

## CONTACT

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🌐 Marco

in Marco Emporio

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## BIO

### Date of birth

30/11/1995

### Address

Legnago, Verona

# MARCO EMPORIO

PhD in Computer Science

## WORK EXPERIENCE

### Postdoctoral Researcher University of Verona - Italy

2024 - ongoing

Improvement of continuous hand gesture recognition systems based on hand skeleton tracking within the "CollaborICE" project: A platform for the modeling, management, and maintenance of collaborative production systems.

## EDUCATION

### Ph. D. in Computer Science University of Verona - Italy

2021 - 2024

My Ph. D. work was focused on the study of **human-machine interaction in extended reality** and creating suitable approaches to build 3D natural interfaces for applications that work in continuous time and use reliable recognition methods. These approaches must commit a low amount of errors and have a real-time latency of mid-air heterogeneous hand gestures as a fundamental input.

### Master's degree in Computer Science & Engineering Visual Computing University of Verona - Italy

2018 - 2021

Passed with **110 cum Laude**. Thesis title: *Online recognition of heterogeneous gestures from 3D hand pose trajectories* – This project aims to improve the interaction in Virtual and Mixed Reality environments, making it more natural and instinctive. I created a convolutional neural network with better accuracy and false-positive ratio than the state-of-the-art to classify the gestures proposed in the [SHREC 2021 benchmark](#). To test the efficiency of the network, I created a demo for Hololens 2 that ran in real-time.

### Bachelor's degree in Computer Science University of Verona - Italy

2014 - 2018

Passed with **88**. Thesis title: *Evaluation with users of methods of manipulation in virtual reality* – I worked on a novel solution for single-handed deviceless object manipulation in immersive visualization environments. The solution was tested with users on a classical visualization task related to finding a point of interest in a 3D object and compared with the well-known "Handlebar" metaphor.

### Research Interests University of Verona - Italy

2017 - ongoing

Human-Computer Interaction, 3D Gesture Recognition, XR Interfaces, Machine Learning, Data Augmentation, Human-Robot Collaboration, Digital Twins, Industry 5.0, Videogame.

## OTHER SITES

### INTELLIGO labs

University of Verona, Italy

[Marco Emporio Page](#)

### ISUE lab

University of Central Florida,  
USA

[Marco Emporio Page](#)

### Google Scholar

[Marco Emporio Page](#)

## TECHNICAL SKILLS

**Programming Languages:** Python, C#, C, Java, JavaScript, HTML

Used across academic and personal projects for AI, web, and AR/VR applications.

**Game Engines:** Unity (2D/3D, AR/VR development)

Experienced in building interactive games and prototypes, especially for AR and VR environments.

**AR/VR Toolkits & SDKs:** Vuforia, AR Foundation, MRTK, OpenXR

Used to develop cross-platform immersive applications for mobile and standalone headsets.

**Head-Mounted Displays:** Meta Quest (2, pro, 3), HoloLens 2, HTC Vive

Hands-on experience in developing and testing immersive applications on a variety of devices.

**Data Science Tools:** Jupyter, NumPy, SciKit-Learn, Matplotlib, pandas, pytorch, CUDA

Applied for signal processing, classification tasks, and data visualization in research projects.

**Languages:** Italian (native), English

Fluent in English, with a 6-month research experience in the USA (University of Central Florida).

**Teamwork & Communication:** Cross-functional collaboration and coordination

Coordinated development teams and collaborated across disciplines in various academic projects.

## EXPERIENCE ABROAD

University of Central Florida, Orlando (FL, USA)

Jan 24 - Jul 24

I collaborated with a research group to develop a 3D gesture generator aimed at improving classification method scores. This project was focused on gestures executed in continuous time, which required the augmentation of non-gestures to enhance model accuracy, leading to improvements in the performance of gesture classification. In addition to this, I conducted an experiment that involved two datasets of gestures—static and dynamic—performed across four game rooms. I designed a game to test the effectiveness of real-time gesture recognition and to evaluate user preferences for static versus dynamic gestures. The experiment provided valuable insights into the practical application of gesture recognition in real-time environments, highlighting user behavior and system performance.

## ACADEMIC EXPERIENCES

Organization of STAG 2024

University of Verona - Italy

Mar 24 - Dec 24

I was part of the organizing team of the [STAG 2024 conference](#) — Smart Tools & Applications in Graphics, organized by the University of Verona and the EGIT Association. The event focuses on the theoretical and practical aspects of Computer Graphics, promoting the exchange of innovative ideas and solutions among researchers and professionals from both national and international communities.

## International Computer Vision Summer School Sicily - Italy

July 2023

I have attended and successfully completed the examination session at the [International Computer Vision Summer School](#). The School especially aimed to provide an objective, clear, and in-depth summary of the state-of-the-art research in the area of Computer Vision, Machine Learning, and Artificial Intelligence. The lectures have covered both theoretical and practical aspects of real problems as well as examples of their successful commercialization. The courses have been delivered by world-renowned experts in the field from both academia and industry.

## Departments of Excellence Project - ICE Laboratory University of Verona - Italy

2021 - ongoing

I am currently working on the development of gesture recognition demos in the context of the [Progetto di eccellenza: Computer Engineering for Industry 4.0](#) funded by the Italian Ministry of Research.

## Organization of the SHREC '22 University of Verona - Italy

Dec 21 - May 22

I was among the organizers of [SHREC '22 contest](#) - Online detection of heterogeneous gestures. We organize a novel edition of the contest, still aimed at benchmarking methods to detect and classify gestures from 3D trajectories of the fingers' joints (requiring 3D geometry processing and being, therefore, interesting for the SHREC community). I collaborated with the hand data acquisition and managed the participants' results in order to create the 2022 benchmark.

## Augmented Reality University of Verona - Italy

2020 - ongoing

Development and testing of methods for analyzing gestures in mixed reality applications using neural networks and simpler methods. I am developing methods for classifying the hand pose stream captured by Hololens 2.

## OPERA 4.0 project University of Verona - Italy

2018 - 2022

I am actively involved in the project: [OPERA 4.0](#) funded by Fondazione Cariverona. The project proposes to develop an industrial monitoring system compliant with privacy regulations and aimed at preventing human errors and dangerous conditions. My main task is to create AR interfaces to allow users to interact with the laboratory machinery.

## Virtual Reality University of Verona - Italy

2017 - ongoing

Development of virtual environments for the analysis of Human-Computer interaction techniques, especially in the field of virtual reality. I developed interactive environments using the Unity framework and participated in the organization of user studies for the evaluation of the usability of the different implemented methods.

# PUBLICATIONS

## Enhancing Safety and Privacy in Industry 4.0: The ICE Laboratory Case Study IEEE Access

2024

F. Cunico, S. Aldegheri, A. Avogaro, M. Boldo, N. Bombieri, L. Capogrosso, A. Caputo, D. Carra, S. Centomo, D. S. Cheng, E. Cinquetti, M. Cristani, M. D. Marchi, F. Demrozi, M. Emporio, F. Fummi, L. Geretti, S. Germiniani, A. Giachetti, F. Girella, E. Martini, G. Menegaz, N. Muijs, F. Paci, M. Panato, G. Pravadelli, E. Quintarelli, I. Siviero, S. F. Storti, C. Tadiello, C. Turetta, T. Villa, N. Zannone, D. Quaglia

**ICELab Demo: an industrial digital-twin and simulator in VR**

2024

**VRST '24: Proceedings of the 30th ACM Symposium on Virtual Reality Software and Technology**

D. Pintani, M. Emporio, A. Caputo, D. S. Cheng, L. Genghini, N. Tomasoni, and A. Giachetti.

**SHREC 2024: Recognition of dynamic hand motions molding clay**

2024

**Computers & Graphics, Volume 123**

B. Veldhuijzen, R. C. Veltkamp, O. Ikne, B. Allaert, H. Wannous, M. Emporio, A. Giachetti, J. J. LaViola, R. He, H. Benhabiles, A. Cabani, A. Fleury, K. Hammoudi, K. Gavalas, C. Vlachos, A. Papanikolaou, I. Romanelis, V. Fotis, G. Arvanitis, K. Moustakas, M. Hanik, E. Nava-Yazdani, C. von Tycowicz

**Integration of Extended Reality with a Cyber-Physical Factory Environment and its Digital Twins**

2024

**ACM Hum.-Comput. Interact. 8, EICS, Article 250**

M. Emporio, A. Caputo, D. Pintani, D. S. Cheng, T. De Marchi, G. Forte, F. Fummi, and A. Giachetti.

**OO-dMVM: A Deep Multi-view Multi-task Classification Framework for Real-time 3D Hand Gesture Classification and Segmentation**

2023

**Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition**

Cunico, F., Girella, F., Avogaro, A., Emporio, M., Giachetti, A. and Cristani, M.

**SHREC 2022 track on online detection of heterogeneous gestures**

2022

**Computers & Graphics (ISSN 0097-8493), Volume 107**

Marco Emporio, Ariel Caputo, Andrea Giachetti, Marco Cristani, Guido Borghi, Andrea D'Eusano, Minh-Quan Le, Hai-Dang Nguyen, Minh-Triet Tran, Felix Ambellan, Martin Hanik, Esfandiar Nava-Yazdani, Christoph von Tycowicz

**STRONGER: Simple trajectory-based online gesture recognizer**

2021

**Smart Tools and Apps for Graphics - Eurographics Italian Chapter Conference (Eurographics Association)**

M. Emporio, F. M. Caputo, A. Giachetti

**The Smart Pin: An effective tool for object manipulation in immersive virtual reality environments**

2018

**Computers & Graphics, Volume 74**

F. M. Caputo, M. Emporio, A. Giachetti

**The smart pin: a novel object manipulation technique for immersive virtual environments**

2017

**Proceedings of the 23rd ACM Symposium on Virtual Reality Software and Technology (VRST '17). Association for Computing Machinery**

F. M. Caputo, M. Emporio, A. Giachetti

Single-Handed vs. Two Handed Manipulation in Virtual Reality: A Novel Metaphor and Experimental Comparisons

2017

Smart Tools and Apps for Graphics - Eurographics Italian Chapter Conference (Eurographics Association)

F. M. Caputo, M. Emporio, A. Giachetti

## WORKSHOPS & CONFERENCES

I presented: 'Gesture based interaction with the Hololens 2'  
CHITALY, Torino, Italia

Sep 2023

[Conference site](#)

I presented: 'SHREC 2022: Track on Online Detection of Heterogeneous Gestures'  
3D Object Retrieval (3DOR), Firenze, Italia

Sep 2022

[Conference site](#)

I presented: 'STRONGER: Simple TRajjectory-based ONLINE GEsture Recognizer'  
Smart Tools and Applications in Graphics 2021, Roma, Italia

Oct 2021

[Conference site](#)

## EXTRACURRICULAR

- I have a great passion and knowledge of **videogames**. This got me into the competitive scene of multiple video games, even winning an Italian team tournament. I played various sports, including basketball and tennis.
- **Communication skills** In my academic career I had the opportunity to work on team projects with other colleagues. The projects ranged from the development of software in multiple languages to the programming of applications of various kinds. I have also worked on scientific development projects where I had to interact with novice computer users.



Dr. Emporio Marco  
Università di Verona

Verona, May 28, 2025