



**PhD in Information Technology and Electrical Engineering**  
Università degli Studi di Napoli Federico II

**PhD Student: Simona Fioretto**

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**Cycle: XXXVIII**

**Training and Research Activities Report**

**Year: First**

*Simone Doucas*

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**Tutor: Prof. Elio Masciari**

*Elio Masciari*

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**Co-Tutor: -**

**Date: October 20, 2023**

# Training and Research Activities Report

PhD in Information Technology and Electrical Engineering

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Author: Simona Fioretto

## 1. Information:

- **PhD student: Simona Fioretto**
- **DR number: DR996638**
- **Date of birth: 29/04/1997**
- **Master Science degree: Management Engineering**      **University: University of Naples Federico II**
- **Doctoral Cycle: XXXVIII**
- **Scholarship type: PNRR - DM 351 Public Administration**
- **Tutor: Prof. Elio Masciari**

## 2. Study and training activities:

Activity	Type <sup>1</sup>	Hours	Credits	Dates	Organizer	Certificate <sup>2</sup>
On the challenges and impact of Artificial Intelligence in Insurance domain	Course	8	3	21-24-28-30/11/2022	Ing. Lorenzo Ricciardi Celsi	Y
Donne e stem: il mio impegno in WIE	Seminar	1	0.2	06/12/2022	Prof.ssa Dajana Cassioli, Roma Tre	N
Game Theory	Seminar	3	0.6	13/12/2022	Prof. Leonardo Badia	Y
From Cyber Situational Awareness to Adaptive Cyber Defense: Leveling the Cyber Playing Field	Seminar	2	0.4	13/12/2022	Prof. Giancarlo Sperli DIETI	Y
Using Deep Learning Properly	Course	10	4	10/01/2023-24/01/2023	Dr. Andrea Apicella, DIETI	Y
Industry 4.0 Fundamentals in Bosch Applications	Seminar	10	2	23-24-25-26/01/2023	Bosch – Centro Studi Componenti per Veicoli and the Decision and Control Laboratory of	Y

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					Politecnico di Bari	
Embracing Data Imperfections Via Domain Enriched Visual Task Learning	Seminar	1	0.2	13/02/2023	Prof. Vishal Monga	Y
Algorithm Unrolling: Efficient, Interpretable Deep Learning for signal and image processing	Seminar	1	0.2	14/02/2023	Prof. Vishal Monga	Y
Non-Destructive Testing (NDT) in contesto aeronautico	Seminar	1	0.2	17/02/2023	Prof. Carlo Forestiere	Y
How to boost your PhD	Course	16	4	11-18-25/01 - 1-8-15-22/02 - 1/03/2023	Prof. Antigone Marino (ITEE - ICTH - CQB)	Y
Statistical Data Analysis for science and engineering research	Course	12	4	06-08-10-13-15-16/02/2023	Prof. Roberto Pietrantuono, DIETI	Y
MLOps: Achieving Operational Velocity with Faster Delivery and Collaboration	Seminar	1	0.2	02/03/2023	Prof. Tarry Singh	Y
Unleashing the Power of LLMs: a Historical perspective on Generative AI	Seminar	1	0.2	02/03/2023	Prof. Tarry Singh	Y
Enhancing qubit readout with Bayesian Learning	Seminar	1	0.2	05/04/2023	Dr. Nicola Lo Gullo	Y
How to Publish Under the CARE-CRUI Open Access Agreement with IEEE	Seminar	1.5	0.3	05/04/2023	Dr. Nino Grizzuti, Eszter Lukacs, Stefano Bianco	Y
Software Engineering @Salerno Week	Doctoral School	-	3	12-13-14-15/06/2023	University of Salerno	Y
I pilastri della trasformazione digitale	Course	10	3	17-18/04 - 5-8-10/5/2023	prof. Nicola Mazzocca - DIETI	Y

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2nd Generation of Mobile EEG Systems: Hands-on Experience	Seminar	1	0.2	29/06/2023	dr. Andrija Dakovic - Manager of mBrainTrain	Y
Migration of legacy IT infrastructures into the cloud	Seminar	2	0.4	23/05/2023	Prof. Roberto Canonico	Y
Academic Entrepreneurship	Course	17	4	29-31/05 - 05-15-20-22/06/2023	Prof. Pierluigi Rippa - DII	Y
Scienza moderna e disciplina giuridica dell'intelligenza artificiale	Course	22	6	07-09-14-16-21-23-28-30/06 - 06-07-10/07/2023	Prof. Lucio Franzese - DIETI	Y
Ricerca e formazione nella società della transizione digitale	Seminar		1	22/09/2023	CINI	N
Come scrivere un articolo scientifico?	Seminar	1.5	0.3	26/09/2023		N
Come funzionano le riviste?	Seminar	1.5	0.3	27/09/2023		N

- 1) Courses, Seminar, Doctoral School, Research, Tutorship
- 2) Choose: Y or N

## 2.1. Study and training activities - credits earned

	Courses	Seminars	Research	Tutorship	Total
Bimonth 1	3	1.2	6		10.2
Bimonth 2	4	2.6	6		12.6
Bimonth 3	8	0.9	3		11.9
Bimonth 4	6	0.6	3		9.6
Bimonth 5	10	-	-		10
Bimonth 6	-	1.6	4.1		5.7
<b>Total</b>	<b>31</b>	<b>6.9</b>	<b>22.1</b>		<b>60</b>
<b>Expected</b>	<b>30 - 70</b>	<b>10 - 30</b>	<b>80 - 140</b>	<b>0 - 4.8</b>	

### 3. Research activity:

#### *Research topic*

The topic of the research activity regards the application of *machine learning approaches to public administration* domain to optimize offered services. In particular, the quality of offered services depends on the effectiveness and efficiency of business processes, which often suffer of problems such as bottlenecks, difficulties in the identification of activities and involved resource. The use of process mining techniques can support the extraction of information about processes from available data that can be exploited to gain in-depth process knowledge and insights on business processes.

#### *Methodology*

In particular, *process mining* is defined as the intersection of data mining and process science, more in detail it can be seen as the discipline that sits between machine learning and data mining and between process modelling and analysis<sup>1</sup>. Process mining uses event logs recorded by information systems currently in use in organizations (such as Enterprise Resource Planning (ERP)), for extracting information related to the process. The distinction of different types of process mining usually is the following<sup>2</sup>: *process discovery* which concerns the modelling of the process starting from event logs, *conformance checking* which concerns the detecting and diagnosis of the differences between the process model and the process obtained through the event log, *process reengineering* which concerns the improvement of the data-based model for example by modifying the model to make it better adhere to reality and *operational support* that influences the process directly by offering support through alerts, predictions and recommendations.

#### *Results*

In the current year the research activity followed two primary paths. On the one hand the research focused on the identification in the literature of the main applications of artificial intelligence within public administrations. Concurrently, the participation in a project within the justice sector contributed to understand the existing situation of the procedures and processes that are managed in the field, with consequent identification of problems and issues. The analysis phase revealed that the critical issues of the public administration in the management of processes concern the lack of awareness and traceability concerning the activities and resources involved in process execution.

Subsequently, the research study moved to process mining methodologies, and precisely on what are the potential applications and current challenges within this domain. In the redefinition of the process mining framework the input data are divided into pre mortem and post-mortem and the models are divided into de jure models and de facto models, consequently the operations or mining activities can be divided into 10 types that also contain the ones previously stated. Among these, *predictive process mining* is the one on which I am currently focusing more as it allows predictions about the future on a specific resource, activity involved in the process or key performance indicator. Predictive process mining is used for operational support and considers both pre-mortem and post-mortem data, i.e. based on a partial trace and a predictive model makes a prediction.

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<sup>1</sup> Van Der Aalst, Wil, and Wil van der Aalst. Data science in action. Springer Berlin Heidelberg, 2016.

<sup>2</sup> van der Aalst, Wil MP. "Object-centric process mining: Dealing with divergence and convergence in event data." Software Engineering and Formal Methods: 17th International Conference, SEFM 2019, Oslo, Norway, September 18–20, 2019, Proceedings 17. Springer International Publishing, 2019.

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The research studies also underscored the division of process mining into traditional and object-centric categories, based on the structure of event logs. In fact, in traditional process mining, simplifying assumptions are made<sup>3</sup>:

- It is assumed that a process model describes the lifecycle of a single object.
- It is assumed that each event refers to precisely one object (often called case) of a given type.

Currently, with the aim of evolving the technique and making the process adhere more and more to reality, these assumptions are questioned, thus giving rise to object-centric process mining (or artifact-centric processes) which represents a challenge for process mining techniques already known.

## 4. Research products:

### *Published Papers*

- Arianna Anniciello, **Simona Fioretto**, Elio Masciari, Enea Vincenzo Napolitano: Covid-19 impact on health information technology: the rapid rise of e-Health and Big Data driven innovation of healthcare processes. *BIBM* 2022: 2759-2764
- **Simona Fioretto**: Business Process Extraction from Documents with AI. *SEBD* 2023: 697-702
- Flora Amato, **Simona Fioretto**, Eugenio Forgillo, Elio Masciari, Nicola Mazzocca, Sabrina Merola, Enea Vincenzo Napolitano: Introducing AI-Based Techniques in the Justice Sector: A Proposal for Digital Transformation of Court Offices. *SEBD* 2023: 497-504
- Enea Vincenzo Napolitano, **Simona Fioretto**, Elio Masciari, Arianna Anniciello: How Pandemic Affected the Adoption of e-Health Systems. *IDEAS* 2023: 94-98
- Flora Amato, **Simona Fioretto**, Eugenio Forgillo, Elio Masciari, Nicola Mazzocca, Sabrina Merola, Enea Vincenzo Napolitano: Evolving Justice Sector: An Innovative Proposal for Introducing AI-Based Techniques in Court Offices. *EGOVIS* 2023: 75-88
- **Simona Fioretto**: Process Mining Solutions for Public Administration. *ADBIS (Short Papers)* 2023: 668-675
- **Simona Fioretto**, Elio Masciari, Enea Vincenzo Napolitano, "A Joint Analysis of Trajectory Mining and Process Mining for Smartphone User Behaviour, " 2023 NFMCP

### *Accepted Papers*

- **Simona Fioretto**, Elio Masciari, Enea Vincenzo Napolitano, "Dossier classification to support workflow management optimization" The 4th International Conference and Summer School, Numerical Computations: Theory and Algorithms NUMTA 2023
- Arianna Anniciello, **Simona Fioretto**, Elio Masciari, Enea Vincenzo Napolitano, "Digital Twins for Traffic Congestion in Smart Cities: a novel solution using Data Mining techniques" KMIS part of IC3K, the 15th International Joint Conference on Knowledge Discovery, Knowledge Engineering and Knowledge Management

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<sup>3</sup> van der Aalst, Wil MP. "Object-Centric Process Mining: Unraveling the Fabric of Real Processes." *Mathematics* 11.12 (2023): 2691.

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- **Simona Fioretto**, Elio Masciari, Nicola Mazzocca, Enea Vincenzo Napolitano, "Can the Study of Trajectories Help to Extract Information from Business Processes? " PMAI23 @IJCAI 2<sup>nd</sup> International Workshop on Process Management in the AI era

## 5. Conferences and seminars attended

### *Attended conferences*

- 31st Symposium on Advanced Database Systems (SEBD2023) for the presentation of the papers: "*Business process extraction from documents with AI*" and "*Introducing AI-Based Techniques in the Justice Sector: A Proposal for Digital Transformation of Court Offices*"
- 27th European Conference on Advances in Databases and Information Systems for the presentation of the paper: "*Process Mining solutions for public administration*"

### *Planned conferences*

- 5th International Conference on Process Mining, 23-27 October, 2023

## 6. Activity abroad

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## 7. Tutorship

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