PERSONAL INFORMATION

Prof. Stefania Costantini

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Gender Female | Date of birth 5 October 1959 | Nationality Italian

CV INCLUDED IN APPLICATION: PRESENT POSITION

Principal Investigator FISR 2020 D.D. n. 562/05-05-2020 - Phase 1

Full Professor of Computer Science, Italian Sector SSD INF/01

Since 1/11/2005, working at: Dipartimento di Ingegneria e Scienze dell'Informazione e Matematica (DISIM) Università degli Studi di L'Aquila, Via Vetoio snc Loc. Coppito, I-67100 L'Aquila (Italia)

BIOGRAPHIC NOTES

Married, two children born 1993 and 1996

1983: Ms.C. in Computer Science ("Scienze dell'Informazione") with Honors at the University of Pisa, Italy (note: Ph.D. programs did not exist in Italy at that time). 1983 – 1987: Industrial Researcher in Software Engineering Italtel SIT, Milan, Italy.

1987 – 1990: Research grant at the Computer Science Department, University of Milan, Italy Luglio

1990 – Marzo 1999: Assistant Professor, Computer Science Department, University of Milan, Italy

April 1999 – March 2001: Assistant Professor, Department of Pure and Applied Mathematics, University of L'Aquila, Italy

March 2001 a November 2005: Assistant Professor, Department of Pure and Applied Mathematics and then Department of Computer Science, University of L'Aquila, Italy

Since November 2005: Full Professor, Department of Computer Science and then Department of Information Engineering, Computer Science and Mathematics, University of L'Aquila, Italy, Leader of the AAAI@AQ (Artificial Agents and Artificial Intelligence) Research group.

Digital competences

SELF-ASSESSMENT				
Information Processing	Communication	Content creation	Safety	Problem solving
Proficient user	Proficient user	Independent user	Independent user	Proficient user

Digital competences - Self-assessment grid

| Computer skills | competent with most Microsoft Office programmes; experience with most common programming languages and database query languages, and with some less common advanced ones (e.g., Datalog, Prolog, Answer Set Programming, AgentSpeak); experience with Ontologies and Ontological Data Access; ability to learn any programming language very fast; ability to teach any programming language. |

PERSONAL SKILLS

| Mother tongue | Italian |

Other languages

UNDERSTANDING		SPEAKING		WRITING
Listening	Reading	Spoken interaction	Spoken production	
C2	C2	C2	C2	C2

English

Levels: A1 and A2: Basic user – B1 and B2: Independent user – C1 and C2: Proficient user Common European Framework of Reference for Languages

| Other skills | Cooking. Enjoy many sports and practice walking, cycling, kayaking, basketball. Love to travel and experience different cultures. |

| Driving licence | B |

RESEARCH INTERESTS

Keywords: Artificial Intelligence, Computational Logic, Software Agents, Knowledge Representation and Reasoning, Logic and Meta-Logic Programming, Machine Ethics, Graph Analysis. Logica Computazionale, Intelligenza Artificiale, Programmazione Logica, Metaprogrammazione e Meta-ragionamento, Agenti e Sistemi Multi-Agente, Metodi per il Ragionamento Automatico, Metodi per la Rappresentazione della Conoscenza.

RESEARCH PROJECTS: PARTICIPATION AND COORDINATION

International Projects

European Projects Coordination: Vice-Coordinator of Action COST CA17124 "DIGital FORensics: evidence Analysis via intelligent Systems and Practices", UNIVAQ Node Coordinator in WASP (Working Group on Answer Set Programming) and CUSPIS (a Cultural Heritage Space Identification System, GJU/05/2412/CTR/CUSPIS).

European Projects Participation: COST action IC0801 "Agreement Technologies", SINTELNET European Network for Social Intelligence (recently completed projects), Esprit P283 FOR-ME-TOO.

Italian Projects

Italian Projects Coordination: Coordinator Univaq node industrial Projects (funded by the Ministry of Economic Development) with CIRA (Italian Center of Aero-Space Research, 2014) and SPEE Company (2015-2018).

Italian Projects Participation: 1999-2000 PRIN "Intelligent Agents for Information Extraction", 2000-2001 PRIN "Aggregate- and number-reasoning for computing: from decision algorithms to constraint programming with multisets, sets, and maps".

Professional Activities

Scientific Associations Since 2019 I am the President of the Italian Association of Computational Logic (GULP, https: //www.programmazionelogica.it/) and I was the past Vice-President. Since 2019 I am a member of the Steering Committee of Italian Association for Artificial Intelligence (AI*IA, https: //www.aixia.it). I am an ACM member (Association for Computing Machinery).

Program Committees and Journal Reviews Co-Chair of RuleML+RR 2017, Co-Chair and JLC (Journal of Logic and Computation) Special Issue Editor ASP07, Chair of GULP92. PC Member of about 100 editions of International Conferences, including (among the best rated ones) recent editions, 2018-2019-2020, of IJCAI (International Joint Conference on Artificial Intelligence), ECAI (European Conference on Artificial Intelligence), ICLP (International Conference on Logic Programming), KR (Knowledge Representation and Reasoning), AAMAS (Agents and Multi-Agent Systems), AAAI Conferences on Artificial Intelligence, LPNMR (International Workshop on Logic Programming and NonMonotonic Reasoning), JELIA (Joint European Conference of Logics in AI), RuleML (Symposium on Rule Technologies, Research, Tools, and Applications), CLIMA (Computational Logic in Multi-Agent Systems), PRIMA (Principles and Practice of Multi-Agent Systems) and others. Reviewer for the most relevant journals related to research interests, among which "Theory and Practice of Logic Programming", "Autonomous Agents and Multi Agent Systems".

Project Revision I am a reviewer (EU Expert) of EU H2020 (FET Open) projects and in 2020 I have been external evaluator of the DECODER project https://www.decoder-project.eu/view/Main/. I have been a reviewer for the Italian Ministry (MUR-MIUR) for projects "Futuro in Ricerca", and "Giovani Ricercatori Programma Rita Levi-Montalcini" also in advanced Mathematics.

VISITING PROFESSOR AND INVITED TALKS ABROAD

Invited Visiting Professor: Univ. of Texas at El Paso (1999, 2 weeks); Imperial College London, UK (2004 and 2010, 4 weeks in total); Univ. Politecnica de Madrid, Spain (2010, two weeks). Corunna Univ., Spain (2010, 2 weeks); Fundacion Univ. de las Americas, Puebla, Mexico (2012, 3 weeks). Invited Speaker at ASPOCP 2016 (Answer Set Programming and Other

Computing Paradigms), New York, October 16 2016, and at LA-NMR Workshop on Logic, Languages, Algorithms and New Methods of Reasoning (Mexico City, 2012).

COOPERATIONS

With common publications and/or joint research activities University of Udine, Italy (Prof. Andrea Formisano); University of Messina, Italy (Prof. Pasquale De Meo and Prof. Alessandro Provetti); University of Bari (Prof. Francesca Lisi); Imperial College London, UK (Prof. Francesca Toni, Prof. Fariba Sadri); Linkoping University, Sweden (Prof. Pierangelo Dell'Acqua); Universidade Nova de Lisboa, Portugal (Prof. Luis Moniz Pereira); University of Corunna, Spain (Prof. Pedro Cabalar); Universidad Politecnica de Madrid, Spain (Prof. David Pearce); CNRS and Universitè Paul Sabatier, Tolouse, France (Prof. Emiliano Lorini).

RESEARCH ACTIVITIES

Ethics of Artificial Intelligence

This research topic is the most recent and it is in my opinion of great importance. It concerns the definition of (interdisciplinary) principles and methods to regulate in ethical terms the behavior of intelligent machines towards human beings with whom they interact, and consequently the definition of formal and practical techniques for the implementation of these principles and the verification of their correct application. I have devised preliminary results that use computational logic, and in particular meta-logic and modal/temporal logic, to verify compliance with principles and properties at execution time. Aspects concerning Ethics are being investigated in cooperation with Giovanni De Gasperis, and with the doctoral students (now female doctors) Abeer Dyoub and Valentina Pitoni. With Abeer Dyoub and with Dr. Francesca Lisi of the University of Bari I have defined a transparent machine learning mechanism based on Inductive Logic Programming to refine general ethical rules to specific application contexts, and to verify their correct application, via reasoning in a background knowledge base.

Graph Analysis

With Prof. Pasquale De Meo, Prof. Antonio Liotta and Prof. Alessandro Provetti, Dr. Giovanni Stilo and (female) PhD student Lucia Cavallaro I have recently contributed to define probabilistic models to evaluate the resilience of a network (represented by means of a graph) to external shocks that entail

the elimination of a node [X]. This elimination can be unwanted (for example the fall of a network server) or desired, for example in order to isolate some persons or groups of people to stop an epidemic. The novelty of the work consists in considering a probabilistic elimination of the nodes, that is, for each node there is an associated probalility of successful elimination (since a node can "resist" to external attacks). In addition, we determined which In addition, we determined which are the minimal group(s) of nodes that should be removed from a graph in order to "damage" it in the most effective possible way. Furthermore, we have implemented particularly efficient heuristic algorithms to identify this group(s), considering that this is in itself an NP-hard problem.

Agents in Computational Logic

I have proposed (with Arianna Tocchio) a new agent-oriented logic programming language, called DALI, which is quite well-known in the international community. The evolutionary semantics of DALI is fully logical, even though the language provides the treatment of several kind of events, both external and internal. DALI has been fully implemented, and the implementation is freely available. It has been experimented in concrete applications, namely in the context of user monitoring and training, hybrid architectures, negotiation scenarios, Intelligent Agents for guided visits to museums and archaeological areas, and security. DALI is equipped with an innovative and functional communication architecture, and is FIPA-compliant. I have recently introduced new run-time self-checking techniques for agents (based on suitably defined temporal logics) that have been experimented in DALI agents, and applied to practical case-studies in system testing and energy saving applications for smart buildings. More generally, I have proposed advances in the agents field concerning Complex Event Programming, Agents' Memory Management, Run-Time Self-Checking and Assurance, Integration with Heterogeneous Data Sources. The DALI interpreter has been extended for application to cognitive robotics applications, where a DALI program constitutes the "brain" of a robot. This in view of pilot projects concerning care robots in eHealth. I have devised (with former Ph.D. student Valentina Pitoni and Prof. Emiliano Lorini) a temporal/modal logics for the representation of memory in agents, and of the evolution of memory via suitable operators. I have been working in goal reasoning (with Giovanni De Gasperis), where I have devised an architecture, with application to the exploration of a territory in the aftermath of catastrophic events. I have worked on the integration of agents and agent systems with other related paradigm such as ASP and MCS (see below) and to the applications of such integration.

Logic Programming with Negation, and Non-Monotonic Reasoning

I have contributed to the theory and practice of Answer Set Programming (ASP), which is a wellestablished logic programming paradigm, able to cope with uncertainty by producing all consistent alternative answers. I have studied conditions for the existence of answer sets, and more generally I have significantly contributed over the years to several aspects concerning Logic Programs with Negation and answer set semantics. In recent work, with Andrea Formisano I have introduced in ASP the possibility of reasoning about resources and (even complex) preferences: RASP (Resourced ASP) allows one to specify resources and resource usage, and supports quantitative reasoning on consumption and production of amounts of resources. A comparison with Linear Logic has been proposed. The RASP approach has been prototypically implemented. Recently, Costantini and Formisano have proposed Resource-Based Answer Set Semantics (RAS), where: answer sets always exist; top-down query-answering becomes easily feasible. I have recently achieved new results concerning Epistemic Logic Programming, where ASP is enriched by means of operators ranging on sets of answer sets (World Views, or for short WVs): I have found for the first time in the literature an upper bound to the number of WVs, and has characterized verification and query-answering of WVs in terms of RAS, also introducing new interesting operators.

I have proposed, with Andrea Formisano, Pedro Cabalar and Giovanni De Gasperis,several extension to the Multi-Context System (MCS) approach, which concerns formal integration of distributed heterogeneous knowledge sources (i.e., MCS provide a semantics to distributed systems and to model knowledge exchange in a uniform way). I have proposed the application of MCSs in the eHealth domain, introducing (with Andrea Formisano, Pedro Cabalar and Giovanni De Gasperis, Antinisca Di Marco, Viviana Mascardi, Valentina Pitoni and others) a system architecture denominated "F&K", for "Friendly and Kind with your health", amenable also to applications involving wearable sensors and care robots controlled by intelligent agents. I have proposed the extension of MCSs to the agent domain by introducing DACMACS (OntologyBased Agent-Based MCSs), ACEs (Agent Computational Environments) and the highly modular K-ACE architecture (K-level ACEs). I have also devised a representation of micro-services architectures in terms of ASP+MCS. Together with Dr. Giovanni De Gasperis and Dr. Raffaele Olivieri we are investigating the possible application of Answer Set Programming and to Artificial Intelligence in general to the "Evidence Analysis" phase of "Digital Forensics", i.e., the examination of elements of digital evidence to be aggregated into elements of proof to be discussed in court. Dr.

Raffaele Olivieri is an officer of an Italian police, and belongs to "Raggruppamento Carabinieri Investigazioni Scientifiche" (Ra.C.I.S.) of Roma, and so he is involved in the treatment of significant real cases.

Metalogic Programming

I have studied how to extend logic programming languages with metalogic constructs, i.e., naming mechanisms for reifying language expressions, metalevel rules, and logical reflection for shifting from the object to the metalevel and vice versa. She defined (with Gaetano Aurelio Lanzarone) and developed the metalogic language Reflective Prolog. The declarative and procedural semantics of Reflective Prolog have been fully defined, and the language and the approach have been applied to several application fields, including Artificial Intelligence and Law, and Analogical and Case-Based Reasoning. Recently, with Andrea Formisano she has introduced the possibility to perform ontological reasoning in logic languages by means of suitable forms of metareasoning.

Extracting Knowledge from Natural Language

A central aspect of knowledge acquisition from natural language sources is related to the automation of the process. I have contributed to a line of work, where natural language sentences that imply uncertain knowledge and thus cannot be translated into classical logic are instead translated into ASP.

Automated Deduction

With Dr. Pasquale Caianiello and Prof. Eugenio Omodeo I contributed to the definition, implementation and experimentation of the Metamorpho framework, which supports mechanisms for definitory extension within a purely equational formalism. namely the 'Schröder-Tarski' Calculus of Dyadic Relations.

Industrial Research

During the period of stay in the Central Research of Italtel SIT I was part of the Software Engineering group. I spent eight months at the Research Center AEG from Ulm (Germany) to develop a functional test system for the CD900 mobile phone prototype, that later originated GSM. This test system has since been widely used for experiments.

The DALI language has been exploited in various practical applications, both in the CUSPIS European project and in collaboration with companies. The definition and implementation of a collaborative test system with Technolabs L'Aquila (formerly Siemens, now Intecs) won the third prize for best application at PAAMS 2012, 10th International Conference on Practical Applications of Agents and Multi-Agent Systems.

Free dowloadable software

The AAAI@AQ research group has produced the following free software packages:

RASP Inference Engine, Raspberry: http://www.dmi.unipg.it/ formis/raspberry/

DALI Interpreter and Framework: https://github.com/AAAI-DISIM-UnivAQ/DALI

SERVICE TO MY UNIVERSITY

Present and Past Activities

2018-now Member of the University of L'Aquila internal Evaluation Committee ("Nucleo di Valutazione"). 2016-2018 Member of the University of L'Aquila Quality Assurance Committee. 2016-now Member of the Steering Committee of the Ph.D. Program in ICT. 2012-15: Chairperson of the Bachelor and Master Programs in Computer Science at the University of L'Aquila. Previously, Vice-Director of the Dept. of Computer Science, and Chairperson of the Ph.D. Program, Director of the CampusOne Program. Member and past President of Department Committees on Quality of teaching and research.

TEACHING ACTIVITIES

Thesis Supervision

I have been the supervisor of more than 100 Bs.C. and Ms.C Theses and of seven Ph.D. Theses. I am presently supervising a Ph.D. student. I participated to various Committees for Ph.D. final defence, of which three abroad (Belgium, Spain, Portugal). I have served as external reviewer of many Ph.D. Theses, also abroad.

Courses   I have been teaching two-three Courses per year in average, and in particular the undergraduate Course on *Databases* (6CFU), the Graduate Course in *Computational Intelligence* (Module on *Intelligent Artificial Agents*, 6CFU), and *Ontologies for Data Representation*, Methods and Applications (3CFU). She has also been teaching Ph.D. short courses, courses for continuing education of teachers and public administration officers (TFA, PAS, Courses at High School of Public Administration), tutorials at Conferences.

PUBLICATIONS AND IMPACT

Bibliometric Data: H-INDEX Scopus 14, Google Scholar 21. More than 140 publications. Publications (in English): more than 20 International Journals; 7 International Book Chapters and one Essay; more than 50 International Conferences and more than 20 Italian Conferences. For publications, one can refer to bibliographic database DBLP at URL https: //dblp.uni-trier.de/pers/hd/c/Costantini:Stefania, ot to SCOPUS.