Mattia Fumagalli

SHORT BIO

I have a Master's Degree in *Philosophy* and a Ph.D. in *Computer Science*. My research concerns primarily *Artificial Intelligence*, with a particular focus on the automated support for *Knowledge Representation* and *Knowledge Discovery*. Other key research interests include *Logic* and *Philosophy of Mind*.

I am currently a *Postdoctoral Researcher/Fixed-term Assistant Professor (RTDa)*, member of the *In2Data* at the *Free University of Bozen-Bolzano*, where I have been a lecturer for the *Information Systems Design* and *Research Methods* courses.

I am also having a strong collaboration with the *Services and Cybersecurity Group* at the *University of Twente*, and, occasionally, I am working with the *Knowdive Group* at the *Department of Information Engineering and Computer Science of the University of Trento*, where I got my Ph.D., and (from 2015 to 2020) I was teaching assistant for the *Computational Logics* and *Knowledge Graphs and Data Integration* courses.

EDUCATION

- **University of Trento** — Trento, Italy
  Doctor of Philosophy (PhD) in Information and Communication Technology — *December 2017*

- **Catholic University of the Sacred Heart** — Milano, Italy
  Master - Philosophy and Metaphysics; 110/110 cum laude — *April 2007*

- **Catholic University of the Sacred Heart** — Milano, Italy
  Bachelor - Philosophy; 110/110 cum laude — *December 2004*

WORK EXPERIENCE

- **Free University of Bozen-Bolzano** — Bolzano, Italy
  Postdoctoral Researcher/Fixed-term Assistant Professor (RTDa) — *January 2023*

- **Free University of Bozen-Bolzano** — Bolzano, Italy
  Postdoctoral Researcher (AR) — *June 2020 - June 2022*

- **University of Trento** — Trento, Italy
  Postdoctoral Researcher (AR) — *December 2017 - May 2020*

- **University of Trento** — Trento, Italy
  PhD Candidate, Research and Teaching Assistant — *October 2012 - December 2017*

- **GroupM - WPP Group** — Milano, Italy
  Web Analytics and Search Engine Optimization Consultant — *May 2009 - September 2012*

- **Logotel S.p.A & Mastra S.r.l.** — Milano, Italy
  Web Analytics and Web Marketing Junior Consultant — *2006 - 2009*

- **Self Employed** — Milano, Italy
  Web Developer and Web Marketing Specialist — *2003 - 2006*

TEACHING EXPERIENCE

- **Free University of Bozen-Bolzano** — Bolzano, Italy
  Research Methods (PhD Seminar) - Lecturer — *February 2023*

- **Free University of Bozen-Bolzano** — Bolzano, Italy
  Information Systems Design - Lecturer — *September 2022 - December 2022*

- **Free University of Bozen-Bolzano** — Bolzano, Italy
  Information Systems Design - Teaching Assistant — *September 2021 - June 2022*

- **Free University of Bozen-Bolzano** — Bolzano, Italy
  IT Management and Enterprise Modeling - Teaching Assistant — *September 2021 - June 2022*

- **University of Trento** — Trento, Italy
  Computational Logics - Teaching Assistant — *September 2016 - May 2020*

- **University of Trento** — Trento, Italy
  Knowledge Graphs and Data Integration - Teaching Assistant — *September 2017 - May 2020*

Research Projects

- **Mining Interesting Patterns in Large-Scale Knowledge Graphs**: Applied and foundational research to mine frequent and actionable subgraph structures over datasets of large-scale knowledge graphs. The research activities of this project focus on the following: 1) applying consolidated technology to graphs representing specific domains (e.g., risk/attack graphs, behaviour graphs, or spatial/event graphs), to find recurring structures that can provide useful insights into domain experts (e.g., attack patterns or recurrent behaviours); 2) enhancing available technology to facilitate users in accessing and analyzing the discovered patterns (e.g., filtering out redundant or spurious patterns, and offering a service to organize and visualize the output patterns); 3) defining the notion of *interestingness* for a frequent subgraph structure and provide metrics to rank these structures accordingly. For more info about this, you can contact Prof. Calvanese and Prof. Guizzardi. (Since June 2022)

- **RiskGraph Project - In collaboration with Accenture Israel Cybersecurity R&D Lab**: Development of an approach to support risk propagation techniques that leverages the semantics encoded by *ad-hoc* ontologies. The approach, starting from an application to the specific domain of cyber security, aims at being generalized to multiple risk scenarios, thus advancing the state of the art in the research of ontology-driven risk assessment and propagation (Since June 2020)

- **NEXON - Foundations of Next-Generation Ontology-Driven Conceptual Modeling**: This project is aimed at developing automatic techniques to support conceptual modelling. The first outcome of this project was an approach that can be used to learn constraints from conceptual model simulations, which leverages the combination of inductive logic programming and model validation. A second outcome was a highly automated interactive solution for the empirical discovery of conceptual modelling patterns from model data sets. A third outcome was the construction of a models catalogue for ontology-driven conceptual modelling research (June 2020 - September 2022)

- **LiveSchema - Adaptable and Reusable Knowledge Graphs**: Development of a research-oriented, open-source, ontologies catalogue (liveschema.eu) with a set of services that can be used to exploit resources in machine learning scenarios. The catalog leverages the gold mine of data collected by many of the already existing ontology catalogs. By implementing a continuously updating aggregation facility, which keeps track of the updates from selected existing catalogs, liveschema.eu offers a family of services to easily access, analyze, transform, and re-use data to set up a relational machine learning pipelines and address predictive tasks. (January 2016 - May 2020)

Languages

- **Italian**: Mother tongue
- **English**:
  - Listening: C1
  - Reading: C1
  - Spoken interaction: C1
  - Spoken production: C1
  - Writing: C2

Skills

- **Programming**:   Python, JavaScript
- **Libraries**:   Scikit, Pandas, Seaborn, Networkx, Rdflib, NodeJS, Gatsby, Graphviz
- **Tools**:   Rapidminer, Visual Paradigm, Alloy, Git, MySQL WorkBench, Protege, Orange3, Neo4j, GraphDB, Wordpress, yED

ODGL: a Logic for Object-Oriented Disruption Graphs

Publications

- **Conference Article - Unpacking the semantics of risk in climate change discourses**: Greta Adamo, Anna Sperotto, Mattia Fumagalli, Alessandro Mosca, Tiago Prince Sales and Giancarlo Guizzardi; forthcoming (2024)

- **Journal Article - A Teleological Approach to Information Systems Design**: Mattia Fumagalli, Roberta Ferrario, Giancarlo Guizzardi; accepted, forthcoming. Minds & Machines (2024)

- **Journal Article - Integrating 3D City Data through Knowledge Graphs**: Linfang Ding, Guohui Xiao, Albulen Pano, Mattia Fumagalli, Dongsheng Chen, Yu Feng, Diego Calvanese, Hongchao Fan, Liqiu Meng; forthcoming (2024)

- **Journal Article - Ontology-based security modeling in ArchiMate Models**: Ítalo Oliveira, Tiago Prince Sales, João Paulo A Almeida, Riccardo Baratella, Mattia Fumagalli, Giancarlo Guizzardi; Software and Systems Modeling (2024)

- **Journal Article - Computational Approaches to Concepts Representation**: Mattia Fumagalli, Riccardo Baratella, Marcello Frixione, Daniele Porello; under review (2024)

- **Journal Article - A FAIR catalog of ontology-driven conceptual models**: Tiago Prince Sales, Pedro Paulo F Barcelos, Claudenir M Fonseca, Isadora Valle Souza, Elena Romanenko, César Henrique Bernabé, Luiz Olavo Bonino da Silva Santos, Mattia Fumagalli, Joshua Kritz, João Paulo A Almeida, Giancarlo Guizzardi; Data & Knowledge Engineering DKE (2023)

- **Conference Article - Property Specification and Models for Risk: Towards Risk Propagation Graphs**: Stefano M. Nicoletti; Mattia Fumagalli; Milan Lopuhaä-Zwakenberg; E. Moritz Hahn; Giancarlo Guizzardi; Mariëlle Stoelinga. International Conference on Computer Safety, Reliability, and Security, SAFECOMP (2023)

- **Conference Article - On the Semantics of Risk Propagation**: Fumagalli, Mattia; Engelberg, Gal; Sales, Tiago Prince; Oliveira, Ítalo; Klein, Dan; Soffer, Pnina; Baratella, Riccardo; Guizzardi, Giancarlo. International Conference on Research Challenges in Information Science, RCIS (2023)

- **Conference Article - Boosting D3FEND: Ontological analysis and recommendations**: Oliveira, Italo; Engelberg, Gal; Sales, Tiago Prince; F Barcelos, Pedro Paulo; Fumagalli, Mattia; Bratella, Riccardo; Klein, Dan; Guizzardi, Giancarlo. 13th Formal Ontology in Information Systems Conference, FOIS (2023)

- **Journal Article - Conceptual Model Visual Simulation and the Inductive Learning of Missing Domain Constraints**: Fumagalli, Mattia; Sales, Tiago Princes; Baião, Fernanda; Guizzardi, Giancarlo. Data & Knowledge Engineering Journal, DKE (2022)

- **Conference Article - Ontological Analysis and Redesign of Security Modeling in ArchiMate**: Oliveira, Italo; Prince Sales, Tiago; Almeida, João Paulo A; Bratella, Riccardo; Fumagalli, Mattia; Guizzardi, Giancarlo. 5th Working Conference on the Practice of Enterprise Modelling, PoEM (2022)

- **Conference Article - An Ontology-Driven Approach for Process-Aware Risk Propagation**: Engelberg, Gal; Fumagalli, Mattia; Kuboszek, Adrian; Klein, Dan; Soffer, Pnina; Guizzardi, Giancarlo. The 38th ACM/SIGAPP Symposium On Applied Computing, SAC (2023)

- **Conference Article - Popularity Driven Data Integration**: Giunchiglia, Fausto; Bocca, Simone; Fumagalli, Mattia; Bagchi, Mayukh; Zamboni, Alessio. 4th Knowledge Graph and Semantic Web Conference, KGSWC (2022)

- **Conference Article - Pattern Discovery in Conceptual Models Using Frequent Itemset Mining**: Fumagalli, Mattia; Sales, Tiago Princes; Guizzardi, Giancarlo. 41st International Conference on Conceptual Modeling, ER (2022)

- **Conference Article - An Ontology of Security from a Risk Treatment Perspective**: Oliveira, Italo; Prince Sales, Tiago; Bratella, Riccardo; Fumagalli, Mattia; Guizzardi, Giancarlo. 41st International Conference on Conceptual Modeling, ER (2022)

- **Conference Article - A FAIR Model Catalog for Ontology-Driven Conceptual Modeling Research**: Favato Barcelo, Pedro; Prince Sales, Tiago; Fumagalli, Mattia; Fonseca, Claudenir; Guizzardi, Giancarlo. 41st International Conference on Conceptual Modeling, ER (2022)

- **Conference Article - Understanding and Modeling Prevention**: Baratella, Riccardo; Fumagalli, Mattia; Oliveira, Italo; Guizzardi, Giancarlo. The Sixteenth International Conference on Research Challenges in Information Science, RCIS (2022)

- **Conference Article - "Mind the Gap!": Learning Missing Constraints from Annotated Conceptual Model Simulations**: Fumagalli, Mattia; Sales, Tiago Princes; Guizzardi, Giancarlo. 14th Working Conference on the Practice of Enterprise Modelling, PoEM (2021)

- **Conference Proceedings - Proceedings of the International Workshop on Value Modelling and Business Ontologies**: Guizzardi, Giancarlo; Prince Sales, Tiago; Griffo, Cristine; Fumagalli, Mattia. CEUR Workshop Proceedings 2835 (2021)

- **Conference Article - Ranking Schemas by Focus: A Cognitively-Inspired Approach**: Fumagalli, Mattia; Shi, Daqian; Giunchiglia, Fausto. 26th International Conference on Conceptual Structures, ICCS (2021)

- **Conference Article - How FAIR are Security Core Ontologies? A Systematic Mapping Study**: Oliveira, Italo; Fumagalli, Mattia; Prince Sales, Tiago; Guizzardi, Giancarlo. The Fifteenth International Conference on Research Challenges in Information Science, RCIS (2021)

- **Conference Article - Ontology-Driven Cross-Domain Transfer Learning**: Fumagalli, Mattia; Bella, Gabor; Samuele Conti; Giunchiglia, Fausto. 11th International Conference on Formal Ontology in Information Systems, FOIS (2020)

- **Workshop Paper - Towards Automated Support for Conceptual Model Diagnosis and Repair**: Fumagalli, Mattia; Sales, Tiago Princes; Guizzardi, Giancarlo. 1st Workshop on Conceptual Modeling Meets Artificial Intelligence and Data-Driven Decision Making, CMAI (2020)

- **Workshop Paper - Assessing Ontologies Usage Likelihood via Search Trends**: Fumagalli, Mattia; Bailoni, Tania, Giunchiglia, Fausto. Proceedings of the 2020 Joint Ontology Workshops, SKALE (2020)

- **Conference Paper - Entity Type Recognition – dealing with the Diversity of Knowledge**: Giunchiglia, Fausto; Fumagalli, Mattia. Principles of Knowledge Representation and Reasoning: Proceedings of the Seventeenth International Conference, KR (2020)

- **Conference Paper - Towards Understanding Classification and Identification**: Fumagalli, Mattia; Bella, Gabor; Giunchiglia, Fausto. PRICAI 2019: Pacific Rim International Conference on Artificial Intelligence (2019)

- **Workshop Paper - On Knowledge Diversity**: Fumagalli, Mattia; Bella, Gabor; Giunchiglia, Fausto. Proceedings of the 2019 Joint Ontology Workshops, WOMoCoE, CEUR (2019)

- **Workshop Paper - Representation of Concepts in AI: Towards a Teleological Explanation**: Fumagalli, Mattia; Ferrario, Roberta. Proceedings of the 2019 Joint Ontology Workshops, CAOS, CEUR (2019)

- **Conference Paper - Teleologies: Objects, actions and functions**: Giunchiglia, Fausto; Fumagalli, Mattia. International conference on conceptual modeling, 520-534, "Springer, Cham" (2017)

- **Conference Paper - Concepts as (Recognition) Abilities**: Giunchiglia, Fausto; Fumagalli, Mattia. The 9th International Conference on Formal Ontology in Information Systems, FOIS, 153-166 (2016)
- **Workshop Paper - An Ontological Foundation for ER Models**: Giunchiglia, Fausto; Fumagalli, Mattia. 3rd International ESSENCE Workshop (2015)
- **Conference Paper - From ER models to the entity model**: Giunchiglia, Fausto; Fumagalli, Mattia. International Conference on Knowledge Engineering and Knowledge Management, 116-119, "Springer, Cham" (2014)
- **Journal Issue - Philosophical Readings II/1**: Colombo, Chiara; Eva, Del Soldato; Di Martino, Francesco; Fumagalli, Mattia; Pozzi, Mattia Luigi; Sgarbi, Marco; Verde, Francesco. January-April, ISSN 2036-4989 (2010)
- **Journal Issue - Philosophical Readings I/1**: Colombo, Chiara; Eva, Del Soldato; Di Martino, Francesco; Fumagalli, Mattia; Pozzi, Mattia Luigi; Sgarbi, Marco; Verde, Francesco. September-December, ISSN 2036-4989 (2009)

Third Missions

CNR Webinar 2024 - Spiegabilità e intelligenza artificiale	Online, Italy	
Speaker	*May 2024*	
ForMoRe Workshop - Formalization and Representation of Social Pattern Analyses	Trento, Italy	
Speaker	*November 2023*	
Festival dell'Economia 2023 - AI: rischi e vantaggi in nuovi scenari di vita	Trento, Italy	
Speaker	*Maggio 2023*	
SCS Seminar - Mining Frequent Structures in Conceptual Models	Enschede, The Netherlands	
Speaker	*February 2023*	

Contribution to International Research Events

EDOC'24 - International Conference on Enterprise Design and Computing	Vienna, Austria	
PC Member	*September 2024*	
CAISE'24 - 36th International Conference on Advanced ISs Engineering	Limassol, Cyprus	
PC Member	*June 2024*	
RCIS'24 - 18th Research Challenges in Information Science	Guimarães, Portugal	
PC Member	*May 2024*	
ER'24 - The 43rd International Conference on Conceptual Modeling	Pittsburgh, USA	
PC Member	*October 2024*	
FOIS'24 - 14th International Conference on Formal Ontology in ISs	Enschede, The Netherlands	
PC Member	*July 2024*	
MDE Intelligence'24 - 6th Workshop on Artificial Intelligence and Model-driven Engineering	Linz, Austria	
PC Member	*September 2024*	
BEWARE'23 - 2nd Workshop on Bias, Risk, Explainability and the Role of Logic	Roma, Italy	
PC Member	*November 2023*	
SWODCH'23 - 3nd Workshop on Semantic Web and Ontology for Cultural Heritage	Athens, Greece	
PC Member	*November 2023*	
ER'23 - 42nd International Conference On Conceptual Modeling	Lisbon, Portugal	
PC Member	*Novemeber 2023*	
EDOC'23 - 27th conference in Enterprise Computing	Groningen, The Netherlands	
PC Member	*July 2021*	
MDE Intelligence'23 - 5th Workshop on AI and Model-driven Engineering	Groningen, The Netherlands	
PC Member	*October 2023*	
FOUST'23 - 7th Workshop on Foundational Ontology	Québec, Canada	
PC Member	*July 2021*	
EDOC'22 - 26th conference in Enterprise Computing	Bolzano, Italy	
PC Chair	*October 2022*	

- **BEWARE'22 - Joint Workshop - AIxIA 2022**   Udine, Italy
  PC Member   *December, 2022*

- **VORTE'22 - 11th International Workshop on Ontologies for the Enterprise**   Amsterdam, Netherlands
  Workshop Chair   *June 2022*

- **JOWO'22 – 8th Joint Ontology Workshops**   Jönköping, Sweeden
  PC Member   *August 2022*

- **JOWO'21 – 7th Joint Ontology Workshops**   Bolzano, Italy
  PC Member   *September 2021*

- **VMBO'21 - 15th International Workshop on Value Modelling and Business Ontologies**   Bolzano, Italy
  PC Member   *March 2021*

- **CBI'21 - 23rd IEEE International Conference on Business Informatics**   Bolzano, Italy
  PC Member   *September 2021*

- **EDOC'21 - 25th conference in Enterprise Computing**   Gold Coast, Australia
  PC Member   *October 2021*

- **IJCAI-PRICAI'20 - International Joint Conference on Artificial Intelligence**   Yokohama, Japan
  PC Member   *January 2020*

- **JOWO'20 - 6th Joint Ontology Workshops**   Bolzano, Italy
  PC Member   *October 2020*

- **Context'19 - 11th International Conference on Modeling and Using Context**   Trento, Italy
  Workshop Chair   *November 2019*

VOLUNTEER EXPERIENCE

- **C.E.Re.S – Non-profit organization**   Milano, Italy
  Caregiver (taking care of persons with disabilities), mini-bus driver, management activities support   *2000 - 2002*