

WORK EXPERIENCE

Department of Information Engineering and Computer Science, University of Trento, Italy

City: Trento | **Country:** Italy

[2023/01/01 – Current] **Assistant Professor**

Research:

- Main researcher and investigator in the PNRR HPC project, Spoke 9 (Centro Nazionale di Ricerca in High Performance Computing Big Data e Quantum Computing (ICSC), funded by the European Union – NextGenerationEU – Piano Nazionale Ripresa e Resilienza)
- Objective: designing, developing and testing a large-scale urban digital twin, with particular focus on the health and wellbeing aspects
- Focusing on both the core implementation of the digital twin architecture and on the high-fidelity real-time 3D representation

Teaching:

- Lecturer – Computer Graphics (15+ students, free choice Information Engineering Masters' course, open to CS, AIS and other curricula)
- Co-supervising the theses of 10+ students

Other:

- Participating in the SowStain: Digital Twins for Precision Agriculture (funded by ICSC Innovation Funds)
- Member of the scientific committee – ICT Days 2025, "Humans, Robots and AI"

Epic Games

City: Pittsburgh, Pennsylvania | **Country:** United States

[2022/06/26 – 2022/10/25] **Research engineer**

Conducted research on the design, training, and evaluation of high-performance **unsupervised 3D human pose estimation networks**, aimed at advancing real-time character animation and motion understanding. Developed novel architectures and training pipelines optimized for scalability and efficiency, and validated their performance on large-scale motion datasets. The work contributed to improving the robustness and generalization of pose estimation models for interactive graphics and gaming applications.

AUSILIA Project - Presidio Ospedaliero VillaRosa

City: Pergine Valsugana | **Country:** Italy

[2018/10/31 – 2021/04/30] **Research engineer**

Leading the development of an autonomous distributed computer vision system for ambient assisted living in hospital contexts

Department of Information Engineering and Computer Science, University of Trento, Italy

City: Trento | **Country:** Italy

[2017/11/30 – Current] **Teaching Assistant**

Teaching assistant for the Computer Vision, Multimedia Communications, Segnali, Visione, Riconoscimento, and Project Course on Computer Graphics.

Xtensa SRL - SICS SRL

City: Trento - Bassano del Grappa | **Country:** Italy

[2018/10/31 – 2019/10/31] **Computer Vision Engineer**

Real-time, GPU powered, high-resolution 4K videos stitching and vision-based tactical camera for Italian Serie A football teams

Perceptual Computing Lab (OpenPose), Carnegie Mellon University

City: Pittsburgh | **Country:** United States

[2016/12/31 – 2017/11/30] **Computer Vision Engineer**

Designing and developing the first official porting of the popular deep learning-based human pose estimation library OpenPose to Python

Athlos SRL

City: Cagliari | **Country:** Italy

[2014/12/31 – 2015/12/31] **NLP Engineer**

Led development of a natural language processing and sentiment analysis pipeline for Italian digital assistants (Aika)

EDUCATION AND TRAINING

[2018/11/01 – 2022/05/31] **PhD - Doctor of Philosophy**

University of Trento | <https://www.disi.unitn.it>

Address: Via Sommarive, 9, 38123, Povo, Trento (TN), Italy | **Field(s) of study:** Computer Vision | **Thesis:** Design of Viewpoint-Equivariant Networks to Improve Human Pose Estimation

During my PhD at the University of Trento, I focused on computer vision and the field of human pose estimation, together with its application to real-world scenarios. I was involved in the AUSILIA project to design a computer vision expert system to track patients activities in a rehabilitation context and provide automatic metrics to the medical personnel. In my thesis, I explore the major flaws of human pose estimation and develop solutions which involve the design of viewpoint-equivariant neural networks capable of reasoning on the viewpoint from a restricted amount of training data. I also focused on the design of novel brain-inspired neural networks architecture that promote interpretability through representation learning. As an outcome, my research has brought state-of-the-art results in recent literature through multiple publications in top venues, as well as tangible improvements of technological applications in real-world scenarios.

[2016/09/30 – 2018/10/09] **M.Sc. Degree in Computer Science**

University of Trento | <https://www.disi.unitn.it>

Address: Via Sommarive, 9, 38123, Povo, Trento (TN), Italy | **Field(s) of study:** Computer Science | **Final grade:** 110 cum laude (Italian grading system) | **Thesis:** Simulating virtual crowds using LSTM networks

During my M.Sc. I mainly focused on deep learning applied to computer vision tasks. In my thesis I focused on human trajectory prediction and crowd simulation using LSTM networks within fully synthetic environments, mainly built using 3D game engines such as

Unity3D. During my M.Sc. I also started collaborating with external universities in the US (Carnegie Mellon University) for an internship.

[2014/07/31 – 2016/07/20]

B.Sc. Degree in Computer Science

University of Cagliari | https://www.unica.it/unica/it/fac_sienze.page

Address: Via Università, 40, 09124, Cagliari (CA), Italy | **Field(s) of study:** Computer Science | **Final grade:** 110 cum laude (Italian grading system) | **Thesis:** Enhancing character posing by a sketch-based interaction

During my B.Sc. I learned the fundamentals of computer science and algorithms, with particular application to the computer graphics field. In my thesis, I propose a framework for the automatic posing of 3D characters in virtual environments using sketches as the only input. The work conducted during my B.Sc. thesis has been published at SIGGRAPH 2016.

INVITED TALKS

[2024/01/22 – 2024/01/23]

Modeling the world with urban digital twins

Invited speaker at the GTTI-MMSP workshop 2024, with the presentation "Modeling the world with urban digital twins". Presenting the new advancements in the urban digital twin research, in the context of the PNRR HPC project.

MAJOR CONFERENCE TALKS / SELECTED PUBLICATIONS

[2022/06/19 – 2022/06/24]

AGGLOMERATOR: Interpretable part-whole hierarchies and conceptual-semantic relationships in neural networks

Oral acceptance rate: ~4%

Oral speaker at CVPR 2022, New Orleans, Louisiana: presenting the paper Interpretable part-whole hierarchies and conceptual-semantic relationships in neural networks (N Garau, N Bisagno, Z Sambugaro, N Conci)

[2021/10/11 – 2021/10/17]

DECA: Deep viewpoint-equivariant human pose estimation using capsule autoencoders

Oral acceptance rate: 3.4%

Oral speaker at ICCV 2021, Seoul, South Korea: presenting the paper DECA: Deep viewpoint-equivariant human pose estimation using capsule autoencoders (N Garau, N Bisagno, P Bródka, N Conci)

[2024/09/29 – 2024/10/04]

EPOCH: Jointly Estimating the 3D Pose of Cameras and Humans

Oral speaker at ECCV 2024, Milano, Italy: presenting the paper EPOCH: Jointly Estimating the 3D Pose of Cameras and Humans (N Garau, G Martinelli, N Bisagno, D Tomè, C Stoll)

JOURNAL PUBLICATIONS

[2026/01/01]

Render, Encode, Plan: A simple pipeline for hybrid RL-DL learning inside Unreal Engine

D Della Pietra, NGarau - Computers & Graphics, 2025

Link: <https://mmlab-cv.github.io/REP/>

- [2023/01/01] **Agglomerator++: Interpretable part-whole hierarchies and latent space representations in neural networks**
Z Sambugaro, N Garau, N Bisagno, N Conci - CVIU, Computer Vision and Image Understanding Journal 2024
Link: <https://www.sciencedirect.com/science/article/pii/S1077314224002406>
- [2023/01/01] **MoMa: Skinned motion retargeting using masked pose modeling**
G Martinelli, N Garau, N Bisagno, N Conci - CVIU, Computer Vision and Image Understanding Journal 2024
Link: <https://www.sciencedirect.com/science/article/pii/S1077314224002224>
- [2022/01/01] **CapsulePose: A variational CapsNet for real-time end-to-end 3D human pose estimation**
N Garau, N Conci - Neurocomputing Journal 2023
Link: <https://www.sciencedirect.com/science/article/pii/S0925231222015351>
- [2021/01/01] **A multimodal framework for the evaluation of patients' weaknesses, supporting the design of customised AAL solutions**
N Garau, D Fruet, A Luchetti, F De Natale, N Conci - Expert Systems with Applications Journal 2022
Link: <https://www.sciencedirect.com/science/article/abs/pii/S0957417422005607>
- [2019/01/01] **Fast automatic camera network calibration through human mesh recovery**
N Garau, FGB De Natale, N Conci - Journal of Real-Time Image Processing 2020
Link: <https://link.springer.com/article/10.1007/s11554-020-01002-w>

PUBLICATIONS

- [2026] **[SDFoam: Signed-Distance Foam for explicit surface reconstruction](#)**
Reference: A Rech, N Conci, N Garau - Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition, 2026
- [2026] **[VolHuMe: a High-Resolution Large Scale Dataset of Volumetric Human Meshes](#)**
Reference: G Martinelli, N Bisagno, N Garau, E Rahtu, N Conci - 2026 IEEE International Conference on Image Processing (ICIP)
- [2026] **Issues and Challenges in Vision-Based Mid-Air Musical Instruments: Control Estimation in an Optical Theremin**
Reference: M Sguario, N Garau, N Conci, F Dal Rí - 7th IEEE International Symposium on the Internet of Sounds
- [2026] **Tackling Cross-Lingual Generalization in Speech Emotion Recognition via Linguistic Grouping: A Spotlight on Neo-Latin Languages**
Reference: F Dal Rì, N Garau, N Conci - EUSIPCO 2026
- [2026] **Edge AI Empowered UAV with Onboard Semantic Extraction for Monitoring Applications**
Reference: P Adesso, M Carpentiero, N Garau, G Giambene, F Granelli, V Matta, PT Vo, R Zambon - 2026 IEEE 13th International Workshop on Metrology for AeroSpace

- [2025] [To Infinity and Beyond: a GPU-driven memory sharing pipeline to generate and process infinite synthetic data](#)
Reference: D Della Pietra, G Lanzo Hahn, N Garau - SIGGRAPH 2025 Posters
- [2025] [Build-A-Volcap: Automated Synthetic Validation of Real-world Volumetric Capture Quality](#)
Reference: A Rech, G Martinelli, N Garau, N Conci, F De Natale - 2025 IEEE International Conference on Image Processing (ICIP)
- [2025] [Drone Agents: learning to fly to learn how to see](#)
Reference: D Della Pietra, K Govindarajan, F Granelli, A Rosani, N Garau - IEEE International Conference on Advanced Visual and Signal-Based Systems (AVSS 2025)
- [2025] [CLaP-Contrast Label Predict: a quest for cheaper labeling in 3D human pose estimation](#)
Reference: D Cavicchini, A Pivotto, S Lorenzo, A Rosani, N Garau - Proceedings of the Winter Conference on Applications of Computer Vision
- [2024] [EPOCH: Jointly Estimating the 3D Pose of Cameras and Humans](#)
Reference: N Garau, G Martinelli, N Bisagno, D Tomè, C Stoll - ECCVW 2024 (European Conference on Computer Vision)
- [2024] [All skeletons are created equal! a domain adaptation transformer to handle multiple topologies](#)
Reference: G Martinelli, N Garau, N Bisagno, N Conci - 2024 IEEE International Conference on Image Processing (ICIP)
- [2024] [Unicrowd simulator: Visual and behavioral fidelity for the generation of crowd datasets](#)
Reference: N Bisagno, AL Stefani, N Garau, F De Natale, N Conci - 2024 IEEE International Conference on Image Processing (ICIP)
- [2024] [Dynamic Crowd Routing: RL-Driven Crowd Dynamics](#)
Reference: DD Pietra, N Garau, N Conci, F Granelli - 2024 IEEE 26th International Workshop on Multimedia Signal Processing (MMSP)
- [2025] [Skeleton-Aware Motion Retargeting Using Masked Pose Modeling](#)
Reference: G Martinelli, N Garau, N Bisagno, N Conci - ECCVW 2024 (European Conference on Computer Vision)
- [2024] [Peek-a-bot: learning through vision in Unreal Engine](#)
Reference: DD Pietra, N Garau, N Conci, F Granelli - Eurographics STAG Conference 2024
- [2022] [Interpretable part-whole hierarchies and conceptual-semantic relationships in neural networks](#)
Reference: N Garau, N Bisagno, Z Sambugaro, N Conci - CVPR 2022 (Proceedings of the IEEE/CVF conference on computer vision and pattern recognition)
ORAL presentation at CVPR 2022
- [2022] [Gender Recognition from 3D Shape Parameters](#)
Reference: G Martinelli, N Garau, N Conci - ICIAP 2022 (International Conference on Image Analysis and Processing)

- [2022] [Networked Musical XR: where's the limit? A preliminary investigation on the joint use of point clouds and low-latency audio communication](#)
Reference: L Turchet, N Garau, N Conci - Proceedings of the 17th International Audio Mostly Conference 2022
- [2021] [DECA: Deep viewpoint-equivariant human pose estimation using capsule autoencoders](#)
Reference: N Garau, N Bisagno, P Bródka, N Conci - ICCV 2021 (Proceedings of the IEEE/CVF International Conference on Computer Vision)
ORAL presentation at ICCV 2021
- [2021] [Panoptop: A framework for generating viewpoint-invariant human pose estimation datasets](#)
Reference: N Garau, G Martinelli, P Bródka, N Bisagno, N Conci - ICCV 2021 (Proceedings of the IEEE/CVF International Conference on Computer Vision)
- [2019] [Unsupervised continuous camera network pose estimation through human mesh recovery](#)
Reference: N Garau, N Conci - Proceedings of the 13th International Conference on Distributed Smart Cameras 2019
- [2019] [Virtual crowds: An LSTM-based framework for crowd simulation](#)
Reference: N Bisagno, N Garau, A Montagner, N Conci - ICIAP 2019 (Image Analysis and Processing)
- [2019] [Technological infrastructure supports new paradigm of care for healthy aging: The living lab Ausilia](#)
Reference: A Grisenti et al. - Ambient Assisted Living: Italian Forum 2019
- [2019] [Joint trajectory and fatigue analysis in wheelchair users](#)
Reference: M Sebastiani, N Garau, F De Natale, N Conci - ICCVW 2019 (Proceedings of the IEEE/CVF International Conference on Computer Vision)
- [2016] [Enhancing character posing by a sketch-based interaction](#)
Reference: S Barbieri, N Garau, W Hu, Z Xiao, X Yang - SIGGRAPH 2016

EDITORIAL ACTIVITIES

- [2023/11/30 – Current] **Reviewer**
Reviewer for the AAAI Conference
- [2021/11/30 – Current] **Reviewer**
Reviewer for the CVPR, ICCV and ECCV conferences
- [2020/11/30 – Current] **Reviewer**
Reviewer for the Neurocomputing, Expert Systems with Applications and Real-time Image Processing Journals

MEMBERSHIPS

- [2019/11/30 – Current] **Member**
IEEE and IEEE SPS Member

[2022/11/30 – Current] **Member**

Member of CNIT - National Inter-University Consortium for Telecommunications

MAIN RESEARCH PROJECTS

[2022/11/30 – Current] **PNRR HPC Spoke 9**

Design and implement a large-scale urban digital twin, focusing on the health and wellbeing thematics.

[2017/11/30 – 2021/11/30] **AUSILIA (funded by the Province of Trento).**

Realize a territorial laboratory that integrates an open research environment and innovation with a hospital clinical service in the administration of aids in motor and cognitive disabilities.

MAJOR COLLABORATIONS

[2021/11/30] **Epic Games**

Collaborators: Iain Matthews (Epic Games), Carsten Stoll (Epic Games), Denis Tomè (Apple)

Topic: Designing and training of an Unsupervised Human Pose Estimation Network

Institution: Epic Games, Pittsburgh, Pennsylvania (PA), USA

[2016/11/30] **OpenPose (CMU - Carnegie Mellon University)**

Collaborators: Yaser Sheikh (CMU, Meta), Ginés Hidalgo Martinez (Meta)

Topic: Developing the OpenPose library for Human Pose Estimation

Institution: CMU - Carnegie Mellon University, Pittsburgh, Pennsylvania (PA), USA

AWARDS

[2024/11/30] **Top Quality Paper**

The paper "Peek-a-bot: learning through vision in Unreal Engine" was selected as a top-quality paper for an extended version in Elsevier's Computers & Graphics journal.

[2019/11/30] **Best Demo Award**

Co-recipient of the best demo award at the national GTTI-MMSP workshop 2020, with the demo "Real-time stitching and Tactical Camera", by Niccolò Bisagno, Nicola Garau, Andrea Montagner, and Nicola Conci

[2017/11/30] **Best Demo Award**

Co-recipient of the best demo award at the national GTTI-MMSP workshop 2018, with the demo "Modeling and observing virtual crowds", by Niccolò Bisagno, Nicola Garau, Andrea Montagner, and Nicola Conci

LANGUAGE SKILLS

Mother tongue(s): Italian

Other language(s):

English

LISTENING C2 READING C2 WRITING C2

SPOKEN PRODUCTION C2 SPOKEN INTERACTION C2

Chinese

LISTENING A1 **READING** A1 **WRITING** A1

SPOKEN PRODUCTION A1 **SPOKEN INTERACTION** A1

Spanish

LISTENING A1 **READING** A1 **WRITING** A1

SPOKEN PRODUCTION A1 **SPOKEN INTERACTION** A1

Levels: A1 and A2: Basic user; B1 and B2: Independent user; C1 and C2: Proficient user

SKILLS

Computer Graphics | Computer Vision | Deep Learning | PyTorch | Unreal engine /C++/ | Proficient in Python, Java, Javascript, C, C++ and some knowledge of Matlab | Machine Learning | Artificial Intelligence