Antonio Guerriero

Tutor: Stefano Russo – co-Tutor: Roberto Pietrantuono

XXXIV Cycle - I year presentation

Testing in the context of Artificial Intelligence (AI):

the oracle problem

Università degli Studi di Napoli
Federico II

My Background

- Master degree in Computer Engineering
  - Thesis: “Reliability Assessment of Microservice Architectures”
- 1 conference Publication
  - R. Pietrantuono, S.Russo, A. Guerriero,

    “Run-time Reliability Estimation of Microservice Architectures”,

    Proc. of the 2018 IEEE International Symposium on Software Reliability Engineering (ISSRE), Memphis, TN, USA, Oct. 15-18, IEEE, 2018,
  - Winner of “ISSRE 2018 Best Research Paper Award”

Period abroad

- From September 2nd 2019 I started a study and research period abroad (six-months) at Chinese University of Hong Kong,
- Visiting the group of prof. Michael Lyu (research areas: Software reliability; Software engineering; Distributed systems; author of the Handbook of Software Reliability Engineering)
- Started joint collaboration on software testing for AI-based systems

Prof. **Michael R. Lyu**
Chairman, Dept of Computer Science and Engineering
Chinese University of Hong Kong
IEEE Fellow
ACM Fellow
AAAS Fellow

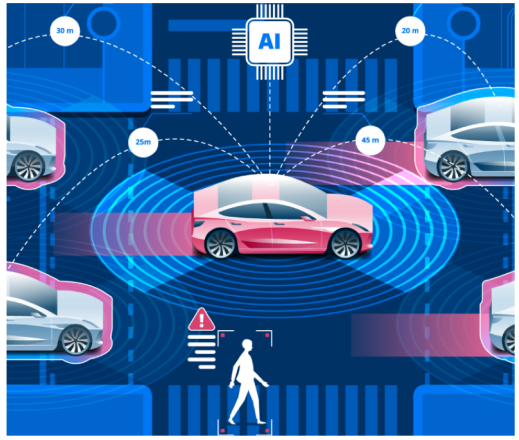
The Chinese University of Hong Kong

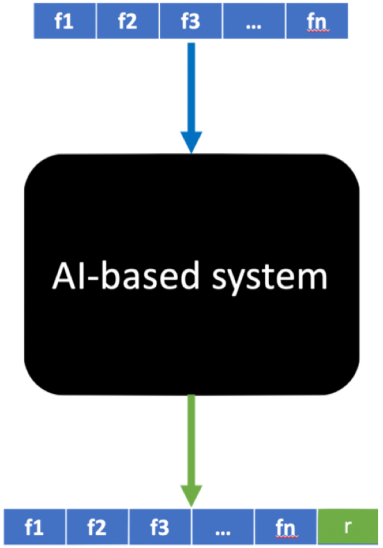
Research activity: Overview

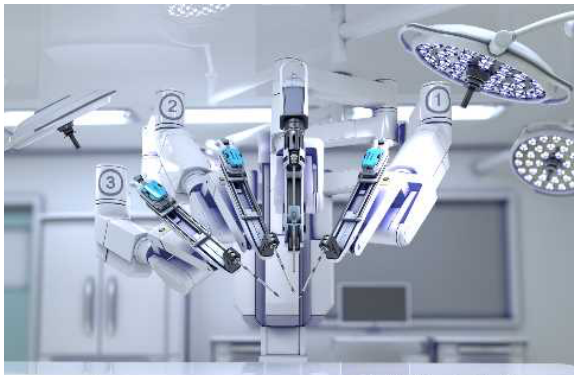
- ***Problem:***
  - Traditional software testing techniques not adequate to test programs based on Artificial Intelligence
  - ***The "oracle problem"****: there is no reliable "test oracle" to indicate what the correct output should be for arbitrary input*
- ***Objective:***
  - Build an entity able to tell **when the output** of an *AI-based program* **is wrong**
- ***Contribution:***
  - Definition of an architectural view of a ***test failure detector***, which is able to detect a certain subset of failures, with an acceptable trade-off between *accuracy* and *automation*

Subjects

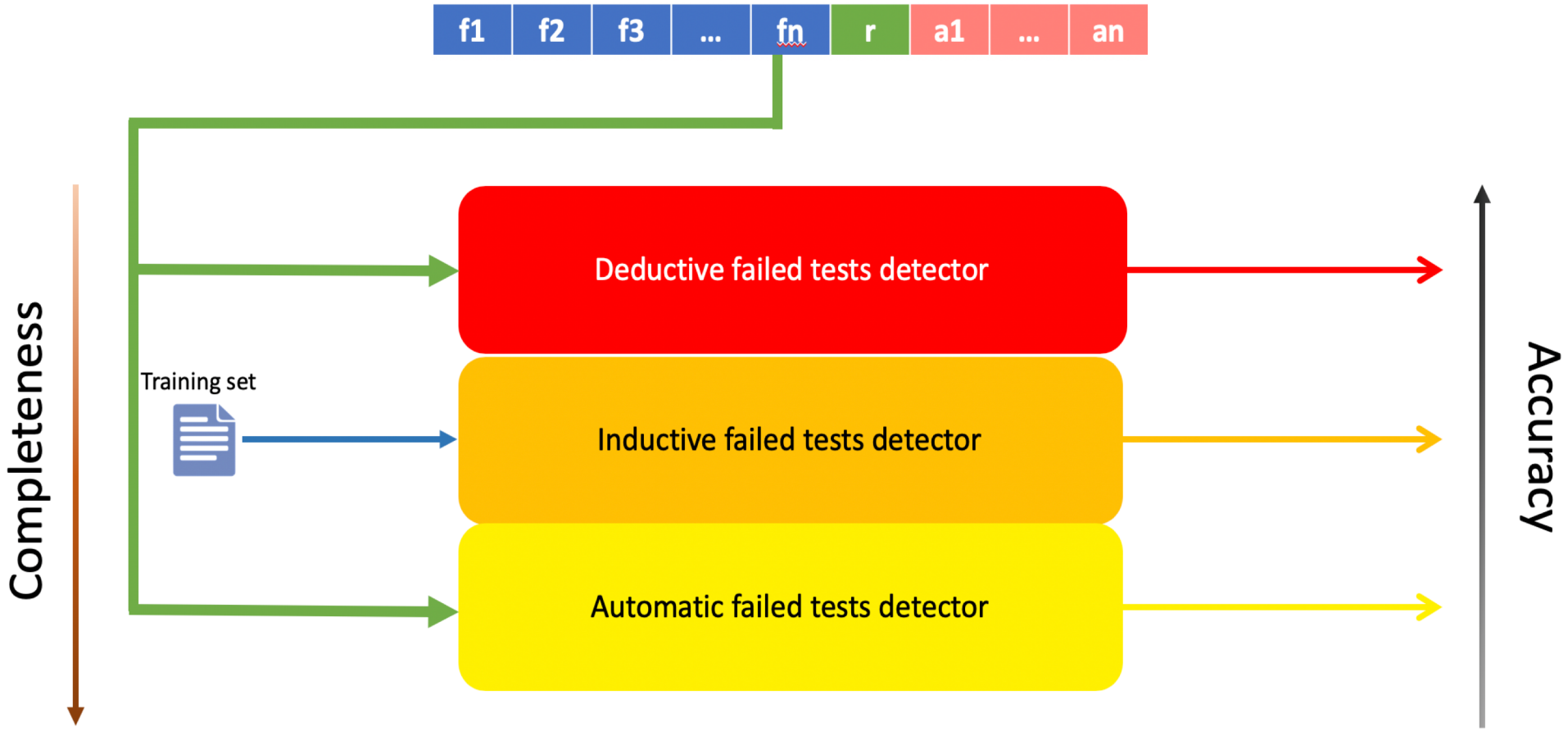
- We define as ***AI-based systems*** those that have an AI as main component
- This kind of systems are usually characterized by a *very complex input* (made by a feature vector), and by producing in output a *response* and a set of additional pieces of information (*additional features*) produced by the other components
- The behavior of the system is strongly dependent from the training set and from the chosen AI algorithm







Proposed architecture



Products

[P1]	A. Guerriero, R. Mirandola, R. Pietrantuono, S.Russo. "*A Hybrid Framework for Web Services Reliability and Performance Assessment*". **1st International Workshop of Governing Adaptive and Unplanned Systems of Systems (GAUSS 2019)**, In: Proc. of the 2019 IEEE International Symposium on Software Reliability Engineering Workshops (ISSREW), pp. 185-192, IEEE.
[P2]	S. Russo, R. Pietrantuono, A. Guerriero, "*Testing Microservice Architectures for Operational Reliability*". **Software Testing, Verification and Reliability** (Accepted for publication).
[P3]	S. Russo, R. Pietrantuono, A. Guerriero, A. Bertolino, B. Miranda, "*Learning-to-Rank vs Ranking-to-Learn: Strategies for Regression Testing in Continuous Integration*". Submitted to the **42nd International Conference on Software Engineering** (ICSE 2020), Seoul, Korea, May 2020. Status: under review.
[P4]	S. Russo, R. Pietrantuono, A. Guerriero, A. Bertolino, B. Miranda, G. De Angelis, "*DevOpRET: Continuous Reliability Testing in DevOps*". Submitted to **Journal of Software: Evolution and Process**. Status: under review.

First year credits and objectives

	Year 1								Year 2	Year 3		
		1	2	3	4	5	6					
	Estimated	bimonth	bimonth	bimonth	bimonth	bimonth	bimonth	Summary	Estimated	Estimated	Total	Check
Modules	20	1.2	0.8	12.5	9.0		2.4	**25.9**	5	0	**30.9**	30-70
Seminars	10	1.2	1.0		10.0	0.4	0.2	**12.8**	0	0	**12.8**	10-30
Research	35	3.0	6.0	6.0	3.0	9.0	10.0	**37.0**	45	60	**142**	80-140
	65	5.4	7.8	18.5	22.0	9.4	12.6	**75.7**	50	60	**185.7**	180