Workshop title

Crowd behavior analysis in smart cities: from real-world data to digital twins

Organizers

General co-chairs

- Nicola Conci
  e-mail: nicola.conci@unitn.it
  webpage: https://webapps.unitn.it/du/en/Persona/PER0003698/Curriculum

Nicola Conci is Associate Professor at the Department of Information Engineering and Computer Science, University of Trento, where he teaches Computer Vision and Signal Processing. He received his Ph.D in 2007 from the same University. In 2007 he was a visiting student at the Image Processing Lab. at University of California Santa Barbara. In 2008 and 2009 he was post-doc researcher in the Multimedia and Vision research group at Queen Mary University of London.
Prof. Conci has authored and co-authored more than 130 papers in peer-reviewed journals and conferences. His current research interests are related to video analysis and computer vision applications for behavioral understanding and monitoring, coordinating a team of 6 Ph.D Students, 1 post-doc and 2 junior researchers.
At the University of Trento he coordinates the M.Sc. Degree in Information and Communications Engineering, he is member of the executive committee of the IECS Doctoral School, and he is delegate for the department of the research activities related to the Winter Olympic Games Milano-Cortina 2026.
He has served as Co-chair of several conferences, including the 1st and 2nd International Workshop on Computer Vision for Winter Sports, hosted at IEEE WACV 2022 and 2023, General Co-Chair of the International Conference on Distributed Smart Cameras 2019, General Co-Chair of the Symposium Signal Processing for Understanding Crowd Dynamics, held at IEEE AVSS 2017, and Technical Program Co-Chair of the Symposium Signal Processing for Understanding Crowd Dynamics, IEEE GlobalSip 2016.

- Lucio Marcenaro
  E-mail: lucio.marcenaro@unige.it
  Webpage: https://luciomarcenaro.github.io/

Lucio Marcenaro received the M.Sc. in Electronic Engineering and Ph.D. in Electronics and Computer Engineering from the University of Genova in 1999 and 2003, respectively.
He became Assistant Professor (2011) and Associate Professor (2021) of Telecommunications with the Polytechnic School, Department of Electrical, Electronic, Telecommunications Engineering and Naval Architecture (DITEN) of the University of Genoa, where he teaches the courses of Multimedia Signal Processing for Autonomous Systems, Pervasive Electronics and Fundamentals of Computer Programming. He spent over 20 years' experience in signal processing, image and video sequence analysis, and has authored almost 200 technical papers related to signal and video processing for signal processing and autonomous systems. He is or was Associate Editor of the IEEE

Transactions on Image Processing (IEEE TIP) (2018 –), Associate Editor of the IEEE Transactions on Circuits and Systems for Video Technology (IEEE TCSVT) (2019 – 2022), Associate Editor of the EURASIP Journal on Image and Video Processing (2022 –), Technical program vice-chair of the IEEE International Conference on Autonomous Systems (IEEE ICAS 2021) (Montréal, Canada, August 11-13, 2021), Chair of the IEEE SPS Autonomous Systems Initiative (IEEE ASI) (2023 –), Chair of the IEEE Signal Processing Society Student Services Committee (2018-2021).

Technical Program Committee

- Bo Zhang
  E-mail: bzhang@dlmu.edu.cn
  Webpage: https://dblp.org/pid/36/2259-45.html

Bo Zhang received the BSc degree in computer science and technology in 2007 and the MSc degree in computer application technology in 2010 from Jilin University, China. He received the PhD degree in telecommunications in 2015 from the University of Trento, Italy. He is currently an assistant professor in Dalian Maritime University, China. His research interests include computer vision, multimedia signal processing, and machine learning.

- Niccolò Bisagno
  e-mail: niccolo.bisagno@unitn.it
  webpage: https://webapps.unitn.it/du/it/Persona/PER0121429/

Niccolò Bisagno is an Assistant Professor (RTD-a) at the University of Trento where he received his PhD in 2020 for the thesis "On simulating and predicting pedestrian trajectories in a crowd". In 2019, he was visiting as a PhD student at the University of Central Florida, Orlando, USA. In 2018, he was a visiting PhD student at the Alpen-Adria-Universität, Klagenfurt , Austria. Prior to that, he received his BS and MS degree in Telecommunication Engineering from the University of Trento, Italy, in 2015 and 2016. He has authored and co-authored multiple papers in top-tier computer vision conferences, such as ECCV, ICCV, CVPR.
His research area focuses on crowd analysis with a focus on pedestrian trajectory prediction and crowd simulation in virtual environments. He is also interested in machine learning and computer vision, with special focus on open set classification and sports analysis applications.

- Pamela Zontone
  e-mail: pamela.zontone@unige.it
  webpage: https://rubrica.unige.it/personale/UkFGXl5h

Pamela Zontone earned a Laurea in Electronic Engineering from the University of Udine
in 2004, and a PhD in Information and Industrial Engineering from the University of Udine in 2008. From 2009 to 2011, she was a postdoctoral fellow at the Department of Information Engineering and Computer Science, University of Trento, working on the LivingKnowledge

European project. In 2017, she joined the Polytechnic Department of Engineering and Architecture, University of Udine, where she worked in the field of sensor signal processing and machine learning techniques applied to biophysical signals. She is currently an assistant professor (RTD-a) at the Department of Electrical, Electronic, Telecommunications Engineering and Naval Architecture, University of Genoa. Her research interests include multidimensional signal processing, biophysical signal processing, and machine learning.

Workshop motivation

The automated analysis of crowds and the identification of crowd behaviors are crucial for predicting adverse events, and in particular for appropriately designing public spaces, as well as for the real-time management of people flows.
Scene understanding, especially motion analysis and trajectory prediction of targets, has been extensively exploited to understand the dynamic of an observed scene. Crowd models have been used to detect anomalies, predict paths and perform data-driven simulations. Most models and algorithms for the analysis of crowds are developed and tested using real-world videos and target different applications including personal mobility, safety and security, and enabling assistive robotics in public spaces.

In crowd analysis as in multiple other research fields, the ever increasing demand for data to train modern machine learning and deep learning algorithms appears to be unstoppable. When dealing with supervised learning, the basic requirement is the availability of a large collection of labeled data. If the amount of annotated data is scarce, supervised solutions often overfit, leading, in the first place, to poor generalization capabilities. The literature has shown that this problem can be mitigated with a variety of regularization techniques, such as the dropout, batch normalization, transfer learning between different datasets, pre-training the network on different datasets, or implementing few-shot and zero-shot learning techniques.

Still, there is an ever growing demand for data, to which researchers respond with larger and larger datasets, at a huge cost in terms of acquisition, storage, and annotation of images and clips. However, when dealing with complex problems, it is common to validate the developed algorithms across different datasets, facing inconsistencies in annotations (i.e. segmentation maps vs bounding boxes), the use of different standards (i.e. the number of joints of human skeletons in OpenPose and SMPL).

The use of synthetically-generated data can overcome such limitations, as the generation engine can be designed to fulfill an arbitrary number of requirements, all at the same time. For example, the same bounding box can hold for multiple viewpoints of the same object/scene; the 3D position of the object is always known, as well as its volume, the appearance, and the motion features. These considerations have motivated the adoption of computer-generated content to satisfy two requirements: (a) the visual fidelity and (b) the behavioral fidelity.

With this respect, crowd analysis provides a rich and diversified use case, in which synthetic data can play a relevant role: the scene should replicate the appearance of a crowd, which consists of multiple subjects of different appearance exhibiting different behaviors. These

elements imply fulfilling the requirements of both *visual fidelity* and *behavioral fidelity*, simulating and modeling the diversity of motion patterns, as well as the ongoing social interactions.

We expect contributions involving, but not limited to crowd analysis applications, and synthetic data applications.

Potential topics include, but are not limited to:

- Crowd analysis
- Trajectory prediction
- Crowd simulation
- Synthetic data for crowds
- People counting
- Anomaly detection
- Crowd simulators
- Behavioral and interactions models

Estimated participation

This workshop is meant for Ph.D and post-doctoral students, researchers and practitioners who deal with images and videos, in all areas including detection, classification, segmentation, retrieval. The topic is at the crossroad between image processing, multimedia, and vision, as well as modeling, simulation, and computer graphics.

Anticipated number of talks/posters and length of workshop (half-day or full-day)

We expect the workshop to be half-day, with two invited talks and two oral sessions with 3-4 papers each. It would be appreciated to also have room for a poster session of the same works.

Paper submission procedure Paper review procedure (single-blind/double-blind, solicited/invited-only pool of reviewers)

Double blind submission, with a mix of solicited and invited-only pool of reviewers.

Paper submission and acceptance deadlines (camera-ready and early registration deadlines for a workshop/contest must coincide with the corresponding deadlines of AVSS-2023 – see Important Dates on [Call for Papers](#))

Paper submission   July 30, 2023

Decision to Authors   August 20, 2023

Camera Ready   August 25, 2023

Special space and equipment requests, if any
None