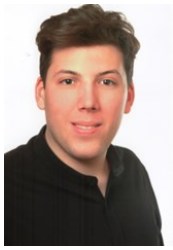
Michael Vanuzzo



Department of Management and Engineering (DTG)
Università degli Studi di Padova
Stradella S. Nicola, 3
36100 Vicenza

Phone: +39 347 3543611
Email: michael.vanuzzo@phd.unipd.it
Nationality: Italian
Date of birth: February 13, 1997

Education

10/2022 - Today: Ph.D. in Mechatronic Engineering at University of Padova; Thesis: "Long-term Human Motion Prediction in Human-Robot Collaborative Settings". Supervisor: Prof. Monica Reggiani.

04/2022: Master of Science in Mechatronic Engineering at University of Padova; Thesis: "Design e commissioning del sistema di controllo dei forni di caratterizzazione del progetto SPES" ("Design and commissioning of the SPES ovens control system"), with mark 110 (out of 110) cum laude. Supervisor: Prof. Roberto Oboe.

09/2019: Bachelor of Science in Mechanic and Mechatronic Engineering - Mechatronics curriculum at University of Padova; Thesis: "Applicazione del modello di Thevenin aumentato per l'analisi delle armoniche" ("Utilization of the augmented Thevenin model for harmonic analysis"), with mark 110 (out of 110) cum laude. Supervisor: Prof. Alessandro Sona.

07/2016: Mechanics, Mechatronics and Energy - Mechanics and Mechatronics curriculum Diploma at I.T.I.S. G. Marconi, Padova (PD), with mark 100 (out of 100).

Languages: Italian (mother tongue), English (B2), and Spanish (A1/A2)

Research responsibilities and projects

- **PRESENCE - anticiPatoRy bEhaviors for Safe and Effective humaN-robot CoopEration (PRESENCE)**, project of the Management and Engineering (DTG), University of Padova. Started in July 2022, it is a 24 months "BIRD" project. Collaboration is based on the ability to anticipate partner intentions. Robots collaborating or sharing the same workspace with people are required to adapt to human motion variability and adjust their trajectories coherently. To enable an effective collaboration, the partner's activities need to be identified on both the macro level, e.g. grasping an object, and on the micro level, e.g. the exact trajectory and velocity of the movement. Currently, the state of the art mainly considers the one or the other. Moreover, the data considered by the robotic system to predict human activities are usually limited when compared with human senses. A multimodal data fusion approach considering data from different sources is necessary to obtain improved and more general robot sensing capabilities. In this project, we seek to tackle the previously described open points in anticipating human intentions during human-robot collaborative tasks. The following components will be developed. (1) A compact representation for multimodal data based on tensors. (2) Deep action primitives to generate reusable building blocks starting from a few demonstrations. (3) Context-free grammars to match human tasks with context-aware labels. (4) Behavior Trees (BTs) to recognize macro-level tasks as well as trajectories based on the previously developed components. The proposed steps embody a disrupting change based on a simple and modular design. This innovative approach is reactive and flexible at the same time and has the potential to bring human-robot collaboration to a completely new level of interaction.
  Research results: The work done in the project allowed me to author already 3 conference papers ([C1], [C2], [C3]) and 2 journal paper ([J2], [J3]).

- **RELOAD - "REsilient LOgistics And supply chain Design (ReLOAD): Progettazione di una supply chain e di una logistica resiliente"**. Started in September 2020 and ended in February 2023. The goal of ReLOAD is to promote innovative actions aimed at digitizing the supply chain, improving the visibility, flexibility, and resilience of the entire logistics process, to reconfigure the entire logistics structure to react with speed and efficiency to the complexities created by the healthcare emergency. The project worked on: virtualization and digitization of logistics activities and processes; the use of Artificial Intelligence algorithms for reliable planning in the medium term; the use of smart tools (IoT, QR code, cameras, online platform) in case of contact limitation between operators; and the optimization of last-mile logistics.
  My role: I am a collaborator in the project developing the digital twin of the transportation entrance gate system and the product flow within the production Acciaierie di Verona S.p.A. **(**Gruppo Pittini**)**. I analyzed the bottlenecks of the system and proposed feasible solutions.

Industrial projects

- **AMANDA - AugMented reAlity maNagement eDging wArehouses (AMANDA)**, collaboration between the Department of Management and Engineering (DTG), University of Padova, and SCM S.p.A. The project started in December 2023 and will last 6 months. The main objective of the project is developing a functional prototype of an Augmented Reality (AR) application for mobile devices that could help an operator to locate an edging spool in a warehouse through a set of visual markers. **My role:** I am a collaborator in the project.

Prizes, grants and awards

- **Winner** of a **PhD scholarship** funded by Department of Management and Engineering (DTG), University of Padova, Padova (PD), Italy, 2022;
- **Winner** of a **5 months scholarship** for carrying out **research activities titled "Miglioramento dell'interfaccia utente del software WEM-Platform"** announced by Decree rep. n. 18/2022 prot. n. 707 of 29/03/2022;
- **Winner** of a **merit scholarship** awarded to the top 3% of the most outstanding students in their first year of master's degree study and funded by University of Padova, Padova (PD), Italy, 2019/2020;
- **Winner** of a **merit scholarship** funded by University of Padova, Padova (PD), Italy, 2018/2019;
- **Winner** of a **merit scholarship** funded by University of Padova, Padova (PD), Italy, 2017/2018;
- **Registration** on the **"Albo Nazionale delle Eccellenze" (Italian Register of Excellence**) for winning the "Gara nazionale di Meccanica" (National Mechanics Competition), Italy, 08/05/2015;
- **Third place** at the **"Gara nazionale di Meccanica" (National Mechanics Competition)** organized by Ministero dell'Università e della Ricerca (MIUR), Italy, 08/05/2015;
- **Second place** at the **"Olimpiade della Macchina Utensile"** organized by Confindustria di Padova, Italy, 20/04/2015;
- **Winner** of a **merit scholarship** funded by I.T.I.S. G. Marconi, Padova (PD), Italy, 15/04/2015;
- Italian **finalist** of the **"Championnat International de Jeux Mathématiques et Logiques" (International Competition for Mathematical and Logical Games)** at Bocconi University, Milano (MI), Italy, 19/05/2015;
- **Winner** of a **scholarship "Erasmus + Let's go"** granted _for conducting a **6-week training internship** in Bandon (Co. Cork) - Ireland, 23/03/2015**;**
- Italian **finalist** of the **"Championnat International de Jeux Mathématiques et Logiques" (International Competition for Mathematical and Logical Games)** at Bocconi University, Milano (MI), Italy, 16/05/2012.

International activities

- **DeepLearn 2023 Summer School** from 17/07/2023 to 21/07/2023 at University of Las Palmas de Gran Canaria. Co-organized by: University of Las Palmas de Gran Canaria, University of Rovira i Virgili, and Institute for Research Development, Training and Advice - Brussels/London (IRDTA). The school was a research training event with a global scope aiming at updating participants on the most recent advances in the critical and fast developing area of deep learning. Most deep learning subareas was displayed, and main challenges identified through 14 four-hour and a half courses, 2 keynote lectures and 1 round table.

Contributions to the scientific community

- **Speaker** at international conferences:
  - European Robotic Forum (**ERF**), **2024**.

- **Member** of the following associations:
  - **IEEE Membership** from 01/01/2023, member number 98708094;
  - **IEEE Young Professionals** from 01/01/2023;
  - **IEEE Robotics & Automation Society (RAS) Membership** from 01/01/2023;

Teaching experience

- Teaching Assistant (attività di supporto) with a module of 8 hours about *C++ programming* for the Course **"Laboratorio di Informatica Industriale" ("Industrial Computer Science Laboratory")**, Bachelor in Mechatronics and Product Innovation Engineering; Department of Management and Engineering (DTG), University of Padova, 2023/2024.
- Tutor Assistant (attività di tutor) with a module of 50 hours about *Laboratory of Foundations of Computer Science* for the Course **"Fondamenti di Informatica" ("Foundations of Computer Science")**, Bachelor in Mechatronics and Product Innovation Engineering; Department of Management and Engineering (DTG), University of Padova, 2023/2024.
- Teaching Assistant (attività di supporto) with a module of 12 hours about *Robot Operating System 2 (ROS2)* for the Course **"Programmazione di Sistemi Embedded" ("Embedded Systems Programming")**, Master in Mechatronics Engineering; Department of Management and Engineering (DTG), University of Padova, 2023/2024.
- Teaching Assistant (attività di supporto) with a module of 20 hours about *Concurrency in Distributed Computing Systems* for the Course **"Programmazione di Sistemi Embedded" ("Embedded Systems Programming")**, Master in Mechatronics Engineering; Department of Management and Engineering (DTG), University of Padova, 2022/2023.

I was **advisor/coadvisor** of the following master thesis:

- Pietro Mercorella; Thesis: **"Improving Human Motion Prediction with Text Semantic and Large Language Models"**; Department of Management and Engineering (DTG), University of Padova, 2024.
- Davide Carollo; Thesis: **"Comparative Analysis of the most recent Neural Networks Architectures on Predicting Human Motion in Collaborative Robotics"**; Department of Management and Engineering (DTG), University of Padova, 2023;
- Marco Casarin; Thesis: **"Enhancing Robot Collaborative Skills by Predicting Human Motion on Small Datasets through Deep Transfer Learning"**; Department of Information Engineering, University of Padova, 2023;

- Francesco Borsatti; Thesis: **"Semantic guided multi-future human motion prediction"**; Department of Management and Engineering (DTG), University of Padova, 2023;

I was **advisor/coadvisor** of the following bachelor thesis:

- Francesco Zulian and Alberto Mingoia; Thesis: **"Metagloves integration in ROS2 for real-time data streaming"**; Department of Management and Engineering (DTG), University of Padova, 2023;
- Lorenzo Dalla Libera and Riccardo Rettore; Thesis: **"Integration between ROS2 and Unity: Performance Analysis"**; Department of Management and Engineering (DTG), University of Padova, 2023;
- Edoardo Menegotto; Thesis: **"Wearable systems for operator monitoring in industrial settings"**; Department of Management and Engineering (DTG), University of Padova, 2023;

Professional experience

05/2022 - 09/2022: IT engineer for the logistics area, Acciaierie di Verona S.p.A. (Gruppo Pittini) - Lungadige Galtarossa, 21C - Verona (VR) - Italy. Development of a digital twin of the transportation entrance gate system and the product flow within the production plant. Analysis of system bottlenecks and proposal of feasible solutions.

10/2021 - 04/2022: Programmer for process control applications, INFN - Istituto Nazionale di Fisica Nucleare (National Institute for Nuclear Physics) - Viale dell'Università, 2 - 35020 Legnaro (PD) - Italy. Design and commissioning of the control system for the characterization furnaces of the SPES project; Implementation of their web interface.

05/2016 - 06/2016: Assistant to design engineer, AZA Aghito Zambonini S.p.A. - Via C. Colombo, 8 - 35027 Noventana (PD) - Italy. Technical drawing creation with Autocad.

08/2015 - 09/2015: Mechanical draftsperson, Twomey Precision Engineering Ltd. - Unit 5 Cloughmacsimon Business Park the Bypass - Bandon (Co. Cork) - Ireland. Design of mechanical parts with Autocad and Inventor.

Publications

Journals

[J1] M. Guidolin, **M. Vanuzzo**, S. Michieletto, and M. Reggiani, **"Enhancing Real-Time Body Pose Estimation in Occluded Environments Through Multimodal Musculoskeletal Modeling"**, IEEE Robotics and Automation Letters. [submitted]

[J2] **M. Vanuzzo**, M. Casarin, M. Guidolin, S. Michieletto, and M. Reggiani, **"Forecasting Future Human Motion: Assessing Long-Term Prediction in Human-Robot Collaborative Settings"**, IEEE Transactions on Emerging Topics in Computational Intelligence. [in progress]

[J3] M. Casarin, **M. Vanuzzo**, M. Guidolin, M. Reggiani, and S. Michieletto, **"Towards Transfer Learning for Human Motion Prediction"**, IEEE Transactions on Artificial Intelligence. [in progress]

Conferences

[C1] **M. Vanuzzo**, F. Borsatti, M. Casarin, M. Guidolin, M. Reggiani, and S. Michieletto, **"Towards Explainable Human Motion Prediction in Collaborative Robotics"** in 2024 European Robotics Forum (ERF2024), Rimini, Italy. March 12-15, 2024.

[C2] **M. Vanuzzo**, M. Casarin, M. Guidolin, S. Michieletto, and M. Reggiani, **"Human Motion Prediction Metrics: from Time to Frequency"** in 2024 European Robotics Forum (ERF2024), Workshop on Human-robot collaboration and AI - hype or reality, Rimini, Italy. March 12-15, 2024.

[C3] M. Casarin, **M. Vanuzzo**, M. Guidolin, M. Reggiani, and S. Michieletto, **"Enhancing Robot Collaboration by Improving Human Motion Prediction in Collaborative Robotics"** in 2024 International Conference on Automation Science and Engineering (CASE2024), Bari, Italy. August 28 - September 1, 2024. [submitted]

Padova, 10/03/2024

……..