

Ph.D. in Information Technology: Thesis Defenses

February 3rd, 2020

Room Seminari "N. Schiavoni- h. 14.00

Darian FRAJBERG – XXXII Cycle

“Artificial Intelligence and Augmented Reality for entertainment applications”

Advisor: Prof. **Piero Fraternali**

Abstract:

Outdoor Augmented Reality applications are an emerging class of software systems that demand the fast identification of natural objects on mobile and embedded systems. They arise as an interesting tool to support the creation of entertainment and educational applications. Artificial Intelligence has recently exhibited superior performance in a variety of Computer Vision tasks and can lead to novel Augmented Reality solutions. Nonetheless, their execution remains challenging and requires non negligible resources for devices with hardware constraints. The goal of the research presented in this thesis is to exploit the commoditization of Artificial Intelligence methods and the forthcoming wave of low-cost mass market Augmented Reality devices, to propose methods, architectures and components to support the creation and evaluation of solutions for outdoor Augmented Reality applications efficiently executable on low-power portable devices. Specifically, the focus is set on entertainment applications that can play a fundamental role to motivate citizens to contribute for environmental crowdsourcing purposes, such as data collection. The experimental results demonstrate how Artificial Intelligence, Computer Vision and Augmented Reality can be successfully integrated for the construction of novel entertaining solutions for limited-capacity portable systems.

Riccardo TOMMASINI – XXXI Cycle

“Velocity on the Web”

Advisor: Prof. **Emanuele Della Valle**

Abstract:

The Web is a distributed environment that populated by resources and agents that identify, represent, and interact with them.

The decentralized nature of Web applications is one of the reasons for the popularity of the Web. Nevertheless, the Web results in an unbounded and noisy environment populated by heterogeneous resources.

As part of the Web environment, applications must take resource heterogeneity into account.

The Web of Data is the Web extension that addresses this challenge, known as Data Variety, using a stack of semantic technologies that include RDF, SPARQL, and OWL.

Recently, a new generation of Web applications is showing the need for taming Data Velocity, i.e., processing data as soon as they arrive and before it is too late.

New protocols are emerging to improve the Web's data infrastructure. Web Sockets and Server-Sent Events respectively enable continuous and reactive data access.

Data velocity is related to the whole data infrastructure, and new abstractions are required, i.e., streams and events that are the fundamental entities of the stream processing. Although seminal work on Stream Reasoning and RDF Stream Processing paved the road for addressing Velocity on the Web, the following research question remains unanswered: \textit{Can we identify, represent, and interact with heterogeneous streams and events coming from a variety of Web sources?}

This PhD thesis investigates how to represent and interact with streams and events on the Web, assuming that existing technologies for identification are sufficiently mature to be used in this innovative context and they do not need further investigation yet.

The investigation follows the structure of design science research projects. It identifies design problems and knowledge questions and solves them according to the Design Science methodology. In particular, this PhD thesis elicits two research problems from the research question: the representation problem and the processing problem.

The former problem calls for an improvement in the Web of Data by representing streams, events, and to audit the provenance of Web stream transformations.

The latter problem calls for an improvement in the Web of Data by enabling expressive yet efficient processing of Web streams and events.

This PhD thesis breaks these two problems into feasible sub-problems, and it presents the formulation, the investigation, and the validation of the proposed solution.

Moreover, this PhD thesis identifies yet another problem related to validation research in the context of the processing problem. The problem is named validation problem, and it calls for an improvement in comparative research for stream and event processing on the Web.

This PhD thesis ends identifying the assumptions that limit the generality of the investigation. These assumptions are then relaxed, endeavoring to envision alternative research directions and future works.

PhD Committee:

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