




CRISTINA CORNELIO

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RESEARCH INTERESTS

My general research interests lie in the areas of Artificial intelligence and Cognitive Computing. In particular, I have worked on preference reasoning, graphical preference representation, preferences under uncertainty, preference aggregation in a multi agent context, voting rules, computational social choice, recommender systems, matching algorithms, logic of preferences and kidney exchange algorithms.

More recently I focused on the research topics of logic and reasoning, inference mechanisms, automated theorem proving, probabilistic logic, knowledge representation and extraction, natural language processing (NLP), neural-symbolic methods, neural embeddings for logic, combination of deep learning techniques with standard reasoning systems and reasoning for scientific discovery.



EDUCATION

PhD in Mathematics (Computer Science Area) | University of Padua, Italy

JANUARY 2013 – MARCH 2016

Supervisor: Francesca Rossi.

PhD Thesis: “Preference reasoning and aggregation over combinatorial domains in uncertain and multi-agent scenarios”.

PhD Thesis reviewers: Barry O’Sullivan and Craig Boutilier.

Master’s degree in mathematics | University of Padua, Italy

OCTOBER 2010 – OCTOBER 2012

Supervisors: Francesca Rossi and K. Brent Venable.

Master Thesis: “Dynamic and Probabilistic CP-nets”.

Master Thesis reviewers: Toby Walsh.

Bachelor’s Degree in mathematics | University of Udine, Italy

SEPTEMBER 2007 – OCTOBER 2010

Bachelor Thesis: “Local search cuts for the maximum satisfiability problem”.

Supervisor: Franca Rinaldi.



WORK EXPERIENCE

Research Scientist | IBM Research – Zurich Research Center (Rüschlikon)

JULY 2019 – PRESENT

Manager: Anika Schumann

Area: Reasoning, NLP and Knowledge Extraction

Research Staff Member | IBM Research – T.J. Watson Research Center

OCTOBER 2017 – JUNE 2019

Manager: Michael Witbrock / Achille Fokoue

Area: AI Foundations - Reasoning

Post-Doc | IBM – T.J. Watson Research Center

JULY 2016 – OCTOBER 2017

Manager: Michael Witbrock

Mentor: Vijay Saraswat

Post-Doc | University of Padua, Italy

JANUARY 2016 – JUNE 2016

Supervisor: Francesca Rossi



SKILLS

- PhD curriculum:
 - Programming Big Data in X10, Quantum Information, Statistical methods, Embedded Real-Time Systems, Preference reasoning in computational social choice, Decision making and social networks, Machine learning for structured domains by kernel methods, Networking Issues and Solutions in Online Games.
- Programming languages:
 - Good: Python, Prolog/Datalog.
 - Basic: Java, C++, C, Mathematica, html.



PUBLICATIONS

- Journal papers:
 - **“Deceased-donor-initiated chains: first report of a successful deliberate case and its ethical implications”**, L. Furian, C. Cornelio, C. Silvestre, F. Rossi, P. Rigotti, E. Cozzi, F. Neri and A. Nicolò, *Transplantation*, 2019.
 - **“Multi-agent soft constraint aggregation via sequential voting: theoretical and experimental results”**, C. Cornelio, M.S. Pini, F. Rossi, K. B. Venable, *Journal of Autonomous Agents and Multi-Agent Systems (JAAMAS)*, 2019
 - **“Potential gain of utilizing kidneys from deceased donors to initiate “Chain” Kidney Paired donations: quantification of benefit through a real-world retrospective analysis”**, C. Cornelio, L. Furian, F. Neri, A. Nicolò, F. Rossi, P. Rigotti, C. Silvestre., *Transpl Int*, 2017
- Conference papers:
 - **“Updates and Uncertainty in CP-net”**, C. Cornelio, U. Grandi, J. Goldsmith, N. Mattei, F. Rossi and K.B. Venable, *Proceedings of the 26th Australasian Joint Conference on Artificial Intelligence, AUAL-13*.

- **“Reasoning with PCP-nets in a Multi-Agent Context”**, C. Cornelio, U. Grandi, J. Goldsmith, N. Mattei, F. Rossi and K.B. Venable, Proceedings of the International Conference on Autonomous Agents & Multiagent Systems 2015, AAMAS-15.
- **“Using deceased-donor kidneys to initiate chains of living donor kidney paired donations: algorithm and experimentation”**, C. Cornelio, L. Furian, A. Nicolò and F. Rossi, Proceedings of the AAAI/ACM Conference on Artificial Intelligence, Ethics and Society (AIES), 2019.
- Published research extended abstracts:
 - **“Dynamic and Probabilistic CP-nets”**, C. Cornelio, Proceedings of the Doctoral Program of International Conference on Principles and Practice of Constraint Programming 2013, CP-13.
 - **“Models for Conditional Preferences as extensions of CP-nets”**, C. Cornelio, Proceedings of the Twenty-Fourth International Joint Conference on Artificial Intelligence (extended abstract), IJCAI-15.
 - **“Voting with Random Classifiers (VORACE)”**, C. Cornelio, M. Donini, A. Loreggia, M.S. Pini, F. Rossi, Proceedings of the International Conference on Autonomous Agents & Multiagent Systems 2020 (AAMAS-20).
 - **“Sequential voting in multi-agent soft constraint aggregation”**, C. Cornelio, M.S. Pini, F. Rossi, K. B. Venable, Proceedings of the International Conference on Autonomous Agents and Multi-Agent Systems (AAMAS) 2020 - JAAMAS track.
- Patents:
 - **“Generative Reasoning for Symbolic Discovery”**, C. Cornelio, L. Horesh, V. Pestun, R. Yan, *filed on: 2/10/2020, patent ID: P202006430US01 (Application Number 17/062058)*
 - **“Symbolic Model Discovery based on a combination of Numerical Learning Methods and Reasoning”**, C. Cornelio, L. Horesh, A. Fokoue-Nkoutche, Sanjeeb Dash, *filed on: 7/21/2020, patent ID: P202000488US01 (Application Number 16/934574)*
 - **“Problem manipulators for language-independent reasoning”**, C. Cornelio, A. Fokoue, A. Pareja, I. Abdelaziz, M. Witbrock, *filed on: 4/29/2020, patent ID: P202000481US01 (Application Number 16/864090)*
 - **“Experimental Design for Symbolic Model Discovery”**, L. Horesh, K. Clarkson, C. Cornelio, S. Magliacane, *filed on: 4/21/2020, patent ID: P201809327US01 (Application Number 16/855085)*
 - **“Capturing the global structure logical formulae with graph long short-term memory”**, M. Crouse, I. Abdelaziz, C. Cornelio, V. Thost, L. Wu, B. Makni, K. Srinivas, A. Fokoue, *filed on: 11/14/2019, patent ID: P201907617US01.*
 - **“Automatic transformation of complex tables in documents into computer understandable structured format and managing dependencies”**, C. Cornelio, M. Canim, R. Musa, M. Rodriguez Muro, A. Iyengar, *P201800552BUS01, filed to the USPTO 4/18/2019 (Application Number 16/389123).*

- **“Automatic transformation of complex tables in documents into computer understandable structured format with mapped dependencies and providing schema-less query support for searching table data”**, C. Cornelio, M. Canim, R. Musa, M. Rodriguez Muro, A. Iyengar, *P201800552AUS01, filed to the USPTO 4/18/2019 (Application Number 16/389102)*.
- **“Method for automatic transformation of complex tables in documents (PDF, Word) into computer understandable structured format and providing schemaless query support Data Extraction”**, C. Cornelio, M. Canim, R. Musa, M. Rodriguez Muro, A. Iyengar, *P201800552US01, filed to the USPTO 4/18/2019: (Application Number 16/389073)*.
- Workshop papers:
 - **“Dynamic Probabilistic CP-nets”**, C. Cornelio, U. Grandi, J. Goldsmith, N. Mattei, F. Rossi and K.B. Venable, *Proceedings of the 7th Multidisciplinary Workshop on Advances in Preference Handling, MPREF-13*.
 - **“Voting with CP-nets using a Probabilistic Preference Structure**, C. Cornelio, U. Grandi, J. Goldsmith, N. Mattei, F. Rossi and K.B. Venable, *5th International Workshop on Computational Social Choice, ComSoC-14*.
 - **“Logical conditional preference theories”**, C. Cornelio, A. Loreggia, and V. Saraswat, *Proceedings of the MPREF workshop of the International Joint Conference on Artificial Intelligence 2015, IJCAI-15*.
 - **“Expressing Probabilistic Graphical Models in RCC”**, C. Cornelio and V. Saraswat, *Symbolic Inference and Optimization workshop of AAIL-17*.
 - **“A Knowledge and Reasoning Toolkit for Cognitive Applications”**, M. Canim, C. Cornelio, R. Farrell, A. Fokoue, K. Gao, J. Gunnels, A. Iyengar, R. Musa, M. Rodriguez-Muro, R. Uceda-Sosa, *HotWeb 2017*.
 - **“Identifying the Discourse Function of News Article Paragraphs”**, W.V.H. Yarlott, C. Cornelio, T.Gao, M.A. Finlayson, *Proceedings of COLING workshop: EventStory 2018*.
 - **“Improving Graph Neural Network Representations of Logical Formulae with Subgraph Pooling”**, M. Crouse, I. Abdelaziz, C. Cornelio, V. Thost, L. Wu, K. Forbus and A. Fokoue, *The Second International Workshop on Deep Learning on Graphs: Methods and Applications 2020 (DLG-KDD’20)*.
- ArXiv papers:
 - **“A Deep Reinforcement Learning Based Approach to Learning Transferable Proof Guidance Strategies”**, M. Crouse, S. Whitehead, I. Abdelaziz, B. Makni, C. Cornelio, P. Kapanipathi, E. Pell, K. Srinivas, V. Thost, M. Witbrock, A. Fokoue, *2019*, arXiv:1911.02065
 - **“RuDaS: Synthetic Datasets for Rule Learning and Evaluation Tools”**, C. Cornelio, V. Thost, *2019*, arXiv:1909.07095
 - **“Schemaless Queries over Document Tables with Dependencies”**, M. Canim, C. Cornelio, A. Iyengar, R. Musa, M. Rodriguez Muro, *2019*, arXiv:1911.09356

- “Improving Graph Neural Network Representations of Logical Formulae with Subgraph Pooling”, M. Crouse, I. Abdelaziz, C. Cornelio, V. Thost, L. Wu, K. Forbus, A. Fokoue, 2019, arXiv:1911.06904
- “Voting with Random Classifiers (VORACE)”, C. Cornelio, M. Donini, A. Loreggia, M.S. Pini, F. Rossi, 2019, arXiv:1909.08996
- “Logical conditional preference theories”, C. Cornelio, A. Loreggia, V. Saraswat, 2015, arXiv:1504.06374.



TALKS

- Conference talks:
 - “Sequential voting in multi-agent soft constraint aggregation”, International Conference on Autonomous Agents and Multi-Agent Systems, 2020.
 - “Reasoning with PCP-net in a Multi-Agent Context”, International Conference on Autonomous Agents and Multi-Agents Systems 2015, AAMAS-15, Istanbul, Turkey.
 - “Using deceased-donor kidneys to initiate chains of living donor kidney paired donations: algorithm and experimentation”, AAAI/ACM Conference on Artificial Intelligence, Ethics and Society (AIES), 2019. Honolulu, Hawaii, USA
- Workshop talks:
 - “Logical conditional preference theories”, MPREF, workshop of the International Joint Conference on Artificial Intelligence 2015, IJCAI-15, Buenos Aires, Argentina.
 - “Expressing Probabilistic Graphical Models in RCC”, C. Cornelio and V. Saraswat, Symbolic Inference and Optimization workshop of AAAI-17
- Poster presentations:
 - “Dynamic and Probabilistic CP-nets”, International Conference on Principles and Practice of Constraint Programming 2013, CP-13, Uppsala, Sweden.
 - “Models for Conditional Preferences as extensions of CP-nets”, International Joint Conference on Artificial Intelligence 2015, IJCAI-15, Buenos Aires, Argentina.
 - “Expressing Probabilistic Graphical Models in RCC”, C. Cornelio and V. Saraswat, Symbolic Inference and Optimization workshop of AAAI-17
 - “Using deceased-donor kidneys to initiate chains of living donor kidney paired donations: algorithm and experimentation”, C. Cornelio, L. Furian, A. Nicolò, F. Rossi, Proceedings of the AAAI/ACM Conference on Artificial Intelligence, Ethics and Society, 2019. Honolulu, Hawaii, USA
- Doctoral consortium talks:
 - “Dynamic and Probabilistic CP-nets”, Doctoral Consortium of the International Conference on Principles and Practice of Constraint Programming 2013, CP-13, Uppsala, Sweden.
 - “Models for Conditional Preferences as extensions of CP-nets”, Doctoral Consortium of the International Joint Conference on Artificial Intelligence 2015, IJCAI-15, Buenos Aires, Argentina.

- Invited talks:
 - “Affable Knowledge Elicitation”, Rensselaer Polytechnic Institute (RPI), Troy (NY), USA, October 2017.
 - “Potential gain of utilizing kidneys from deceased donors to initiate “Chain” Kidney Paired donations: quantification of benefit through a real-world retrospective analysis”, Workshop on Matching Theory and Applications, University of Padua, Padua, Italy, December 2017.
- Other talks:
 - “Probabilistic and Dynamic CP-Nets”, (PRANA Seminar Series), University of Padua, Padua, Italy.
 - “Reasoning with PCP-net in a Multi-Agent Context: Optimality and Dominance”, (Insight Seminar Series), Insight Centre for Data Analytics, Cork, Ireland.
 - “Preferences in AI”, (Doctoral Seminar Series), University of Padua, Padua, Italy.



ATTENDED CONFERENCES

- 2013: International Conference on Principles and Practice of Constraint Programming 2013, CP-13, Uppsala, Sweden.
- 2013: AI*IA, Turin, Italy. Workshop on Iterative Voting and Voting Games, Padua, Italy.
- 2014: Workshop on Iterative Voting and Voting Games, Padua, Italy.
- 2015: International Conference on Autonomous Agents and Multi-Agents Systems 2015, AAMAS-15, Istanbul, Turkey.
- 2015: International Joint Conference on Artificial Intelligence 2015, IJCAI-15, Buenos Aires, Argentina.
- 2016: International Conference on Logic Programming, ICLP-16, New York, USA.
- 2017: AAAI-17, San Francisco, USA.
- 2019: AAAI-19, Honolulu, Hawaii, USA
- 2019: AIES-19, Honolulu, Hawaii, USA
- 2019: Dagstuhl seminar: “Application-Oriented Computational Social Choice”
- 2020: AAMAS-20 (Online conference)



AWARDS

- Special mention for “Premio per NeoLaureati” (Italian national award for recent graduates) AI*IA-2013, Italian Association of Artificial Intelligence.
- Paper “Updates and Uncertainty in CP-nets”: nomination for the best paper at the 26th Australasian Joint Conference on Artificial Intelligence.
- “Patent issuance award”: IBM patent & invention program (on Acclaim), 2020.
- “Plateau”: IBM patent & invention program (on Acclaim), 2020.



PROFESSIONAL ACTIVITIES AND ACHIEVEMENTS

- 2013-2014: [Project “Incorporating patients’ preferences in kidney transplant decision protocols”](#): From January 2018 the system is piloted in Padova (involving NITp - Nord Italia Transplant program) and it started recently to be adopted nationally. It received national media and press attentions.
- 2013-2014: PhD representative for the Department of Mathematics of the University of Padua (Computer Science Area).
- 2014: Co-Organization of “Workshop on Iterative Voting and Voting Games” and realization of the corresponding web site.
- 2014 SEPTEMBER-DECEMBER:
 - Internship at “Insight Centre for Data Analytics” (Cork, Ireland) under the supervision of Nic Wilson and Barry O’Sullivan.
 - Co-Internship at *Avego*: optimization of the car-sharing algorithms for the application “CARMA”.
- 2014: Co-supervision of a Computer Science Master thesis: “A Personalized Recommender System for the Financial Domain”.
- 2015: IJCAI-15 Student Volunteer Program in Buenos Aires, Argentina.
- 2015: Post-Doc representative for the Department of Mathematics of the University of Padua.
- 2017: Co-supervision of summer intern at IBM Research.
- 2018: Co-supervision of summer intern at IBM Research.
- 2019: Co-author of the proposal [“Accelerated Scientific Discovery via Globally Optimal Symbolic Regression”](#), accepted by [DARPA](#) for the call [AIRA \(Artificial Intelligence Research Associate\)](#)
- 2019-2021: participation in the [DARPA project AIRA](#)
- **REVIEWING FOR CONFERENCES:**
 - European Conference of Artificial Intelligence (**ECAI**): 2014, 2015, 2016.
 - International Conference on Algorithmic Decision Theory (**ADT**): 2017.
 - International Joint Conference on Artificial Intelligence (**IJCAI**): 2015, 2016, 2017, 2018, 2020.
 - Conference on Artificial Intelligence, Ethics and Society (**AIES**): 2018, 2019, 2020
 - International Conference on Autonomous Agents and Multi-agent Systems (**AAMAS**): 2018, 2019
 - International Conference on Artificial Intelligence (**AAAI**): 2018, 2019, 2020
 - International Conference on Artificial Intelligence (**AAAI**) - **Demo** track: 2020
 - Neural Information Processing Systems (**NeurIPS**) - 2020