LUCA CASTRI

PhD Student in
AI and Robotics
University of Lincoln, UK

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SUMMARY

I am a Robotic and AI scientist specialised in Causal Inference applied to Human-Robot Spatial Interaction (HRSI). My research focuses on enabling robots to learn the effects of their behaviours by observing how humans react to the robot's actions and enhancing the quality of the interaction by exploiting the acquired causal knowledge.

Research interests: Causal Inference - Causal Robotics

SKILLS

Robotics & AI:	ROS, Gazebo, Docker, Keras, Tensorflow, Scikit-learn
Computer Science:	Python, C++, Java, SQL, JavaScript, HTML, LaTeX, git, MATLAB & Simulink
Languages:	Italian (native) - English (fluent)

ACADEMIC EXPERIENCE

Jan/2024-Jun/2024 — **MSc Student Supervisor** — **University of Lincoln**
- Thesis: "Learning hierarchical tasks for human-robot on-demand co-production"

Apr 2024 — **Causal Discovery for Time-Series Data** — **University of Padua**
- Lecture in the Artificial Intelligence course of the Computer Science program

Apr 2023 — **Causal Discovery** — **University of Padua**
- Lecture in the Artificial Intelligence course of the Computer Science program

Jan/2023 – Jul/2023 — **Team member of LCASTOR RoboCup team** — **University of Lincoln**
- Competition: 2023 RoboCup@Home Open Platform League – Responsible for the "Person Following" task
- Technical tools – libraries – sensors: `ROS, Docker, Python, C++` – Bayes People Tracker – Velodyne VLP-16

Oct/2021 – Jun/2022 — **Associate Demonstrator (Workshop assistant)** — **University of Lincoln**
- Advanced Artificial Intelligence (Autumn term)
- Autonomous and Mobile Robotics (Spring term)

PROFESSIONAL EXPERIENCE

Jan/2020 – Jun/2021 — **Software Specialist** — **Metapack Engineering**
- Analysis of logic and HMI requirements
- HMI and PLC development
- Developing communication protocols for HMI and machine devices (motor, camera, printer, PLC)
- Follow test and start-up procedures
- Acquired skills: Collaborative coding using `GitHub - Python - C++`
- Main fields: Food and beverages – Pharmaceutical

Apr/2019 – Dec/2019 — **Test Engineer** — **Ferrari (Amaris Consultant)**
- Analysis of logic and HMI requirements, legislative constraints and corner cases
- Creation of test cases for single ECU validation
- Planning of test cases creation activities in order to meet deadlines related to software releases
- Participation in the ECU design process
- Key Areas: ADAS (ACC, Blind Spot Detection, Park Assist System) – Event Data Record (AirBag) – Infotainment

EDUCATION

Jul/2021 - present — **PhD in AI and Robotics** — **University of Lincoln**
- Supervisors: Nicola Bellotto and Marc Hanheide
- Responsible for the "Causal Reasoning for Safe HRSI" task of the European H2020 DARKO project
- Research focuses on discovering the features and causal structure of HRSI scenarios, embedding the causal model into forecasting and decision-making frameworks to enhance HRSI
- Active participation in review and integration meetings
- Main research topics: Causality, Robotics, Human-Robot Spatial Interaction (HRSI)

Oct/2016 - Jan/2019 — **Master of Science – Control Engineering (Mark: 110/110)** — **La Sapienza University of Rome**
- Relevant modules: Robotics, Process Automation, Multivariable systems, Control system.
- Thesis: "*Autonomous car driving systems: new control strategy*" – Supervisors: Gianluca Pepe, Antonio Carcaterra
- Technical tools: `MATLAB & Simulink, VRML, LaTeX`

Sep/2013 - Oct/2016 — **Bachelor of Science – Information and Control Engineering (Mark: 101/110)** — **La Sapienza University of Rome**
- Relevant modules: Systems Theory, Automation, Telecommunications, Electronics.
- Thesis: "*Modeling and Control of Robot KUKA LWR4+ in Simulink / VRML*" – Supervisor: Alessandro De Luca
- Technical tools: `MATLAB & Simulink, VRML, LaTeX`

PUBLICATIONS AND TALKS

CAnDOIT: Causal Discovery with Observational and Interventional Data from Time-Series
L. Castri, S. Mghames, M. Hanheide and N. Bellotto. (2024) **https://github.com/lcastri/causalflow**
Advanced Intelligent Systems

neuROSym: Deployment and Evaluation of a ROS-based Neuro-Symbolic Model for Human Motion Prediction
S. Mghames, **L. Castri**, M. Hanheide and N. Bellotto. (2024) **https://github.com/sariahmghames/neuROSym**
Proceedings of IEEE International Conference on Cybernetics and Intelligent Systems (CIS) and IEEE Conference on Robotics, Automation and Mechatronics (RAM).

Experimental Evaluation of ROS-Causal in Real-World Human-Robot Spatial Interaction Scenarios
L. Castri, G. Beraldo, S. Mghames, M. Hanheide and N. Bellotto. (2024) **https://lcastri.github.io/roscausal**
Proceedings of IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)

ROS-Causal: A ROS-based Causal Analysis Framework for Human-Robot Interaction Applications
L. Castri, G. Beraldo, S. Mghames, M. Hanheide and N. Bellotto. (2024) **https://github.com/lcastri/roscausal**
Causal-HRI Workshop, ACM/IEEE International Conference on Human-Robot Interaction (HRI)

Enhancing Human-Robot Spatial Interaction through Causal Inference
Invited talk at the University of Padua (Oct 2023)

Efficient Causal Discovery for Robotics Applications
L. Castri, S. Mghames and N. Bellotto. (2023)
Proceedings of Italian Conference on Robotics and Intelligent Machines (I-RIM 3D)

Qualitative Prediction of Multi-Agent Spatial Interactions
S. Mghames, **L. Castri**, M. Hanheide and N. Bellotto. (2023)
Proceedings of IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)

A Neuro-Symbolic Approach for Enhanced Human Motion Prediction
S. Mghames, **L. Castri**, M. Hanheide and N. Bellotto. (2023)
Proceedings of International Joint Conference on Neural Networks (IJCNN).

Enhancing Causal Discovery from Robot Sensor Data in Dynamic Scenarios
L. Castri, S. Mghames, M. Hanheide and N. Bellotto. (2023) **https://github.com/lcastri/fpcmci**
Proceedings of Conference on Causal Learning and Reasoning (CLeaR)

From Continual Learning to Causal Discovery in Robotics
L. Castri, S. Mghames and N. Bellotto. (2023)
AAAI Bridge Program "Continual Causality"

Causal Discovery of Dynamic Models for Predicting Human Spatial Interactions
L. Castri, S. Mghames, M. Hanheide and N. Bellotto. (2022)
Proceedings of International Conference on Social Robotics (ICSR)

From Human Perception and Action Recognition to Causal Understanding of Human-Robot Interaction in Industrial Environments
S. Ghidoni, M. Terreran, D. Evangelista, E. Menegatti, C. Eitzinger, E. Villagrossi, N. Pedrocchi, N. Castaman, M. Malecha, S. Mghames, **L. Castri**, M. Hanheide and N. Bellotto. (2022)
Convegno Nazionale CINI sull'Intelligenza Artificiale (Ital-IA)

EVENTS PARTICIPATION

Conference Reviewer: *CLeaR - ICRA - IROS*

Workshop Reviewer: *ICRA LHMP*

Attended courses: *Advanced Course on AI (ACAI2021)*