



PhD in Information Technology and Electrical Engineering

Università degli Studi di Napoli Federico II

PhD Student: Vincenzo Norman Vitale

XXXIV Cycle

Training and Research Activities Report – First Year

Tutor: Prof. Sergio Di Martino



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

1. Information

PhD Candidate: Vincenzo Norman Vitale – Mat. DR993627

Date of Birth: 30/08/1989

Master Science Title: Master’s degree in Computer Science (cum laude) 23/10/2018, Università degli Studi di Napoli “Federico II”

Master Thesis: A protocol for automatic collection of information to generate advanced reports in cultural heritage

Fellowship: “Industry 4.0: Storing, Retrieving and Mining sensor data for Predictive Maintenance” supported by AvioAero a GE Aviation Business

Tutor: Prof. Sergio Di Martino

Year: First

Cycle: XXXIV

Publication: “Increasing information accessibility on the Web: A rating system for specialized dictionaries”, Caruso, V., Prof.ssa De Meo, A., Vitale, V.N. , 2016 CEUR Workshop Proceedings

2. Study and Training activities

Lecture/Activity	Type	Hours	Credits	Dates	Organizer	Certificate
Author Seminar how to publish a scientific Paper	Seminar	2	0.4	26/11/2018	Università di Napoli Federico II	Yes
Data Science and Optimization	Ad hoc Module		1.2	05/02/2019, 06/02/2019, 07/02/2019	Università di Napoli Federico II	Yes
Computational and Machine Learning Methods for Complex Ecosystems	Seminar	1	0.2	26/02/2019	Università di Napoli Federico II	Yes
Big Data	Ad Hoc Module		3	26/02/2019, 28/02/2019, 04-6/03/2019	Università di Napoli Federico II	Yes
14 th International Summer School on Software Engineering	Doctoral School		3	17/06/2019 to 21/06/2019	Università degli studi di Salerno	Yes
Machine Learning for itee – lecture VI	Seminar	2	0.4	13/05/2019	Università di Napoli Federico II	Yes
Methods for explainable machine learning – lecture II	Seminar	2	0.4	22/05/2019	Università di Napoli Federico II	Yes
Ingegneria del Software 2	MSC		6	02/09/2019	Università di Napoli Federico II	Yes

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	Inf/01					
Advanced Technology at the Service of Visitors to Cultural Heritage Sites	Seminar	2	0.4	11/10/2019	Università di Napoli Federico II	Yes
Ethics, science & society in Brain Computer Interface	Seminar	3	0.4	18/10/2019	Università di Napoli Federico II	Yes

	Credits year 1								YR 2	YR 3	Total	Check
	Estimated	1 bimonth	2 bimonth	3 bimonth	4 bimonth	5 bimonth	6 bimonth	Summary	Estimated	Estimated		
Modules	20		1.2	3	3		6	13.2	20	0	33.2	30-70
Seminars	5	0.4	0.2		0.8		1	2.4	10	0	12.4	10-30
Research	35	8	8	6	10	6	8	46	40	60	146.0	80-140
	60	8.4	9.4	9	13.8	6	15	61.6	70	60	191.6	180

3. Research Activity

The first year of research activities focused on the study of Time Series and technologies concerning it.

There are two real world application contexts. The first one regards industry 4.0 in the AvioAero plant in Pomigliano. In this case the focus is management of massive Time Series data. On the other side there is the Intelligent Transportation Systems context, focused on Spatio-Temporal data.

3.1 Industrial Context

The AvioAero's Pomigliano Plant aims to become a smart-factory according to Industry 4.0 principles. In such context my activities are related to Massive Time Series Data management and processing, in order to enable advanced maintenance tasks. In this first phase, the study was focused on IIoT, namely Industrial IoT, since the company has a great number of connected industrial machineries producing a huge quantity of data. On the other hand the focus was on Industrial Big Data and Analytics, since such massive data amount must be analysed in order to reach the final objective, namely Predictive Maintenance.

Predictive Maintenance aims to minimize machineries downtime, by predicting specific components breakages. This way the maintenance team is able to schedule interventions, in order to minimize downtime while taking maximum advantage of the whole component life.

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In the first part, my activities focused on the choice of the right technology for Massive Time Series data storage, retrieval and integration. In fact this phase could cause delays to subsequent analytics tasks, like predictive maintenance. Since general purpose DBMS tends to sacrifice performances on a phase in favour of another one, granting for instance rapid retrieval but very slow ingestion. The correct choice in this phase is critical, since it may decrease delays in data supply chain.

In the second part the focus was on the design of a cloud architecture, based on micro-services. It aims to allow storage, retrieval and processing tasks in cloud. Taking advantage of the flexibility and technology freedom offered by micro-services.

3.2 Intelligent Transportation Systems

In the ITS field, Time Series are smaller than the industrial context, but are almost ever integrated with other data sources, almost ever with spatial data. Such data is often used in the context of Intelligent Vehicles to support the driver, or even for autonomous driving tasks.

In the first phase, I focused on the study of driver assistance systems, namely Parking Guidance Information systems (PGI). Such systems take advantage of Time Series data from on-street parking sensors, in order to support the driver for on-street parking search. Such Time Series have also a spatial component with different granularity. In particular the focus was on two dataset. The first one is SFPark a project from San Francisco, in which every 5 minutes a snapshot of on-street parking stalls at street granularity, was taken. While the second one is from the city of Melbourne, in which every sensor reports arrival and departure events, at single parking space granularity.

In the second phase, within a collaboration with DICEA and Ing. Luigi Pariota, I focused on two arguments. The first argument is Time Series produced by a vehicle. A car is capable to produce a great number of Time Series. Such data transits on the CAN-BUS and could be used for a wide range of tasks. The main focus was on data management on board of the vehicle, for monitoring car and driver state.

While the second argument was monitoring of traffic and public transportation, via wireless signal acquisition. Within this argument 2 undergraduate students made their thesis.

4. Products

- Conference Paper “Industrial Internet of Things: Persistence for Time Series with NoSQL Databases” in proceedings of “28th IEEE International Conference on Enabling Technologies: Infrastructure for Collaborative Enterprises” WETICE 2019
- Conference Paper “Investigating the Influence of On-Street Parking Guidance Strategies on Urban Mobility” in proceedings of “6th International Conference on Models and Technologies for Intelligent Transportation Systems” MT-ITS 2019 Conference
- Conference Paper “Comparing Different On-Street Parking Information for Parking Guidance and Information Systems” in proceedings of “30th IEEE Intelligent Vehicles Symposium”

5. Conferences and Seminars

Conferences

Conferences	Place	Dates	Role
6th International Conference on Models and Technologies for Intelligent Transportation Systems	Krakow, Poland	5-7 June 2019	Author
28th IEEE International Conference on Enabling Technologies: Infrastructure for Collaborative Enterprises	Capri (NA), Italy	12-14 June 2019	Author, Member of Local Organizing Committee

Presentation made:

- As an author I presented the following conference Papers:
 - Sergio Di Martino, Luca Fiadone, Adriano Peron, Alberto Riccabone, Vincenzo Norman Vitale “Industrial Internet of Things: Persistence for Time Series with NoSQL Databases”
 - Sergio Di Martino, Vincenzo Norman Vitale, Fabian Bock “Investigating the Influence of On-Street Parking Guidance Strategies on Urban Mobility”
- During the FS Academy I made a presentation to introduce DBMS and NoSQL.
- During the “14th International Summer School on Software Engineering” I presented my work entitled “Data supply chain in Industry 4.0”
- During the MSC “Ingegneria del Software II” I presented “Micro-services Architecture” and “Microservices in Practice: Docker and Kubernetes”
- During the MSC “Basi di Dati II” I presented “Industrial IoT: NoSQL vs TSMS vs RDBMS” and “NoSQL & Time Series”

6. Activity abroad

7. Tutorship

During this first year I made some tutorship to one master student and five undergraduate students:

- The master student Luca Fiadone made his thesis entitled “Storage and retrieval of Time Series for Predictive Maintenance”, during an internship in “AvioAero a GE Aviation Business” on efficient management of Time Series Data. **Graduated**
- The undergraduate student Sergio Di Meglio made his internship during an internal collaboration with the DICEA, his thesis was entitled “Georeferenziazione di dispositivi mobile attraverso tracciamento di mac address”. **Graduated**
- The undergraduate student Anna Scognamiglio made his internship during an internal collaboration with the DICEA, his thesis was entitled “Calcolo di traiettorie di dispositivi mobili basato su tracciamento di MAC address”. **Graduated**

- The undergraduate student Alessio Scafora made his thesis entitled “Industria 4.0: sviluppo di un’architettura a microservizi per la gestione di dati ad alta frequenza”, during an internship in “AvioAero a GE Aviation Business”. **Graduated**
- The undergraduate student Gianluca Di Maio made his thesis entitled “Sviluppo di un’architettura a microservizi per il supporto al lean manufacturing”, during an internship in “AvioAero a GE Aviation Business”.
- The undergraduate student Miran Warnkulasooriya made his thesis entitled “Gestione di dati spazio temporali nell’ambito degli ITS”.

During this first year I have been teaching assistant at:

- Course “Ingegneria del Software I”
- Course “Ingegneria del Software II”
- Course “Basi di Dati II”
- Course “Object Orientation”