

SHORT BIOGRAPHY OF FRANCESCO LEOTTA

Francesco Leotta is an **assistant professor (RTD-A in the Italian system)** (scientific disciplinary sector **ING-INF/05**) at Sapienza Università di Roma, Italy, Dipartimento di Ingegneria Informatica, Automatica e Gestionale Antonio Ruberti (DIAG – Dept. of Computer, Control and Management Engineering), since 2014.

He got a **PhD in Engineering in Computer Science** (Dottorato di Ricerca in Ingegneria Informatica) from Sapienza Università di Roma in September 2014. He previously studied Engineering in Computer Science (Ingegneria Informatica) at Sapienza Università di Roma, where he obtained a Bachelor Degree in 2006 and a Master Degree in 2010 both with honours. Since 2010, he is qualified to practice as Computer Science Engineer (abilitato all'esercizio della professione di Ingegnere). Between the master degree in January 2010 and June 2011, he served as a research fellow and scientific developer at Fondazione Santa Lucia (FSL). Between 2014 and August 2019 he has been a research fellow at Sapienza Università di Roma – DIAG.

RESEARCH ACTIVITY

Francesco Leotta is affiliated to **DASILab** (Data and Service Integration Lab) at DIAG. He is a member of the **Data and Service Management research group** and of the **Human-Computer Interaction research group**. His overall research activity has been carried out in Rome (Italy) between Dipartimento di Ingegneria Informatica, Automatica e Gestionale Antonio Ruberti and Fondazione Santa Lucia.

The research of Francesco Leotta concerns **algorithmic, methodological, experimental and practical aspects** in different areas of Computer Science, including **ubiquitous computing, human-computer interaction and digital humanities**. Such topics are challenged in the application domains of **smart spaces, smart manufacturing and cultural heritage**.

Since 2010, Francesco Leotta has defined a research project that involves the employment of techniques from machine learning and data mining, specifically from business process management and mining, in order to address the problem of **smart space monitoring and automation**. Here, the term smart space is intended in the widest sense possible, covering **smart homes, factories, museums, smart cities and offices**. In particular, the goal of the research project is **learning and visualizing human habits and procedures from unlabeled data sources** such as sensor logs or even written texts and data tables. These habits can be used for anomaly detection, recommender systems and automation. Notably, the term *habit mining* has been introduced by Francesco Leotta to describe this area of research.

One of the peculiarities of this research is the attention to **usability for both technicians and end users**. As witnessed by the success of the NEST thermostat, the main obstacle to the diffusion of smart spaces is easiness of installation and use.

A functioning smart space is based on models. These models must be analyzed and validated by experts of the domain. Thus, one aspect of usability in smart spaces is **making the models produced by the system readable to human experts for analysis and inspection**. Here, the **intuition** behind the research of Francesco Leotta is employing established formalisms from the area of Business Process Management (BPM). A second aspect of usability applied to smart spaces is **making the deployment of smart space systems easy**, reducing the burden of technicians in terms of training. This aspect has been addressed through the massive employment of unsupervised learning techniques.

From the point of view of usability for the end users, Francesco Leotta worked on **advanced interfaces for smart spaces based on the employment of mobile applications and chat-bots** applied to the context of smart homes, cultural heritage and public administration offices. These advanced interfaces also addressed the problem of **accessibility**. Part of the research of Francesco Leotta, during the period spent at Fondazione

Santa Lucia, has been indeed devoted to enlarging the range of end users that can benefit of a smart space, including **people with severe disabilities**.

Recently, Francesco Leotta has increasingly focused his attention on the research domain of **Industry 4.0**. In particular, he is working on the definition of architectures which allow the automatic composition, short- and long-term adaptation of digital twins in industrial contexts thanks to the application of techniques taken from artificial intelligence to the Internet of Things. In addition, this research activity is currently developed in the context of privately funded (Rotalaser Fustella 4.0) and publicly funded (FIRST, ElectroSpindle 4.0) projects.

As collateral results of his research and project activity, Francesco Leotta also published several results in the area of **information systems**, including works on web services, software architectures and information retrieval.

SCIENTIFIC PUBLICATIONS

Since 2011, Francesco Leotta regularly **publishes the results of his research** in international journals and conferences. Overall, he has co-authored **46 peer-reviewed scientific papers** on the above research topics, including **17 journal articles**, **1 authored book chapter**, and **28 workshop and conference papers**, and 3 technical reports.

His Google Scholar profile reports an **h-index** of **11** and an **i10-index** of 13, with **935 overall citations** (cf. <https://scholar.google.it/citations?user=Z216gywAAAAJ&hl=it>).

AWARDS

Francesco Leotta, together with Massimo Mecella and Donatella Firmani has been the recipient of the **best paper award at IEEE International Conference on Web Services (ICWS 2019)** for his contribution on “On Computing Throttling Rate Limits in Web APIs through Statistical Inference”.

PROJECTS

Francesco Leotta is/has been **actively involved** in **several research projects**, including SM4All, TOBI and VOICE (FP7 European projects) and the Italian projects FIGO (as Unit Leader), NEPTIS and SAPIENTIA. He is currently involved in the H2020 ERC NOTAE project, in H2020 project DESTINI (**of which he is scientific responsible for Sapienza**), in H2020 project FIRST (**of which he is scientific responsible of Workpackage 3**) and the Industry 4.0 projects Rotalaser (**of which he is scientific responsible**) and ElectroSpindle 4.0 (workpackage leader).

INVITED TALKS AND SCIENTIFIC TUTORIALS

Francesco Leotta has given tutorials on topics concerning the application of BPM to the context of IoT – Internet of Thing. In particular, he has given the tutorial “Hands-on Process Mining for Smart Environments” during the Intelligent Environments (IE) 2019 conference, and the tutorial “IoT for BPMers. Challenges, Case Studies and Successful Applications” in occasion of the International Conference on Business Process Management (BPM) 2019. In 2019, during a **visiting period with prof. Estefanía Serral Asensio at KU Leuven**, he has given the tutorial “Hands-on Process Mining for Smart Environments” as invited lesson in the context of the Business Process Management course of KU Leuven.

TEACHING EXPERIENCE

Francesco Leotta has an **excellent teaching experience**. Within Sapienza, he has taught as **main lecturer** the graduate course of **Interaction Design** (ING/INF 05 – 6 CFU – semester Spring 2018). Since 2011, he has been teaching assistant for the undergraduate courses of **Basi di Dati** (2011, 2013, 2016, 2017, 2018) and **Fondamenti di Informatica** (2014). Furthermore, he gave seminars for the graduate course **Seminars in Software and Services for the Information Society** (2015, 2016, 2017). For academic year 2018/2019, he has

been appointed as lecturer for the course of **Fondamenti di Informatica** (ING/INF 05 – 6 CFU – semester Spring 2019). For academic year 2019/2020, he has been appointed as professor for the course of **Basi di Dati** (ING/INF 05 – 6 CFU, semester Fall 2019) and **Fondamenti di Informatica** (ING/INF 05 – 6 CFU – semester Spring 2020). For academic year 2020/2021, he has been appointed as professor for the course of **Basi di Dati** (ING/INF 05 – 6 CFU, semester Fall 2020) and **Fondamenti di Informatica** (ING/INF 05 – 6 CFU – semester Spring 2021).

Francesco Leotta has also **experience as a lecturer for industries and companies**. He taught, for example the course of **Process Discovery** at NESEA in 2015.

SUPERVISION OF STUDENTS

Since 2011, within DIAG, Francesco Leotta **co-supervised**:

- **4 B.Sc. students** and **2 M.Sc. students** in Engineering in Management Science on the topics of database design, open data analysis and mixed public transportation routing
- **4 B.Sc. students** and **30 M.Sc. students** in Engineering in Computer Science on the topics of smart spaces, advanced user interfaces based on chatbots, digital humanities, information retrieval and recommending systems, natural language processing, open data management, industry 4.0, indoor localization and tracking, business process mining, simulation environments

Notably, **9 of his M.Sc. students published the results of their thesis** in international peer-reviewed scientific journals, conferences and workshops.

Additionally, between 2017 and 2019, Francesco Leotta **co-supervised the PhD** of Daniele Sora about human habit discovery and mining in smart spaces.

ACADEMIC COMMUNITY SERVICE

Francesco serves/has served regularly as a **reviewer for international journals**, such as SPE - Software: Practice and Experience (Wiley), Intelligent Systems (IEEE), JDIQ - Journal of Data and Information Quality (ACM), and JODS – Journal of Data Semantics (Springer). Additionally, he serves as a reviewer for international and national conferences and he is/has been in the program committee of S-BPM ONE 2019, PRACTI-O-WEB 2017, RW-BPMS 2017, ICHMS 2020 and AVI 2020.

As far as **organization of conferences and workshops**, Francesco Leotta has acted/is acting as:

- Poster and short paper chair of the 17th International Conference on Intelligent Environments (IE 2021)
- Program chair of the 4th International Workshop on Business Processes Meet the Internet-of-Things (BP-Meet-IoT 2020)
- Short paper chair of the International Conference on Advanced Visual Interfaces (AVI 2020)
- Web and Social Media Chair of the 31st Int. Conf. on Advanced Information Systems Engineering (CAiSE 2019)
- Demos and Video Chair of the 14th International Conference on Intelligent Environments (IE 2018)
- Program Chair of the International Workshop on the Practice of the Open Web (PRACTI-O-WEB 2017)
- Web Chair of the 8th IEEE Int. Conf. on Service Oriented Computing & Applications (SOCA 2015)
- Local Organizing Chair of the 12th Int. Conf. on Mobile Web and Intelligent Inf. Syst. (MobiWis 2015)
- Publicity Chair of the 3rd Int. Conf. Future Internet of Things and Cloud (FiCloud 2015)

PROFESSIONAL ACTIVITY AND OPEN-SOURCE PROJECTS

Francesco Leotta served as a consultant for several companies and public administrations on topics related to software and **system architectures, database design and Industry 4.0**. Notably, he is currently appointed by the Government Agencies for ICT in the Public Administrations, specifically from 2018 he is working with **AgID and Team Digitale** on the specifications of the Modi 2018 – Modello di Interoperabilità 2018, and

in 2018—2021 he is working with **Dipartimento della Funzione Pubblica** on the technological specifications for FOIA – Freedom of Information Act. Additionally, between 2016 and 2017 he collaborated with **Ministero delle Infrastrutture e dei Trasporti** – MIT to investigate the ecosystem development opportunities connected to mixed public transportation networks. Additionally, among the products of his research activity, Francesco Leotta follows the development and maintenance of three **open source projects: PLaTHEA, MWIMT and VPM.**

FRANCESCO LEOTTA CURRICULUM VITAE

Part I – General Information

Full Name	Francesco Leotta
Citizenship	Italian
E-mail	leotta@diag.uniroma1.it --- francescoleotta@hotmail.com
Spoken Languages	Italian (Native), English (Excellent)

Part II – Education

(II A) – Academic Achievements

Type	Year	Institution	Notes
PhD	2014	Sapienza Università di Roma	<u>PhD</u> in Engineering in Computer Science (Cycle XXVI). PhD Thesis: “ <i>Instrumenting and Mining Smart Spaces</i> ”. <u>Advisor</u> : Prof. Massimo Mecella
Licensure in Engineering	2010	Sapienza Università di Roma	<u>National qualification</u> to practice as a Computer Science Engineer.
University graduation	2010	Sapienza Università di Roma	<u>Master Degree</u> in Engineering in Computer Science. Final mark: 110/110 cum laude (with honours) . Master Thesis: “ <i>A Service-Based People Localization and Tracking System for Domotic Applications</i> ”. <u>Advisor</u> : Prof. Massimo Mecella
University graduation	2006	Sapienza Università di Roma	<u>Bachelor Degree</u> in Engineering in Computer Science. Final mark: 110/110 cum laude (with honours) . Bachelor Thesis: “ <i>Progetto di Reti di Calcolatori: Aggiungi un Gioco a Tavola</i> ”.

(II B) – Participation to PhD Schools

Type	Year	Institution	Notes
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PhD School	2012	Sapienza Università di Roma	<i>Hot Topics in Secure and Dependable Computing for Critical Infrastructures</i> Course Leader: Prof. Roberto Baldoni, Sapienza Università di Roma, Italy.
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Part III – Appointments

(III A) – Academic Appointments

Start	End	Institution	Contract/Grant ¹	Position
01/08/2019	Present	Dipartimento di Ingegneria Informatica, Automatica e Gestionale, Sapienza Università di Roma	C8	Assistant Professor (RTD-A) in the DASILab group. <u>Research topics:</u> Smart Space Automation, HCI – Human-Computer Interaction, Digital Humanities, Information Retrieval from Web and Open Data
01/10/2014	31/07/2019	Dipartimento di Ingegneria Informatica, Automatica e Gestionale, Sapienza Università di Roma	C4, C5, C6, C7	Research fellow in the DASILab group. <u>Research topics:</u> Smart Space Automation, HCI – Human-Computer Interaction, Digital Humanities, Information Retrieval from Web and Open Data
01/11/2010	30/09/2014	Dipartimento di Ingegneria Informatica, Automatica e Gestionale, Sapienza Università di Roma	C2, C3	PhD Student under the supervision of Prof. Massimo Mecella. <u>Research topics:</u> Smart Space Automation, Indoor Localization
01/02/2010	31/07/2011	Fondazione Santa Lucia	C1	Research Assistant under the supervision of Prof. Febo Cincotti and Donatella Mattia, M.D.. <u>Research Topics:</u> Signal Processing, Biosignal Processing, HCI – Human-Computer Interaction

(III B) – Contracts and Research Grants

¹ For each Academic Appointment, the associated contracts or research grants are listed in Section (III B).

ID	Start	End	Duration	Institution	Contract Type
C1	01/02/2010	31/07/2011	18 months	Fondazione Santa Lucia, Roma	CO.CO.PRO (short term contract)
C2	01/11/2010	31/10/2013	36 months	Dipartimento di Ingegneria Informatica, Automatica e Gestionale of Sapienza Università di Roma	PhD Research Grant (Borsa di Studio di Dottorato)
C3	01/11/2013	31/10/2014	12 months (the whole period was benefited during the last year of PhD)	Dipartimento di Ingegneria Informatica, Automatica e Gestionale of Sapienza Università di Roma	Research Grant (Assegno di Ricerca)
C4	01/11/2014	30/06/2016	20 months	Dipartimento di Ingegneria Informatica, Automatica e Gestionale of Sapienza Università di Roma	Research Grant (Assegno di Ricerca)
C5	01/07/2016	30/11/2016	6 months	Dipartimento di Ingegneria Informatica, Automatica e Gestionale of Sapienza Università di Roma	Research Scholarship (Borsa di Studio)
C6	01/12/2016	30/11/2017	12 months	Dipartimento di Ingegneria Informatica, Automatica e Gestionale of Sapienza Università di Roma	Research Grant (Assegno di Ricerca)
C7	01/01/2018	31/07/2019	19 months	Dipartimento di Ingegneria Informatica, Automatica e Gestionale of Sapienza Università di Roma	Research Grant (Assegno di Ricerca)
C8	01/08/2019	31/07/2022	3 years	Dipartimento di Ingegneria Informatica, Automatica e Gestionale of Sapienza Università di Roma	Ricercatore a tempo determinato di tipologia A (RTD-A)

Part IV – Teaching experience

(IV A) – Teaching in Academia

Year	Institution	Lecture/Course
2020/2021	Sapienza Università di Roma B.Sc. in Engineering in Management Science	Teacher of the course “ Fondamenti di Informatica ” (Foundations of Computer Science – ING/INF 05 – 6 CFU)
2020/2021	Sapienza Università di Roma B.Sc. in Engineering in Management Science	Teacher of the course “ Basi di Dati ” (Database – ING/INF 05 – 6 CFU)
2019/2020	Sapienza Università di Roma B.Sc. in Engineering in Management Science	Teacher of the course “ Fondamenti di Informatica ” (Foundations of Computer Science – ING/INF 05 – 6 CFU)
2019/2020	Sapienza Università di Roma B.Sc. in Engineering in Management Science	Teacher of the course “ Basi di Dati ” (Database – ING/INF 05 – 6 CFU)
2018/2019	Sapienza Università di Roma B.Sc. in Engineering in Management Science	Lecturer (Docente a contratto) of the course “ Fondamenti di Informatica ” (Foundations of Computer Science – ING/INF 05 – 6 CFU)
2018/2019	Sapienza Università di Roma M.Sc. in Engineering in Management Science	Teaching assistant (Tutor) of the course “ Basi di Dati ” (Databases - ING-INF/05 - 6 CFU). Course Leader: Prof. Tiziana Catarci
2017/2018	Sapienza Università di Roma B.Sc. in Engineering in Management Science	Teaching assistant (Tutor) of the course “ Basi di Dati ” (Databases - ING-INF/05 - 6 CFU). Course Leader: Prof. Tiziana Catarci
2017/2018	Sapienza Università di Roma M.Sc. in Design, Multimedia and Visual Communication	Lecturer (Docente a contratto) of the course “ Ambienti Virtuali Interattivi ” (Interaction Design – ING/INF 05 – 6 CFU)
2016/2017	Sapienza Università di Roma B.Sc. in Engineering in Management Science	Teaching assistant (Tutor) of the course “ Basi di Dati ” (Databases - ING-INF/05 - 6 CFU). Course Leader: Prof. Tiziana Catarci
2014/2015	Sapienza Università di Roma B.Sc. in Computer Science and Engineering	Teaching assistant (Tutor) of the course “ Fondamenti di Informatica II ” (Databases - ING-INF/05 - 6 CFU). Course Leader: Prof. Fabrizio D’Amore and Giuseppe De Giacomo
2012/2013	Sapienza Università di Roma B.Sc. in Engineering in Management Science	Teaching assistant (Tutor) of the course “ Basi di Dati ” (Databases - ING-INF/05 - 6 CFU). Course Leader: Prof. Tiziana Catarci

2011/2012	Sapienza Università di Roma B.Sc. in Engineering in Management Science	Teaching assistant (Tutor) of the course “ Basi di Dati ” (Databases - ING-INF/05 - 6 CFU). Course Leader: Prof. Tiziana Catarci
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(IV B) – Lectures and specialized seminars in Academia

Year	Institution	Lecture/Course
2017/2018	Sapienza Università di Roma M.Sc. in Computer Science and Engineering	Specialized Seminars (4 talks on Development Boards and Smart Spaces, for 8 academic hours) for the course of “ Seminars in Software and Services for the Information Society ” (ING-INF/05 - 6 CFU) <u>Course Leader:</u> Prof. Massimo Mecella
2016/2017	Sapienza Università di Roma M.Sc. in Computer Science and Engineering	Specialized Seminars (4 talks on Development Boards and Smart Spaces, for 8 academic hours) for the course of “ Seminars in Software and Services for the Information Society ” (ING-INF/05 - 6 CFU) <u>Course Leader:</u> Prof. Massimo Mecella
2015/2016	Sapienza Università di Roma M.Sc. in Computer Science and Engineering	Specialized Seminars (4 talks on Development Boards and Smart Spaces, for 8 academic hours) for the course of “ Seminars in Software and Services for the Information Society ” (ING-INF/05 - 6 CFU) <u>Course Leader:</u> Prof. Massimo Mecella

(IV C) –Teaching in Industry

Start	End	Institution	Lecture/Course
13/10/2015	15/10/2015	NESEA. via Flavio Domiziano 10, 00145 Rome (Italy)	Lecturer (Docente a contratto) for the course “ Process Discovery ”, held for NESEA ² . Nesea is an Italian consulting ICT company.

(IV D) – Supervision of students

Since 2011, within DIAG, Francesco Leotta **co-supervised**:

- **4 B.Sc. students** and **2 M.Sc. students** in Engineering in Management Science on the topics of database design, open data analysis and mixed public transportation routing
- **4 B.Sc. students** and **30 M.Sc. students** in Engineering in Computer Science on the topics of smart spaces, advanced user interfaces based on chatbots, digital humanities, information retrieval and

² <http://www.nesea.it/>

recommending systems, natural language processing, open data management, industry 4.0, indoor localization and tracking, business process mining, simulation environments

Notably, **9 of his M.Sc. students published the results of their thesis** in international peer-reviewed scientific journals, conferences and workshops (see below for more details).

- M. Boccuzzi, T. Catarci, **L. Deodati (M.Sc. student)**, **A. Fantoli (M.Sc. student)**, A. Ghignoli, **F. Leotta**, M. Mecella, A. Monte, N. Sietis. *Identifying, classifying and searching graphic symbols in the NOTAE system*. In Italian Research Conference on Digital Libraries (IRCDL 2020), pp. 111-121, Springer, Bari, Italy, 29-31 January 2020
- **F. Leotta**, A. Marrella, M. Mecella, F. Palucci, **C. Seri (M.Sc. student)**, T. Catarci. *Encouraging persons to visit cultural sites through mini-games*. In: EAI Endorsed Transactions on Serious Games, EAI, 2018
- **F. Leotta**, M. Mecella, D. Sora, **G. Spinelli (M.Sc. student)**. *Pipelining user trajectory analysis and visual process maps for habit mining*. In: IEEE Ubiquitous Intelligence & Computing (UIC 2017), pp. 1-8, IEEE, San Francisco, USA, 4-8 August 2017
- **M. Dimaggio (M.Sc. student)**, **F. Leotta**, M. Mecella, D. Sora. *Process-based habit mining: experiments and techniques*. In: IEEE Ubiquitous Intelligence & Computing (UIC 2016), pp. 145-152, IEEE, Toulouse, France, 18-21 July 2016
- T. Catarci, **F. Leotta**, A. Marrella, M. Mecella, D. Sora, P. Cottone, G. Lo Re, M. Morana, M. Ortolani, V. Agate, G. Renato, **G. Meschino (M.Sc. student)**, G. Pecoraro. *Your Friends Mention It. What About Visiting It? A Mobile Social-Based Sightseeing Application*. In: Proceedings of the 13th International Conference on Advanced Visual Interfaces (AVI 2016), pp. 300-301, ACM, Bari, Italy, 7-10 June 2016
- **G. Cucari (M.Sc. student)**, **F. Leotta**, M. Mecella, S. Vassos. *Collecting human habit datasets for smart spaces through gamification and crowdsourcing*. In: International Conference on Games and Learning Alliance (GALA 2015), pp. 208-217, Springer, Rome, Italy, 10-11 December 2015
- **S. Porreca (M.Sc. student)**, **F. Leotta**, M. Mecella, S. Vassos, T. Catarci. *Accessing Government Open Data through Chatbots*. In: International Workshop on the Practice of the Open Web (PRACTI-O-WEB 2017), Proceedings of the 17th International Conference on Web Engineering (ICWE 2017), Springer, Rome, Italy, 5-8 June 2017
- M. Caruso, **Ç. Ilban (M.Sc. student)**, **F. Leotta**, M. Mecella, S. Vassos. *Synthesizing daily life logs through gaming and simulation*. In: 2nd Workshop on recent advances in behavior prediction and pro-active pervasive computing (AwareCast 2013), Proceedings of the ACM conference on Pervasive and ubiquitous computing (UBICOMP 2013), ACM, Zurich, Switzerland, 8-12 September 2013

Finally, between 2017 and 2019, Francesco Leotta **co-supervised the PhD** of Daniele Sora about human habit discovery and mining in smart spaces.

Part V – Research Activities

Francesco Leotta is affiliated to **DASILab** (Data and Service Integration Lab) at DIAG. He is a member of the **Data and Service Management research group** and of the **Human-Computer Interaction research group**. His overall research activity has been carried out in Rome (Italy) between Dipartimento di Ingegneria Informatica, Automatica e Gestionale Antonio Ruberti and Fondazione Santa Lucia.

The research of Francesco Leotta concerns **algorithmic, methodological, experimental and practical aspects** in different areas of Computer Science, including **ubiquitous computing, human-computer interaction and digital humanities**. Such topics are challenged in the application domains of **smart spaces, smart manufacturing and cultural heritage**.

Since 2010, Francesco Leotta has defined a research project that involves the employment of techniques from machine learning and data mining, specifically from business process management and mining, in order to address the problem of **smart space monitoring and automation**. Here, the term smart space is intended in the widest sense possible, covering **smart homes, factories, museums, smart cities and offices**. In particular, the goal of the research project is **learning and visualizing human habits and procedures from unlabeled data sources** such as sensor logs or even written texts and data tables. These habits can be used for anomaly detection, recommender systems and automation. Notably, the term *habit mining* has been introduced by Francesco Leotta to describe this area of research.

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From the point of view of usability for the end users, Francesco Leotta worked on **advanced interfaces for smart spaces based on the employment of mobile applications and chat-bots** applied to the context of smart homes, cultural heritage and public administration offices. These advanced interfaces also addressed the problem of **accessibility**. Part of the research of Francesco Leotta, during the period spent at Fondazione Santa Lucia, has been indeed devoted to enlarging the range of end users that can benefit of a smart space, including **people with severe disabilities**.

Recently, Francesco Leotta has increasingly focused his attention on the research domain of **Industry 4.0**. In particular, he is working on the definition of architectures which allow the automatic composition, short- and long-term adaptation of digital twins in industrial contexts thanks to the application of techniques taken from artificial intelligence to the Internet-of-Things. In addition, this research activity is currently developed in the context of privately funded (Rotalaser Fustella 4.0) and publicly funded (FIRST, ElectroSpindle 4.0) projects.

As collateral results of his research and project activity, Francesco Leotta also published several results in the area of **information systems**, including works on web services, software architectures and information retrieval.

His main research accomplishments in all the areas of interest are summarized below.

Keywords

Habit Mining in Smart Spaces
Application of techniques from data mining and business process mining to obtain and visualize smart space models

Brief Description

Pervasive computing embodies a vision of computers seamlessly integrating into everyday life, responding to information provided by sensors in the environment, with little or no direct instruction from users. **Smart spaces** represent an application area of pervasive computing. A **smart space** is an environment centered on its human users in which a set of embedded networked artefacts, both hardware and software, collectively realize the paradigm of **ambient intelligence - (Aml)**. A survey of these technique have been provided in **J12**. Many different definitions of Aml do exist, but the common element of all of these definition is the need for Aml system to ground its action into models of the environment and of human habits. In this context, **the research of Francesco Leotta** has mainly focused on proposing methods to extract and visualize models

that can be analyzed and inspected by experts of the domain instead of researchers. In order to obtain this goal, Francesco Leotta has proposed an approach called **habit mining** where models of human habits are obtained and visualized using techniques borrowed from the world of business process management and mining. Human habits are completely different from traditional business process both in their nature (human habits are extremely flexible) and in the traces they leave on the environment (human habits can be only observed through very fine grain sensor logs that are completely different from event logs used in process mining. All the challenges to be addressed have been highlighted in **W4**. Results of this research have been published in **J13, C10, C9, C8, C5, N1, W8, C11**.

All of the proposed techniques strongly relies on discrete positions of human users. During the research project Francesco Leotta also work on **continuous tracking of positions**, which represent an important contextual information. This research direction have been published in **J9, W1**. These topics were also investigated within the SM4All project. Another important contextual information is represented by power consumption as reported in **W6**.

In order to perform evaluation of the proposed techniques, datasets are needed. Even though free datasets are available from international project, they do not usually meet the requirements in terms of available sensors, thus **simulation techniques based on crowdsourcing and virtual environments** have been proposed in **C6, C3, W3**.

Recently, Francesco Leotta also investigated the relationship between processes and data, as a possible evolution of the representation methods employed for habit mining. Surveyed techniques are presented in **J11**. As a perfect example of Smart Space with data, Francesco Leotta applied Business Process Mining in the context of a Roman Hospital as witnessed by **J14** and **J16**.

Additionally, he recently bootstrapped a new research direction involving event prediction in smart spaces by employing deep neural network, as published in **C14**.

Industry 4.0

Techniques for modeling and automatizing smart factories and digital twins

Last years witnessed a continuous evolution of technologies in the fields of communication, networking, storage and computing, that found their way in the traditional world of industrial automation. This trend, functional to increase productivity and quality, to ease workers' lives, and to define new business opportunities, goes under the name of smart manufacturing or Industry 4.0.

Digital factory is a key concept. It aims at using digital technologies to promote the integration of product design processes, manufacturing processes, and general collaborative business processes across factories. An important aspect of this integration is to ensure interoperability between machines, products, processes, and services. A digital factory consists of a multi-layered integration of the information related to various activities along the factory and related resources. Actors can fall in different categories, being humans (i.e., final users or participants in the production process), information systems or industrial

machines. These physical entities must have a faithful representation in the digital world, usually referred to as digital twins.

Francesco Leotta is currently investigating a complex architecture for digital factories, which exploits digital twins and aim at exploiting automatic composition techniques of web services. The approach proposed in **C12, N3 and W10** captures analogies and differences between digital twins and web services, and enables integration and composition of digital twins through offered services and data available in the data space of the factory.

Advanced Interfaces

Techniques to improve accessibility smart space and cultural heritage in smart cities and museums

Usability is a two-faced coin. If usability for domain experts and technicians is fundamental, usability for end users decide the success of a technique. For this reason, Francesco Leotta studied advanced interfaces in different application scenarios. In particular, interfaces to simplify the access to **cultural heritage in smart cities** have been presented in **J10, C7**. The research in cultural heritage is currently conducted in the context of the NOTAE H2020 ERC project, where Francesco Leotta is working on human-in-the loop methods allowing to simplify the research of symbols in medieval documents on papyrus, clay tablets, slates and parchments. A first effort of this research is published in **N4**.

The access to smart spaces must be made available also to people with severe disabilities. For this reason, Francesco Leotta investigated the employment of **Brain-Computer interfaces** (i.e., control means based on the real-time analysis of electroencephalographic – EEG signal). The results of this work have been published in **J1-J8, B1, C4, C2, C1, W2**. The employment of advanced interfaces in the health sector is also the subject of **J15**.

Humans follow their own habits inside smart spaces, but in other cases they must follow certain procedures (e.g., public administration procedures). These procedures are usually represented in plain text and data tables. In order to query this kind of procedures, Francesco Leotta worked on interfaces based on **chatbots**, which analyze text (through NLP) and different categories of available data, and allows user to query them with sentences in natural languages. Results of this research have been published in **N2, W7**. Similar techniques have been used to provide natural language interfaces to specific topic documents (e.g., documents related to entrepreneurship) with the development of a specific purpose search engine based on a **NOSQL database** as published in **W4**. Additionally, chatbot-based interfaces as been employed in the challenging world of Industry 4.0 as published in **W9**.

Information Systems

Techniques to support smart spaces and services

As collateral results of his several research directions and participation to projects, Francesco Leotta published several papers in the area of information systems.

In the context of his collaboration with Ministero delle Infrastrutture e dei Trasporti, Francesco Leotta worked on techniques to encourage providers of public services (e.g., public transport operators) to provide free API. In particular, starting from the consideration that many public operators do not publish open data through API due to the possibility of aggregate analysis of their performance, Francesco Leotta proposed a principled method based on statistical inference to

estimate the maximum API call rate an operator can accept before a meaningful statistical analysis of its performance is possible. **The innovatively of the proposed approach fruited Francesco Leotta the best paper award (see C13) at ICWS 2019, one of the main conferences in the area of web services.**

As a support tool to meet the needs of Industry and the skills of Academia, Francesco Leotta also contributed with **J15** where **data integration** is applied to this aim. In particular, different academic source (e.g., Scopus, Web of Science) are integrated, through an ontology, to provide information to institutional and private actors in the context of Sapienia Project.

Finally, in order to support entrepreneurship, in the context of VOICE European project, Francesco Leotta defined an **information retrieval and integration** architecture which, through the employment of Natural Language Processing is able to provide useful information to new entrepreneurs (so called want-preneurs) by matching their need with available contents on the Internet. The result of this effort has been published in **W4**.

Part VI – Summary of Scientific Achievements

Product type	Number	Data Base	Start	End
Journal Papers [international]	17	Google Scholar	2011	2020
Book Chapters [scientific]	1	Google Scholar	2011	2020
Conference Papers [international]	14	Google Scholar	2011	2020
Conference Papers [national]	4	Google Scholar	2016	2020
International Workshops [scientific]	10	Google Scholar	2011	2020
Technical Reports [scientific]	3	Sapienza	2015	2020
Theses [academic]	3	Sapienza	2006	2014

Metrics	Google Scholar	Scopus
Number of Research Products*	46	41
Total Citations	935	564
Average Citations per Product°	20.32	13.76
Hirsch (H) index	11	9
i10-index	13	9

*Edited works, technical reports and theses are not considered in the list of research products.

° The *average citations* are calculated on the basis of the peer-reviewed articles published (and already indexed in the respective databases) from 2007 to 2019.

Part VII – Publications

International Journals³

- J1. C. Zickler, A. Riccio, **F. Leotta**, S. Hillian-Tress, S. Halder, E. M. Holz, P. Staiger-Sälzer, E.J. Hoogerwerf, L. Desideri, D. Mattia, A. Kübler. *A brain-computer interface as input channel for a standard assistive technology software*. In: Clinical EEG and Neuroscience, SAGE Publications, 2011. [IF 1.986] [SJR Q2] <https://doi.org/10.1177/155005941104200409>
- J2. F. Aloise, F. Schettini, P. Aricò, **F. Leotta**, S. Salinari, D. Mattia, F. Babiloni, F. Cincotti. *P300-based brain-computer interface for environmental control: an asynchronous approach*. Journal of neural engineering, IOP Publishing, 2011. [IF 6.221] [SJR Q1] <https://doi.org/10.1088/1741-2560/8/2/025025>
- J3. A. Riccio, F. Leotta, F. Aloise, L. Bianchi, D. Mattia, F. Cincotti. *Evaluation of a p300 overlaid stimulation for controlling an assistive technology software*. In: International Journal of Bioelectromagnetism, 2011, Vol. 13 Num. 3, ISSN 1456-7865 <http://www.ijbem.org/volume13/number3/141-143.pdf>
- J4. G. R. Müller-Putz, C. Breitwieser, M. Tangermann, M. Schreuder, M. Tavella, R. Leeb, F. Cincotti, **F. Leotta**, C. Neuper. *Tobi hybrid BCI: principle of a new assistive method*. In: International Journal of Bioelectromagnetism, 2011, Vol. 13 Num. 3, ISSN 1456-7865 <http://www.ijbem.org/volume13/number3/144-145.pdf>
- J5. F. Schettini, F. Aloise, P. Aricò, **F. Leotta**, S. Salinari, F. Babiloni, D. Mattia, and F. Cincotti. *Improving Asynchronous Control for P300-based BCI: Towards a Completely Autoadaptive System*. In: International Journal of Bioelectromagnetism, 2011, Vol. 13 Num. 3, ISSN 1456-7865 <http://www.ijbem.org/volume13/number3/150-151.pdf>
- J6. A. Riccio, **F. Leotta**, L. Bianchi, F. Aloise, C. Zickler, E.J. Hoogerwerf, A. Kübler, D. Mattia, F. Cincotti. *Workload measurement in a communication application operated through a P300-based brain-computer interface*. Journal of neural engineering, IOP Publishing, 2011 [IF 6.221] [SJR Q1] <https://doi.org/10.1088/1741-2560/8/2/025028>
- J7. G. R. Müller-Putz, C. Breitwieser, F. Cincotti, R. Leeb, M. Schreuder, **F. Leotta**, M. Tavella, L. Bianchi, A. Kreiling, A. Ramsay, M. Rohm, M. Sagebaum, L. Tonin, C. Neuper, J. del R Millán. *Tools for brain-computer interaction: a general concept for a hybrid BCI*. In: Frontiers in neuroinformatics, Frontiers, 2011 [IF 4.033] [SJR Q1] <https://doi.org/10.3389/fninf.2011.00030>
- J8. A. Riccio, E. M. Holz, P. Aricò, **F. Leotta**, F. Aloise, L. Desideri, M. Rimondini, A. Kübler, D. Mattia, F. Cincotti. *Hybrid P300-based brain-computer interface to improve usability for people with severe motor disability: electromyographic signals for error correction during a spelling task*. In: Archives of physical medicine and rehabilitation, WB Saunders, 2015 [IF 3.730] [SJR Q1] <https://doi.org/10.1016/j.apmr.2014.05.029>

³ The quality of a journal is assessed, where available, through the following metrics (all metrics are updated to the publication year, for most recent ones the 2019 values are considered):

- (In absence of JCR) Impact Factor (IF) extracted from Scopus.
- SCImago Journal Rank (SJR) measures the scientific influence of a journal and ranges from Q1 (top) to Q4.

- J9. **F. Leotta**, M. Mecella. *PLaTHEA: a marker-less people localization and tracking system for home automation*. In: *Software: Practice and Experience*, Wiley, 2015 [IF 1.804] [SJR Q2] <https://doi.org/10.1002/spe.2262>
- J10. **F. Leotta**, A. Marrella, M. Mecella, F. Palucci, C. Seri, T. Catarci. *Encouraging persons to visit cultural sites through mini-games*. In: *EAI Endorsed Transactions on Serious Games*, EAI, 2018 <http://dx.doi.org/10.4108/eai.4-1-2018.153531>
- J11. **F. Leotta**, M. Mecella, D. Sora, T. Catarci. *Surveying Human Habit Modeling and Mining Techniques in Smart Spaces*. In: *Future Internet*, MDPI, 2019 [IF 1.284][SJR Q3] <https://doi.org/10.3390/fi11010023>
- J12. **F. Leotta**, M. Mecella, D. Sora. *Visual process maps: a visualization tool for discovering habits in smart homes*. In: *Journal of Ambient Intelligence and Humanized Computing*, Springer, 2019 [IF 6.324] [SJR Q1] <https://doi.org/10.1007/s12652-019-01211-7>
- J13. S. Steinau, A. Marrella, K. Andrews, **F. Leotta**, M. Mecella, M. Reichert. *DALEC: a framework for the systematic evaluation of data-centric approaches to process management software*. In: *Software & Systems Modeling*, Springer, 2019 <https://doi.org/10.1007/s10270-018-0695-0> [IF 2.980] [SJR Q2]
- J14. T. Catarci, **F. Leotta**, A. Marrella, M. Mecella, M. Sharf. *Process-Aware Enactment of Clinical Guidelines through Multimodal Interfaces*. In: *Computers*, MDPI, 2019 <https://doi.org/10.3390/computers8030067> [IF 2.316] [SJR Q3]
- J15. M. Angelini, C. Daraio, M. Lenzerini, **F. Leotta**, G. Santucci. *Performance model's development: A novel approach encompassing ontology-based data access and visual analytics*. In: *Scientometrics*, Springer, 2020 <https://doi.org/10.1007/s11192-020-03689-x> [IF 3.555] [SJR Q1]
- J16. S. Agostinelli, F. Covino, G. D'Agnese, C. De Crea, **F. Leotta**, A. Marrella. *Supporting Governance in Healthcare Through Process Mining: A Case Study*. In: *Access*, IEEE, 2020 <https://doi.org/10.1109/ACCESS.2020.3030318> [IF 4.983] [SJR Q1]
- J17. C. Janiesch, A. Koschmider, M. Mecella, B. Weber, A. Burattin, C. Di Ciccio, G. Fortino, A. Gal, U. Kannengiesser, **F. Leotta**, F. Mannhardt, A. Marrella, J. Mendling, A. Oberweis, M. Reichert, S. Rinderle-Ma, E. Serral, W. Song, J. Su, V. Torres, M. Weidlich, M. Weske, L. Zhang. *The Internet of Things Meets Business Process Management: A Manifesto*. *IEEE Systems, Man, and Cybernetics Magazine*, IEEE, 2020

Book Chapters

- B1. S. C. Kleih, T. Kaufmann, C. Zickler, S. Halder, **F. Leotta**, F. Cincotti, F. Aloise, A. Riccio, C. Herbert, D. Mattia, A. Kuebler. *Out of the frying pan into the fire - the P300-based BCI faces real-world challenges*. In: *Progress in brain research* (ISBN 978-0-444-53815-4), Volume 194, pp. 27-46, Elsevier, January 2011 <https://doi.org/10.1016/B978-0-444-53815-4.00019-4>

International Conferences⁴

- C1. F. Aloise, F. Schettini, P. Aricò, **F. Leotta**, S. Salinari, D. Mattia, F. Babiloni, F. Cincotti. *Toward Domestic Appliances Control through a Self-paced P300-based BCI*. In: International Joint Conference on Biomedical Engineering Systems and Technologies (BIOSIGNALS 2011), pp. 239-244, Rome, Italy, 26-29 January 2011
- C2. F. Cincotti, F. Pichiorri, P. Aricò, F. Aloise, **F. Leotta**, F. de Vico Fallani, J del R Millán, M. Molinari, D. Mattia. *EEG-based Brain-Computer Interface to support post-stroke motor rehabilitation of the upper limb*. In: Annual International Conference of the IEEE Engineering in Medicine and Biology Society, pp. 4112-4115, IEEE, 28 August – 1 September 2012 <https://doi.org/10.1109/EMBC.2012.6346871>
- C3. M. Caruso, **F. Leotta**, M. Mecella, S. Vassos. *Benchmarking smart spaces through autonomous virtual agents*. In: Proceedings of the 2013 international conference on Autonomous agents and multi-agent systems (AAMAS 2013), AAMAS, St. Paul, USA, 6-10 May 2013 [**CORE A++**] [**GII-GRIN A+**] <http://dl.acm.org/citation.cfm?id=2485156>
- C4. M. Caruso, F. Cincotti, **F. Leotta**, M. Mecella, A. Riccio, F. Schettini, L. Simione, T. Catarci. *My-world-in-my-tablet: an architecture for people with physical impairment*. In: International Conference on Human-Computer Interaction (HCI 2013), pp. 637-647, Springer, Las Vegas, USA, 21-26 July 2013 https://doi.org/10.1007/978-3-642-39330-3_69
- C5. V. Degeler, A. Lazovik, **F. Leotta**, M. Mecella. *Itemset-based mining of constraints for enacting smart environments*. In: The 1st Symposium on Activity and Context Modeling and Recognition (ACOMORE 2014), Proceedings of the IEEE International Conference on Pervasive Computing and Communications (PERCOM 2014), IEEE, Budapest, Hungary, 24-28 March 2014 <https://doi.org/10.1109/PerComW.2014.6815162>
- C6. G. Cucari, **F. Leotta**, M. Mecella, S. Vassos. *Collecting human habit datasets for smart spaces through gamification and crowdsourcing*. In: International Conference on Games and Learning Alliance (GALA 2015), pp. 208-217, Springer, Rome, Italy, 10-11 December 2015 https://doi.org/10.1007/978-3-319-40216-1_22
- C7. T. Catarci, **F. Leotta**, A. Marrella, M. Mecella, D. Sora, P. Cottone, G. Lo Re, M. Morana, M. Ortolani, V. Agate, G. Renato, G. Meschino, G. Pecoraro. *Your Friends Mention It. What About Visiting It? A Mobile Social-Based Sightseeing Application*. In: Proceedings of the 13th International Conference on Advanced Visual Interfaces (AVI 2016), pp. 300-301, ACM, Bari, Italy, 7-10 June 2016 [**CORE B**] [**GII-GRIN B**] <https://doi.org/10.1145/2909132.2926065>
- C8. M. Dimaggio, **F. Leotta**, M. Mecella, D. Sora. *Process-based habit mining: experiments and techniques*. In: IEEE Ubiquitous Intelligence & Computing (UIC 2016), pp. 145-152, IEEE, Toulouse, France, 18-21 July 2016 [**CORE B**] <https://doi.org/10.1109/UIC-ATC-ScalCom-CBDCom-IoP-SmartWorld.2016.0043>
- C9. **F. Leotta**, M. Mecella, D. Sora, G. Spinelli. *Pipelining user trajectory analysis and visual process maps for habit mining*. In: IEEE Ubiquitous Intelligence & Computing (UIC 2017), pp.

⁴ The quality of a conference is assessed according to the well-known GII-GRIN (A++, A+: excellent, top notch conferences, A: very good events) and CORE (A*: top 4%, A: top 14%) rankings.

1-8, IEEE, San Francisco, USA, 4-8 August 2017 [**CORE B**] <https://doi.org/10.1109/UIC-ATC.2017.8397509>

- C10. **F. Leotta**, M. Mecella, D. Sora. *Visual analysis of sensor logs in smart spaces: Activities vs. situations*. In: IEEE Fourth International Conference on Big Data Computing Service and Applications (BigDataService 2018), pp. 105-114, IEEE, Bamberg, Germany, 26-29 March 2018 <https://doi.org/10.1109/BigDataService.2018.00024>
- C11. **F. Leotta**, A. Marrella, M. Mecella. *IoT for BPMers. Challenges, Case Studies and Successful Applications*. In International Conference on Business Process Management (BPM 2019), pp. 16-22, Springer, Vienna, Austria, 1-6 September 2019 [**CORE A**] https://doi.org/10.1007/978-3-030-26619-6_3
- C12. T. Catarci, D. Firmani, **F. Leotta**, F. Mandreoli, M. Mecella, F. Sapio. *A Conceptual Architecture and Model for Smart Manufacturing Relying on Service-Based Digital Twins*. In: IEEE International Conference on Web Services (ICWS 2019), pp. 229-236, IEEE, Milano, Italy, 8-13 July 2019 [**CORE A**] <https://doi.org/10.1109/ICWS.2019.00047>
- C13. D. Firmani, F. Leotta, M. Mecella. *On Computing Throttling Rate Limits in Web APIs through Statistical Inference*. IEEE International Conference on Web Services (ICWS 2019), pp. 418-425, IEEE, Milano, Italy, 8-13 July 2019 [**CORE A**] <https://doi.org/10.1109/ICWS.2019.00075> **Best Paper Award**
- C14. G. Fortino, A. Guzzo, M. Ianni, F. Leotta, M. Mecella. *Exploiting Marked Temporal Point Processes for Predicting Activities of Daily Living*. IEEE International Conference on Human-Machine Systems (ICHMS 2020), IEEE, Roma, Italy, 07-09 September 2020 <https://doi.org/10.1109/ICHMS49158.2020.9209398>

National Conferences

- N1. M. Dimaggio, **F. Leotta**, M. Mecella, D. Sora. *Mining User Habits in Smart Spaces through Process Mining Techniques*. In: Proceedings of the 24th Italian Symposium on Advanced Database System (SEBD 2016), Matematicamente 2016, Ugento, Lecce, Italy, 19-22 June 2016
- N2. S. Porreca, **F. Leotta**, Massimo Mecella, Tiziana Catarci. *Chatbots as a Novel Access Method for Government Open Data*. In: Proceedings of the 25th Italian Symposium on Advanced Database Systems (SEBD 2017), CEUR Workshop Proceedings (Vol. 2037), Squillace Lido, Catanzaro, Italy, 25-29 June 2017
- N3. N. Bicocchi, G. Cabri, **F. Leotta**, F. Mandreoli, M. Mecella, F. Sapio. *An Architectural Approach for Digital Factories*. SEBD 2019
- N4. M. Boccuzzi, T. Catarci, L. Deodati, A. Fantoli, A. Ghignoli, **F. Leotta**, M. Mecella, A. Monte, N. Sietis. *Identifying, classifying and searching graphic symbols in the NOTAE system*. In Italian Research Conference on Digital Libraries (IRCDL 2020), pp. 111-121, Springer, Bari, Italy, 29-31 January 2020

International Workshops

- W1. **F. Leotta**, M. Mecella, F. Aloise. *PERICLES: A Performance Evaluation Platform for Indoor Localization Systems*. In: 3rd ACM SIGSPATIAL International Workshop on Indoor Spatial Awareness (ISA '11), ACM, Chicago, USA, 1-4 November 2011 <https://doi.org/10.1145/2077357.2077362>
- W2. E. Holz, A. Riccio, J. Reichert, **F. Leotta**, P. Aricò, F. Cincotti, D. Mattia, A. Kübler. *Hybrid-P300 BCI: Usability testing by severely motor-restricted end-users*. In: TOBI Workshop IV, Sion, Switzerland, 23-25 January 2013
- W3. M. Caruso, Ç. Ilban, **F. Leotta**, M. Mecella, S. Vassos. *Synthesizing daily life logs through gaming and simulation*. In: 2nd Workshop on recent advances in behavior prediction and pro-active pervasive computing (AwareCast 2013), Proceedings of the ACM conference on Pervasive and ubiquitous computing (UBICOMP 2013), ACM, Zurich, Switzerland, 8-12 September 2013 <https://doi.org/10.1145/2494091.2495977>
- W4. **F. Leotta**, M. Mecella, S. Vassos. *Ideas matchmaking for supporting innovators and entrepreneurs*. Proceedings of the Workshop on Data-Driven Innovation on the Web (DDI@WebSci 2016), ACM, Hannover, Germany, 22-25 May 2016 <https://doi.org/10.1145/2911187.2914583>
- W5. **F. Leotta**, M. Mecella, J. Mendling. *Applying process mining to smart spaces: Perspectives and research challenges*. In: Workshop on Real World Business Process Management System (RW-BPMS 2015), Proceedings of the International Conference on Advanced Information Systems Engineering (CAISE 2015), Springer, Stockholm, Sweden, 8-12 June 2016 https://doi.org/10.1007/978-3-319-19243-7_28
- W6. D. Sora, M. Mecella, **F. Leotta**, L. Querzoni, R. Baldoni, G. Bracone, D. Buonanno, M. Caruso, A. Cerocchi, M. Leva. *Micro-accounting for Optimizing and Saving Energy in Smart Buildings*. In: Workshop on Energy-awareness and Big Data Management in Information Systems (EnBIS 2016), Proceedings of the International Conference on Advanced Information Systems Engineering (CAISE 2016), Springer, Ljubljana, Slovenia, 13-17 June 2016 https://doi.org/10.1007/978-3-319-39564-7_15
- W7. S. Porreca, **F. Leotta**, M. Mecella, S. Vassos, T. Catarci. *Accessing Government Open Data Through Chatbots*. In: International Workshop on the Practice of the Open Web (PRACTI-O-WEB 2017), Proceedings of the 17th International Conference on Web Engineering (ICWE 2017), Springer, Rome, Italy, 5-8 June 2017 https://doi.org/10.1007/978-3-319-74433-9_14
- W8. D. Sora, **F. Leotta**, M. Mecella. *A Habit is a Process: A BPM-Based Approach for Smart Spaces*. BP-Meet-IoT Workshop, Proceedings of the 2017 International Conference on Business Process Management (BPM 2017), Springer, Barcelona, Spain, 10-15 September 2017 https://doi.org/10.1007/978-3-319-74030-0_22
- W9. D. Rooein, D. Bianchini, **F. Leotta**, M. Mecella, P. Paolini, B. Pernici. *Chatting About Processes in Digital Factories: A Model-Based Approach*. Proceedings of the 2021 Business Process Modeling, Development, and Support Working Conference (BPMDS 2021), Springer, Grenoble, France, https://doi.org/10.1007/978-3-030-49418-6_5
- W10. D. Firmani, **F. Leotta**, F. Mandreoli, M. Mecella. *Towards Smart Manufacturing with Dynamic Dataspace Alignment*. Proceedings of the CAISE 2020 Workshops. Springer, Grenoble, France https://doi.org/10.1007/978-3-030-49165-9_5

Technical Reports

- T1. T. Catarci, S.R. Humayoun, **F. Leotta**, A. Marrella, M. Mecella, A. Poggi. *HORIZON: A Development Methodology for Collaborative Projects*. In: DIAG Technical Reports. 2015
- T2. M. Romanenko, M. Mecella, **F. Leotta**. *Analysis and Optimization of Business Processes (Tutorial Laboratory Workshop)*. In: DIAG Technical Reports. 2016
- T3. D. Ghedalia, F. Leotta, M. Mecella. *Realizing Smart Manufacturing Architectures through Digital Twin Frameworks*. In DIAG Technical Reports. 2020

Theses

- P1. **F. Leotta**. *Instrumenting and Mining Smart Spaces*. PhD Thesis in Engineering in Computer Science (Cycle XXVI), Sapienza Università di Roma, Italy. September 2014. URL: http://www.dis.uniroma1.it/~leotta/publications/Leotta_PhD_Thesis.pdf
- M1. **F. Leotta**. *A Service-Based People Localization and Tracking System for Domotic Applications*. M.Sc. Thesis in Engineering in Computer Science, Sapienza Università di Roma, Italy. January 2010
- B1. **F. Leotta**. *Progetto di Reti di Calcolatori: Aggiungi un Gioco a Tavola*. B.Sc. Thesis in Engineering in Computer Science, Sapienza Università di Roma, Italy. March 2006

Part VIII – Paper presentation

Francesco Leotta has presented the results of his research in the following events:

Year	Event	Paper
2020	IEEE International Conference on Human-Machine Systems (ICHMS 2020)	Exploiting Marked Temporal Point Processes for Predicting Activities of Daily Living.
2020	16th Italian Research Conference on Digital Libraries (IRCDL 2020)	Identifying, classifying and searching graphic symbols in the NOTAE system
2019	The 15th International Conference on Intelligent Environments (IE 2019)	Hands-on Process Mining for Smart Environments (TUTORIAL)
2019	International Conference on Business Process Management (BPM 2019)	IoT for BPMers. Challenges, Case Studies and Successful Applications. (TUTORIAL)
2019	IEEE International Conference on Web Services (ICWS 2019)	On Computing Throttling Rate Limits in Web APIs through Statistical Inference
2018	IEEE Fourth International Conference on Big Data Computing Service and Applications (BigDataService 2019)	Visual analysis of sensor logs in smart spaces: Activities vs. situations

2017	International Workshop on the Practice of the Open Web (PRACTI-O-WEB 2017)	Accessing Government Open Data Through Chatbots
2015	Workshop on Real World Business Process Management System (RW-BPMS 2015)	Applying process mining to smart spaces: Perspectives and research challenges
2015	International Conference on Games and Learning Alliance (GALA 2015)	Collecting human habit datasets for smart spaces through gamification and crowdsourcing
2014	1st Symposium on Activity and Context Modeling and Recognition (ACOMORE 2014)	Itemset-based mining of constraints for enacting smart environments
2013	2nd Workshop on recent advances in behavior prediction and pro-active pervasive computing (AwareCast 2013)	Synthesizing daily life logs through gaming and simulation.
2013	International Conference on Human-Computer Interaction (HCI 2013)	My-world-in-my-tablet: an architecture for people with physical impairment
2013	2013 International conference on Autonomous agents and multi-agent systems (AAMAS 2013)	Benchmarking smart spaces through autonomous virtual agents
2011	3rd ACM SIGSPATIAL International Workshop on Indoor Spatial Awareness (ISA '11)	PERICLES: A Performance Evaluation Platform for Indoor Localization Systems.

Part IX – Awards

Francesco Leotta, together with Massimo Mecella and Donatella Firmani has been the recipient of the **best paper award at IEEE International Conference on Web Services (ICWS 2019)** for his contribution on “On Computing Throttling Rate Limits in Web APIs through Statistical Inference”.

Part X – Invited Talks and Scientific Tutorials

Francesco Leotta has given tutorials on topics concerning the application of BPM to the context of IoT – Internet of Thing. In particular, he has given:

- the tutorial “Hands-on Process Mining for Smart Environments” during the Intelligent Environments (IE) 2019 conference
- the tutorial “IoT for BPMers. Challenges, Case Studies and Successful Applications” in occasion of the International Conference on Business Process Management (BPM) 2019.
- he has given the tutorial “Hands-on Process Mining for Smart Environments” as invited lesson in the context of the Business Process Management course of KU Leuven given by prof. Jochen De Weerd.

Part XI – Visiting periods abroad

In 2019 he has been visiting professor at KU Leuven, working on dataset generation and process mining for IoT and, in particular, smart spaces. Francesco Leotta has been invited by prof. Estefania Serral Asensio in order to discuss research ideas related to smart spaces, in particular concerning the automatic generation of datasets and the discovery of automation rules. This collaboration is currently ongoing.

Part XII – Academic Community Service

(XII A) – Conferences and Workshops Organization and Chairing

As far as organization of conferences and workshops, Francesco Leotta has acted/is acting as:

- Poster and short paper chair of the 17th International Conference on Intelligent Environments (IE 2021)
- Program chair of the 4th International Workshop on Business Processes Meet the Internet-of-Things (BP-Meet-IoT 2020)
- Short paper chair of the International Conference on Advanced Visual Interfaces (AVI 2020)
- Web and Social Media Chair of the 31st Int. Conf. on Advanced Information Systems Engineering (CAiSE 2019)
- Demos and Video Chair of the 14th International Conference on Intelligent Environments (IE 2018)
- Program Chair of the International Workshop on the Practice of the Open Web (PRACTI-O-WEB 2017)
- Web Chair of the 8th IEEE Int. Conf. on Service Oriented Computing & Applications (SOCA 2015)
- Local Organizing Chair of the 12th Int. Conf. on Mobile Web and Intelligent Inf. Syst. (MobiWis 2015)
- Publicity Chair of the 3rd Int. Conf. Future Internet of Things and Cloud (FiCloud 2015)

(XII B) – Program Committee Membership

Francesco Leotta serves/served in the Program Committee of:

- International Conference on Advanced Visual Interfaces (AVI 2020)
- 1st International Conference on Human-Machine Systems (ICHMS 2020)
- 21st IEEE Conference on Business Informatics (CBI 2019)
- 11-th International Conference on Subject-Oriented Business Process Management (S-BPM ONE 2019)
- International Workshop on the Practice of the Open Web (PRACTI-O-WEB 2017)
- 3rd Int. Workshop on the Role of Real-world objects in BPM Systems (RW-BPMS 2017)

(XII C) – Reviewer for International Journals, Conferences and Workshops

Francesco Leotta serves/has served as a reviewer for:

- **International Journals:**
 - SPE - Software: Practice and Experience (Wiley)
 - Intelligent Systems (IEEE)
 - JDIQ - Journal of Data and Information Quality (ACM)
 - Multimedia Tools and Applications (Springer)
 - JODS – Journal of Data Semantics (Springer)
 - Journal of Ambient Intelligence and Humanized Computing (Springer)
 - Information Technology & People (Emerald)
 - ACM computing surveys (ACM)
- **International Conferences:**

- Mobile Software Eng. and Systems (MOBILESoft)
 - Advanced Visual Interfaces (AVI)
 - Web Information System Engineering (WISE)
 - Business Process Management (BPM)
 - Business Information Systems (BIS)
 - International Conference on Software and System Processes (ICSSP)
 - International Conference on Advanced Information Systems Engineering (CAiSE)
 - International Conference on Ubiquitous Intelligence and Computing (UIC)
 - Intelligent Environments (IE)
- **International Workshops:**
 - International Workshop on the Practice of the Open Web (PRACTI-O-WEB)
 - International Workshop on the Role of Real-world objects in Business Process Management Systems (RW-BPMS)
 - Business Process Innovation with Artificial Intelligence (BPAI)
- **National Conferences:**
 - Italian Symposium on Advanced Database Systems (SEBD)
 - Conference of the Italian SIGCHI Chapter (CHIItaly)

Part XIII – Professional Activity

Francesco Leotta served as a consultant for several companies and public administrations on topics related to software and system architectures and database design. Notably, he is currently appointed by Government Agencies for ICT in the Public Administrations, notably in 2018/19 he is working with AgID and Team Digitale on the specifications of the Modi 2018 – Modello di Interoperabilità 2018, and in 2018—2021 he is working with Dipartimento della Funzione Pubblica on the technological specifications for FOIA – Freedom of Information Act. Additionally, between 2016 and 2017 he collaborated with Ministero delle Infrastrutture e dei Trasporti – MIT to investigate the ecosystem development opportunities connected to mixed public transportation networks. This initiative culminate in a demonstration project, called OpenTrasporti, presented at the 2017 G8 Cagliari meeting concerning innovations in public transportation.

Additionally, Francesco Leotta serves as expert for the assignation of research and study grants funded by the Japanese Embassy in Rome.

As an expert, he **also serves/has served as author for articles on electronic and printed, non-academic journals** such as agendadigitale.eu and Billboard.

Part XIV – Participation to Research Projects

Francesco Leotta is/has been involved in the following research projects:

1. (2019-Present) **NOTAE** – is an ERC grant whose recipient is prof. Antonella Ghignoli. The goal of the project is the study of symbols from medieval charters. **Francesco Leotta is conducting studies** to automatically discover and describe symbols in medieval documents.

2. (2019-Present) **DESTINI** – is a H2020 research project intended to support the growth of the research in Industry 4.0 in Cyprus. In this project, **Francesco Leotta acts as unit leader for Sapienza with the SCIENTIFIC RESPONSIBILITY ON THE PROJECT.**
3. (2019-Present) **ElectroSpindle 4.0** – An Industry 4.0 research contract with a leader company in the field electrical spindles. In this project, **Francesco Leotta will coordinate the workpackage** dealing with design and development of an IoT data acquisition platform to monitor the operativity of electrical spindles.
4. (2017-Present) **FIRST** – is an H2020 RISE project intended to encourage the collaboration between industrial and research partners in the field of Industry 4.0 and smart manufacturing. In this project, **Francesco Leotta is conducting studies** for the application of indoor localization techniques to warehouses and factories. In addition, he has the **SCIENTIFIC RESPONSIBILITY FOR WORKPACKAGE 3.**
5. (2018-2019) **ROTALASER** – An Industry 4.0 research contract with a leader company in the field of die-cutter machines for packaging. In this project, **Francesco Leotta coordinates the workpackage** dealing with the development of the so called “smart die-cutter”, which is a die-cutter able to keep track of its employment and anticipate the end of its working life signaling the need for a replacement. In addition, he has the **SCIENTIFIC RESPONSIBILITY ON THE PROJECT.**
6. (2015-2018) **NEPTIS** – “Soluzioni ICT per la fruizione e l’esplorazione aumentata di Beni Culturali”. The NEPTIS Project focuses on developing ICT-based solutions for augmented fruition and exploration of cultural heritage. Concretely, it aims at implementing an integrated system to create services and applications supporting smart itineraries, which will offer to citizens, tourists and visitors an assisted access and a personalized experience before, during and after their visits to physical cultural assets. In this project, **Francesco Leotta has conducted** innovative research activity on social signal processing applied to the fruition of cultural heritage, indoor localization, habit mining.
7. (2014-2017) **VOICE** – “Virtual Open InCubation Ecosystem” is an EU CIP (European Union Competitiveness and Innovation framework Programme) project concerning the development the innovoice platform, an open online collaborative ideation system that empowers crowd to innovate and prosper. Innovoice facilitates startup idea development by evolving concepts, enriching their content, creating partnerships, matchmaking with business and product developers, enabling the development of minimum viable products (MVP) and solid business models. In this project, **Francesco Leotta has led** the development of the VCON (Voice Content) component, a specific purpose search engine, crawling and scraping authoritative internet sources in the field of entrepreneurship allowing document based searches and recommendations.
8. (2016-2017) **SAPIENTIA** – Development of an ontology describing research actors and products in relation with the geographical area. In particular, the project aims at gather existing performance indicators, combining them and extracting new ones. In this project, **Francesco Leotta participated to the following activities:**
 - Knowledge gathering over the domain of interest
 - Ontology development
 - Data source analysis
9. (2014-2015) **FIGO** – “Un Framework aperto ed Integrabile basato su modelli di nuova generazione per la Gestione ottimizzata e il cOnsolidamento di sistemi IT che prevedono l’erogazione di servizi B2B mediante l’utilizzo massivo di device mobile, anche attraverso il tracciamento ed il monitoraggio dei processi di business”. The FIGO project developed an open framework that allows performing

process mining and data mining techniques on processes and data coming from Telecommunication companies. **Francesco Leotta has covered the role of unit leader of the Process Discovery component.**

10. (2010-2011) **TOBI** – “TOols for Brain-computer Interfaces” was an EU IP (European Union Integrated Project) whose goal was the investigation of advanced employments of brain-computer interfaces for easing the use of computer interfaces from people with physical disabilities, and improving rehabilitation process. In this project, **Francesco Leotta has**
 - a. Designed a distributed architecture for EEG signal processing
 - b. Designed human-computer interaction interfaces aimed at controlling established Assistive Technology solutions using EEG signal.
11. (2009-2010) **SM4All** – “Smart Homes for All” was an EU STREP (European Union Specific Target Research Project) focused on the development of solutions for smart space automation solutions usable by all kind of individuals, including those with physical disabilities. In this project, **Francesco Leotta has developed** an indoor localization and tracking system, providing positions of human individuals in the home, thus allowing to provide customized services.

Part XV – Open-Source Projects

Among the products of his research activity, Francesco Leotta follows the development and maintenance of two open source projects:

1. **PLaTHEA**. People Localization and Tracking for HomE Automation. A stereo vision based indoor localization and tracking system. The system acquires a stereo video stream from different kind of input devices included not-synchronized network cameras. The system is the result of the research presented in **J9** and is freely available at <https://sourceforge.net/p/plathea>
2. **MWIMT**. My World In My Tablet. A framework intended to apply P300 brain-computer interface to general purpose and specific purpose graphical user interfaces. The system is the result of the research presented in **C6** and is freely available at <https://sourceforge.net/p/mwimt/>
3. **VPM**. Visual Process Maps is the current version of the habit mining framework, which is the main topic of the research of Francesco Leotta. The version of the system published in **J13** is available at <https://tinyurl.com/VPMv1-0>