code received by web browsers

Accessibility Testing: created tests for WCAG guidelines and assessed their quality using mutants

API testing: used mutation analysis for distributed applications testing

Machine Learning testing: adapted mutation analysis to these complex systems, redefining mutants and units of test

- New mutation operators for ML systems
- **Mutants selection** to limit their number
- We have analysed and improved mutation testing tools for Java
- We have proposed new mutant selections techniques (e.g., focusing on code commits)
- We have evaluated more complex mutants (Higher Order Mutants)

Impact:

- **15 publications**
- **3 Best Paper Awards:** ICSME 2020 (CORE A); Mutation Workshop (co-located with ICST; CORE A) 2020 & 2022
- **SFI Frontiers for the Future Award**

Better "unit tests" for ML practitioners

Impact:

mazda

- 10 publications
- patent
- Award from the Japan Society for the Promotion of Science

国立情報学研究所



³ TESTING AI SYSTEMS:

- We proposed new solutions to test conversational AI
- We developed the concept of (AI) dataset auditing
- We addressed chatbot's quality of experience (ethics, personality) for conversational Al

Impact:

- **15 publications**
- Engineered a chatbot for Syrian refugees, with NGOs (NRC, NetHope) – co-designed with 100 refugees
- **1Best Paper Award**: FAccT 2022 •
- **50+ news items** (Irish Times, SiliconRepublic, Time, Business • Post, Irish Independent, etc.)
- **BBC StoryWorks "Battling AI" 2021**
- VentureBeat Al Innovation Award 2020

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4 ENGINEERING AI SOFTWARE APPLICATIONS:

The TCD Complex Software Lab has worked on **engineering** complex software applications with Al components, focusing on impact and co-construction with users and stakeholders Language: Sign Language, Speech Recognition Sports Analytics: Rugby **Computational Archaeology:** Megalithic Art Accessibility: Deaf and Hard of Hearing, Low vision

Impact:

- 10 publications
- Collaboration with the **Deaf community**
- Collaboration with the **IRFU**
- Collaboration with **EDC** (Education NGO) and **Zeeko** (Education company)

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Microsoft

people access education online

AI 'chatbot

Claire O'Connell Thu Feb 14 2019 - 01:00

NETHOPE

Research Lives: Dr Anthony Ventresque, Lero, researcher and director of the UCD Complex Software Lab



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IRISH RESEARCH COUNCIL

Microsoft



[...] Microsoft is working already with the Norwegian Refugee Council, NetHope and University College Dublin to develop a chatbot using AI technologies [...]

A young mother and her baby visit the local nutrition center in rural Madaaascar to participate in a



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