Curriculum Vitae

Davide Andrea Guastella

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DAVIDE ANDREA GUASTELLA

PHD

Davide Andrea Guastella 32 years old Italian Nationality davide.guastella90@gmail.com

ACADEMIC BACKGROUND

08/2019-10/2019 • VISITING FELLOW, Smart Infrastructure Facility, University of Wollongong, Australia.

10/2017- 12/2020 • **PHD CANDIDATE** at the Toulouse Institute of Computer Science Research (IRIT, http://www.irit.fr) of University of Toulouse III Paul Sabatier, member of the Cooperative Multi-Agent Systems team (Systèmes Multi-Agent Coopératifs, SMAC, http://www.irit.fr/SMAC), under the supervision of Marie-Pierre Gleizes (SMAC-IRIT) and Valérie Camps (SMAC-IRIT).

Thesis realized in co-supervision with the University of Catania (Italy), under the direction of Cesare Valenti (University of Palermo) and Massimo Cossentino (National Research Council, CNR, Palermo, Italy). **Thesis title:** "Dynamic Learning of the Environment for Eco-Citizen Behavior".

2015 - 2017 • MASTER DEGREE IN COMPUTER SCIENCE, joint double degree, University of Palermo (Italy) - University Paris-Est Marne-La-Vallée (*mention bien*).

2009 - 2014 • BACHELOR'S DEGREE IN COMPUTER SCIENCE, University of Palermo (Italy).

PROFESSIONAL EXPERIENCES

01/2023–ongoing • RESEARCH FELLOW, Université Libre de Bruxelles (ULB), Bruxelles, Belgium 10/2021–10/2022 • RESEARCH FELLOW, Italian National Research Council, ICAR, Italy.

09/2020–8/2021 • **TEMPORARY TEACHING ASSISTANT (ATER)**, full time (192h), within ANITI, the Toulouse Interdisciplinary Institute of Artificial Intelligence.

09/2018-09/2020 • **DOCTORAL STUDENT IN CHARGE OF TEACHING (DCE)** at the Faculty of Science and Engineering (FSI) of the University Toulouse III Paul Sabatier.

2017 • PART-TIME LECTURER at the Faculty of Science and Engineering (FSI) of the University Toulouse III Paul Sabatier.

2017 • INTERNSHIP, Laboratoire d'Informatique de Paris 6 (LIP6). Internship carried out under the supervision of Ms. Amal El Fallah Seghrouchni (LIP6-UPMC) and Ms. Safia Kedad-Sidhoum (CNAM).

Title of the internship: "Development of a heuristic for the scheduling problem of task plans".

I developed a heuristic to solve the problem of scheduling task plans. Plans are ordered vectors of tasks, tasks are basic operations performed by resources. Schedules are bound by time constraints, priorities and resources, making the scheduling problem difficult to solve in polynomial time.

2014 - 2015 • FIXED TERM CONTRACT, Italian National Research Council, ICAR, Palermo, Italy

I contributed to the development of a workflow management system based on a multi-agent architecture called MUSA (Middleware for User-driven Service Adaptation). MUSA has been used in the OCCP (Open Cloud Computing Platform) project dedicated to the automatic composition of cloud services. Its objective was to allow a user to define a new cloud application as the integration (in terms of data and processes) of existing cloud applications. The solution was developed using Java and Jason (a language close to AgentSpeak). The OCCP project was funded by the Autonomous Region of Sicily as part of the European regional development fund initiative.

2013 • 2014 - INTERNSHIP, Italian National Research Council, ICAR, Palermo, Italy

During this internship, I developed a tool integrated into the Eclipse environment for the automatic production of documentation from UML diagrams. The documentation is in form of structured text in word format, containing text, diagrams and tables that help the final user in understanding the input UML diagrams.

TEACHING EXPERIENCES

During the academic year 2017-2018, I was part-time lecturer at the Faculty of Science and Engineering (Faculté des Sciences et Ingénierie) at the University of Toulouse III Paul Sabatier. I did not apply for a DCE position in 2017-2018 because I thought I did not master the French language enough to teach. Nevertheless, I have provided 20 hours of TPs (Travaux Pratiques, practical courses) to two groups of 14 students of L2 students in the second half of 2017-2018.

During the academic year 2018-2019, as DCE I provided 66 hours of TPs (on a minimum of 64 hours) among heterogeneous teaching courses. I was also DCE in 2019-2020. During this year I had the opportunity to provide TPs as well as courses/TDs (Travaux Dirigés, supervised works).

Since September 2020 I am Temporary Teaching Researcher assistant (ATER) within ANITI (Artificial and Natural Intelligence Toulouse Institute). I teach at the Faculty of Science and Engineering (FSI) of Toulouse to students of different levels (L2, L3, M1, M2).

The table below summarizes the courses I taught between 2017 and 2020 as well as those I have to provide this academic year 2020-2021. For the academic year 2020-2021, the missing hours in the table (10.47h) are compensated by supervising internships.

Academic year	Type – Hours	Effective	Subject	Course title	Level
2020-2021 (ATER)	$\begin{array}{l} TD-2h\\ TP-8h \end{array}$	1 group of 12 students	Introduction to ambient systems, multi-agent systems	Systèmes ambiants et mobiles	M2
	TP – 8h	3 groups of 10,15 and 16 students	Algorithmic complexity, Sorting, meta- heuristics, data structure, linear programming	Algorithmique avancée	M1
	$\begin{array}{c} TD-2h\\ TP-6h \end{array}$	1 group of 18 students	Introduction to collective behaviors for problem solving by autonomous agents	Agents intelligents	M1
	CTD-22h TP-8h	3 groups CTD 5 groups TP	Image representation, punctual transformations, algorithms for binary images, image segmentation, geometric transformations	Informatique graphique, traitement et analyse d'image	L3
	CTD-20h TP-8h	1 group CTD 3 groups TP	Search in a state space, heuristics, graph coloring, constraint satisfaction problems	Intelligence artificielle	L3

	CTD-30h	1 group of 39 students	Propositional and Predicate Logic, Demonstration techniques, Natural Deduction	Logique 2	L2
2019-2020 (DCE)	$\begin{array}{c} TD-2h\\ TP-8h \end{array}$	1 group of 12 students	Introduction to ambient systems, multi-agent systems	Systèmes ambiants et mobiles	M2
	TD – 6h	1 group of 9 students	Introduction to Design Patterns	Composants, design patterns : composition et flexibilité	M1
	TP-10h	1 group of 20 students	Java Programming	Conception Objet et Outillages	L3
	CTD-14h TP – 16h	1 group of 8 students	Introduction to C programming	Développement et environnements	L2
	TP - 12h	1 group of 18 students	UNIX Programming, C programming	Système 2	
2018-2019 (DCE)	TP-10h	2 groups, 31 students	Java Programming	Conception objet et outillages	L3
	TP-10h	1 group of 11 students	UNIX Programming, C programming	Système 2	
	TP – 16h	1 group of 19 students	UNIX programming/ Shell scripting	Système 1	L2
	TP – 16h	2 groups, 31 students	Fundation of programming	Fondements de la programmation en langage C	
	TP – 14h	1 group of 19 students	Introduction to Python programming	Informatique	L1
2017-2018 (PART-TIME LECTURER)	TP – 20h	2 groups of 14 students	UNIX Programming, C programming	Système 2	L2

As ATER, I had the opportunity to contribute to pedagogical activity of the different courses that have been assigned to me by authoring:

- An auxiliary support for the course "Logic 2".
- Exam exercises for the course "Logic 2" exams
- An introductory support to Valgrind for the course "Advanced Algorithms".
- An introductory support to the TP on networks flows and linear programming for the course "Advanced Algorithms".

During the three years as DCE, I contributed to the pedagogical activity of the teachings that were assigned to me by:

- writing a TP subject for the Java Programming course,
- writing self-evaluation exercises for the Introduction to C programming course,
- evaluating exam assignments for the course Java Programming EU,
- evaluating and correcting TPs for Système 2 course.

RESEARCH ACTIVITY

PHD THESIS

From October 2017 to December 2020 I was a PhD student at the Institute of Research in Computer Science of Toulouse (Institute de Recherche en Informatique de Toulouse, IRIT) as a member of the Cooperative Multi-Agent

Systems team (Systèmes Multi-Agents Coopératifs, SMAC). My research activity, supervised by Marie-Pierre Gleizes, Valerie Camps, Massimo Cossentino and Cesare Valenti, is about using cooperative multi-agent systems in smart* environments (smart campus, smart building, etc.) for:

- Partitioning geo-localized data,
- Lifelong learning without user feedback,
- Data fusion from raw data acquired from sensors.

Thesis directors :

- Marie-Pierre Gleizes (Full Professor, IRIT-SMAC, University of Toulouse III Paul Sabatier)
- Massimo Cossentino (Senior Reseach Scientist, ICAR-CNR, Palerme, Italie)

Thesis co-supervisors :

- Valérie Camps (Associate Professor, IRIT-SMAC, University of Toulouse III Paul Sabatier),
- Cesare Valenti (Associate Professor, University of Palermo, Italy),

Jury composition :

- Andrea Omicini (Full Professor, University of Bologna, Italy)
- Jean-Paul Jamont (Full Professor, University of Grenoble)
- Laurent Vercouter (Full Professor, INSA Rouen Normandie)
- Giancarlo Fortino (Full Professor, University of Calabria, Italie)

Abstract: « The development of sustainable smart cities requires the deployment of Information and Communication Technology (ICT) to ensure better services and available information at any time and everywhere. As IoT devices become more powerful and low-cost, the implementation of an extensive sensor network for an urban context can be expensive.

This thesis proposes a technique for estimating missing environmental information in large scale environments. Our technique enables providing information whereas devices are not available for an area of the environment not covered by sensing devices. The contribution of our proposal is summarized in the following points:

- *limiting the number of sensing devices to be deployed in an urban environment;*
- the exploitation of heterogeneous data acquired from intermittent devices;
- real-time processing of information;
- *self-calibration of the system.*

Our proposal uses the Adaptive Multi-Agent System (AMAS) approach to solve the problem of information unavailability. In this approach, an exception is considered as a Non-Cooperative Situation (NCS) that has to be solved locally and cooperatively. HybridIoT exploits both homogeneous (information of the same type) and heterogeneous information (information of different types or units) acquired from some available sensing device to provide accurate estimates in the point of the environment where a sensing device is not available.

The proposed technique enables estimating accurate environmental information under conditions of uncertainty arising from the urban application context in which the project is situated, and which have not been explored by the state-of-the-art solutions:

- openness: sensors can enter or leave the system at any time without the need for any reconfiguration;
- *large scale*: the system can be deployed in a large, urban context and ensure correct operation with a significant number of devices;
- *heterogeneity*: the system handles different types of information without any a priori configuration.

Our proposal does not require any input parameters or reconfiguration. The system can operate in open, dynamic environments such as cities, where a large number of sensing devices can appear or disappear at any time and without any prior notification. We carried out different experiments to compare the obtained results to various standard techniques to assess the validity of our proposal. We also developed a pipeline of standard techniques to produce baseline results that will be compared to those obtained by our multi-agent proposal. »

[Link] PhD manuscript

[Link] Thesis defense video

PhD thesis description

The smart city focuses on improving the quality of life of its inhabitants. To be closer to reality, a smart city requires regular observation of its environment through sensors for a better knowledge of human activities and the conditions in which these activities are carried out. Nevertheless, even if these sensors are often cheap, their installation and maintenance costs increase rapidly with their number. The purpose of our work is to learn the state of the environment of such a system without needing to deploy a lot of sensors. In this way, the costs related to the management of the sensor infrastructure can be therefore reduced by the proposed solution.

In my thesis work, which is part of the neOCampus operation, we assume that the number of people transiting daily on the Paul Sabatier University campus amounts to about 20.000 and that 80% of them have a smartphone which allows the acquisition of more than 500.000 daily data. We want to use a cooperative multi-agent approach to estimate environmental information by using heterogeneous, partial and intermittent information coming from the smartphones of the users of the University Paul Sabatier. The use of different heterogeneous devices allows the multi-agent system to determine as accurately as possible the environmental values (temperature, brightness, humidity, noise ...) but also deduce the state of the surrounding devices (lights, shutters, doors, ...) anywhere in the campus to guarantee a good level of comfort to users.

Progress

Currently, the development of the HybridIoT system continues thanks to a joint action between the University of Toulouse and MODIS. Also, the project received a grant from Toulouse Tech Transfer (TTT) for which a working prototype must be developed and deployed on the campus of the University of Toulouse.

RESEARCH FELLOW AT ICAR-CNR

During the research fellow period at CNR-ICAR, I was part of the NETTUNIT project, involving cross-border cooperation between Italy and Tunisia. The NETTUNIT project aims to implement a fully operational platform to facilitate collaboration between Italian and Tunisian parties in the response to accidents impacting the population.

The main research goals of this project are:

- Cyber-physical systems, human interaction in emergency plan resolution
- Engineering self-adaptive workflows
- Dynamic execution of emergency plans

Plans for emergency response are complex collaborations in which actors take roles and responsibilities. They are generally long textual documents containing practical instructions, in natural language, for hazard responses. A more rigorous structured text would be useful for a twofold audience. On the one hand, it can be useful for quickly understanding the plan, and on the other hand, it can be used to improve the modeling phase and deliver an automatic emergency-support system. I contributed to the definition of an approach, conceived for humans, for converting a free-form plan document into a structured version of the same document. The approach is based on a linguistic and semantic analysis that is strictly correlated and materializes in a metamodel. It contains the essential elements of an emergency plan, and it aids in interpreting the input document also reducing inconsistencies, redundancies, and ambiguities.

One of the challenges in emergency response is to generate an executable emergency workflow from emergency plans in free-text form, to help the authorities manage the crisis. In this context, we use the proposed metamodel to structure each operational part of an emergency plan; the result is a set of structures, without any language-specific property, that describe clearly the objectives involved in an emergency resolution. These structures are then converted into a goal-specification language, named GoalSPEC, that allows describing rigorously a set of goals, their dependencies in terms of pre- and post-conditions, and the roles involved, without specifying how the goals are addressed. The goals are then orchestrated by the MUSA software, which generates an executable workflow addressing the goals (in GoalSPEC) given in input. We used an open-source solution for the execution of workflows obtained from GoalSPEC.

RESEARCH PERIOD ABROAD

From August 2019 to October 2019 I spent a period abroad at the University of Wollongong (Australia). The research carried out at the SMART Infrastructure Facility laboratory was the subject of a publication accepted at the International Conference on Agents and Artificial Intelligence (ICAART'21). The contribution of this paper is twofold: we present a **dataset of environmental information** obtained by indoor and outdoor sensors deployed in the SMART building at the University of Wollongong (Australia). Then, we propose a new approach based on an evolutionary algorithm to **determine which sensor pairs are correlated with each other**. The resulting sensor pairs are computed almost instantaneously.

Compared to state-of-the-art methods, the proposed technique considers mobile and intermittent sensors as well as heterogeneous information. The resulting correlation values can be used in smart buildings for optimizing resource consumption.

During my internship in Australia, I was invited to participate in an NVIDIA workshop on deep learning which resulted in an internationally recognized certificate.

LIST OF PUBLICATIONS

ARTICLES IN INTERNATIONAL JOURNALS

[2022] Linguistic and Semantic Layers for Emergency Plans Massimo Cossentino, Davide Andrea Guastella et al. Intelligenza Artificiale (IOS press) Volume 16, no. 1, pp. 7-25, 2022

[2021] Edge-Based Missing Data Imputation in Large-Scale Environments

Davide Andrea Guastella, Guilhem Marcillaud and Cesare Valenti MDPI Information 2021 Volume 12, issue 195 DOI: 10.3390/info12050195 CiteScore : 2.4

[2020] A Cooperative Multi-Agent System for Crowd Sensing Based Estimation in Smart Cities

Davide Andrea Guastella, Valérie Camps and Marie-Pierre Gleizes IEEE Access (Q1) DOI: 10.1109/ACCESS.2020.3028967 Impact Factor: 3.745

[2016] Cartoon Filter via Adaptive Abstraction

Davide Andrea Guastella, Cesare Valenti Journal of Visual Communication and Image Representation (**Q2**) Volume 36, Pages 149-158, 2016 DOI: 10.1016/j.jvcir.2016.01.012 Impact Factor: 2.259

ARTICLES IN INTERNATIONAL CONFERENCES

[2023] Adaptive Execution of Workflows in Emergency Response
Massimo Cossentino, Davide Guastella, Salvatore Lopes, Luca Sabatucci
20th International Conference on Information Systems for Crisis Response and Management (ISCRAM'23)

[2022] Estimation de données environnementales manquantes sans déploiement de capteurs supplémentaires : le système HybridIoT

Davide Guastella, Valérie Camps, Marie-Pierre Gleizes Journées Francophones sur les Systèmes Multi-Agents (JFSMA'22)

[2022] From Textual Emergency Procedures to Executable Plans

Massimo Cossentino, Davide Andrea Guastella et al. ISCRAM'22

[2021] Learn to Sense vs. Sense to Learn: A System Self-Integration Approach (extended abstract)

Davide Andrea Guastella, Evangelos Pournaras 2021 IEEE International Conference on Autonomic Computing and Self-Organizing Systems Companion (ACSOS-C), DC, USA, 2021 pp. 178-179.

[2021] Evaluating Correlations in IoT Sensors for Smart Buildings

Davide Andrea Guastella, Nicolas Verstaevel, Cesare Valenti, Bilal Arshad, Johan Barthèlemy 13th International Conference on Agents and Artificial Intelligence (ICAART'21) DOI: 10.5220/0010210502240231

[2019] Estimating missing environmental information by contextual data cooperation

Davide Andrea Guastella, Valérie Camps, Marie-Pierre Gleizes Principles and Practice of Multi-Agent Systems (PRIMA), Springer. Torino, Italy. October 2019 DOI: 10:1007/978-3-030-33792-637 Acceptance rate: 26%

[2019] Multi-agent systems for estimating missing information in smart cities

Davide Andrea Guastella, Valérie Camps, Marie-Pierre Gleizes 11th International Conference on Agents and Artificial Intelligence (ICAART'19) Prague, Czech Republic. February 2019 DOI: 10.5220/0007381902140223 Acceptance rate: 22.7%

[2018] Estimating missing information by cluster analysis and normalized convolution

Davide Andrea Guastella, Cesare Valenti IEEE 4th International Forum on Research and Technology for Society and Industry (RTSI) Palermo, Italy. September 2018 DOI: 10.1109/RTSI.2018.8548454

OTHER SCIENTIFIC ACTIVITIES AND RESPONSIBILITIES

INVITED SEMINARS

- 8/12/2022 Research seminar, School of Computing, University of Leeds
- 24/09/2019 Technology for the Greater Good Virtual Sensors Turning on Air Cons, Sustainable Buildings Research Centre (SBRC), Wollongong (Australia)
- **11/09/2019** Technology for the Greater Good Virtual Sensors Turning on Air Cons, SMART Infrastructure Facility, Wollongong (Australia)

SEMINARS

- 30/1/2019 Introduction to JavaFX, IRIT, Toulouse (France)
- 7/3/2018 Ordonnancement de plans de tâches (Scheduling plans of tasks), IRIT, Toulouse (France)

PROGRAM COMMITTEE MEMBER

• 2020 – Program committee member for the conference COGNITIVE 2020.

REVIEW OF ARTICLES

- 2021 Additional reviewer for an article submitted to 20th International Conference on Autonomous Agents and Multiagent Systems (AAMAS'21)
- **2020** Additional reviewer for an article submitted to the Francophone Day on Multi-Agent Systems (JFSMA)
- 2018 Additional reviewer for Journal of Healthcare Engineering
- **2018** Additional reviewer for the journal "Image Segmentation Techniques for Healthcare *Systems*" (special issue in "Journal of Healthcare Engineering")

ADMINISTRATIVE RESPONSIBILITIES

• 2019 – Substitute member of the research commission of the doctoral students' college of the University of Toulouse III Paul Sabatier

CONFERENCE ORGANIZATION

- 09/2023 Organization member of the FARI conference, Brussels
- 07/2019 Organization of the sixth neOCampus scientific day, 10/7/2019, 100 participants
- 07/2019 Participation in the organizing committee of the Artificial Intelligence Platform (PFIA), ~ 500 participants
- 07/2019 Participation in the organizing committee of the Francophone Days on Multi-Agent Systems (JFSMA), ~ 100 participants

OTHER ACTIVITIES

- **2020** Organization of a seminar dedicated to the authoring of scientific papers for the SMAC team, 24/3/2020
- Since 2019 Responsible for the organization of ICIcafé seminars for the SMAC team
- 03/2019 Participation in the "Math en Scène" day (Salle du Lac, Castanet-Tolosan) as a speaker on the introduction to the LEGO Mindstorm programming for high school students (03/14/2019).

INTERNSHIP SUPERVISION

2023 • in progress - Co-supervision with Gianluca Bontempi (ULB-MLG) of:

- Ali Manzer, MsC student: state of the art in traffic simulation.
- Damien Declaire, MsC student: development of a data collection, storage and preparation system for traffic simulation with SUMO.

2023 • in progress - Co-supervision, with Valérie Camps, of Nathan Stievano. This internship focuses on the implementation of the HybridIoT system to learn the state of environmental variables using partial and intermittent information from smartphones belonging to users on the campus of the Université Toulouse III Paul Sabatier.

2021 • Co-supervision, with G. Picard (ONERA), A. El Fallah Seghrouchni (UPMC-LIP6) and J.L. Farges (ONERA) of Heber Dibwe Fita. The objective of this internship is the design and development of a scheduling technique for plans of tasks under temporal, precedence and resource constraints. In particular, we are interested in scheduling plans considering the uncertainty on the execution time of tasks.

2021 • Co-supervision, with Guihem Marcillaud (SMAC-IRIT), of Mathieu BENOIST (L3 bachelor's degree). The objective of this internship is to develop an approach to map smart cities using data acquired from connected vehicle fleets. The GAMA multi-agent simulation platform is used to pursue a city-scale simulation and simultaneously address the properties of openness and heterogeneity.

2021 • Tutor of two groups, each one of 4 students (M1), in the context of the internship entitled "Analysis of air quality on an urban scale". As part of this internship, students have to carry out a state of the art on solutions for monitoring air quality at the urban scale, discuss their advantages and their disadvantages.

2021 • Tutor of a group of 4 students (M1) in the context of the internship entitled "Lifelong monitoring of the city through connected vehicles". The objective of this study is to study the most recent techniques which use IoT devices and data acquired by connected cars to produce cartographies of cities and provide precise information on the dynamics of the environment and the state of traffic.

 $2019 \cdot$ Tutor of a group of 4 students (M1) in the context of the internship entitled "Self-adaptive systems in smart cities". The objective of this study was to review the main technologies used for the design of intelligent cities, identify and classify them according to the properties of self-adaptation.

2019 • Tutor Moufdi Oulad Hadj Messaoud (L3 Student). The objective of this internship was to create a smartphone application that allows the acquisition of ambient data in the campus of the University Toulouse III - Paul Sabatier and to store the acquired data in the neOCampus servers.

EXPERIENCES AND TECHNICAL SKILLS

FRAMEWORK ET LIBRARIES

RabbitMQ, Flowable workflow engine, SciPy, NumPy, SciKit-learn, Pandas, Android programming, Arduino, CORBA, Java RMI, Java Web Services, Java Server Faces (JSF), PrimeFaces, ArcGIS SDK

PROGRAMMING LANGUAGES Java, Scala, C++, C, C#, Matlab, Python, Html, Jason, SQL, LaTeX

OPERATING SYSTEMS Mac OS, Microsoft Windows, Linux

DATA ANALYSIS TOOLS KNIME

DICHIARAZIONE SOSTITUTIVA DI CERTIFICAZIONE (art. 46 e 47 D.P.R. 445/2000)

Il sottocritto Davide Andrea Guastella, ai sensi e per gli effetti degli articoli 46 e 47 e consapevole delle sanzioni penali previste dall'articolo 76 del D.P.R. 28 dicembre 2000, n. 445 nelle ipotesi di falsità in atti e dichiarazioni mendaci, dichiara che le informazioni riportate nel presente curriculum vitae corrispondono a verità.

Bruxelles, 26/06/2023

Grade Die toan