BIOGRAPHICAL SKETCH

NAME: Carmine Tommaso Recchiuto

POSITION TITLE: Associate Professor

EDUCATION/TRAINING

INSTITUTION AND LOCATION	DEGREE	Start Date MM/YYYY	Completion Date MM/YYYY	FIELD OF STUDY
Università di Pisa	Master Degree	10/2005	12/2008	Electronic Engineering
Università di Roma Tor Vergata	Ph. D.	11/2009	05/2015	Mechatronics

A. Personal Statement

Since 2009 I have been carrying out research activities in the field of robotics, with a twofold view: to enhance the methodological and technological aspects of robotics linked to Information Technology, and to develop intelligent robotic solutions closely aligned with the needs of society. With this spirit, I have been in 2022 one of the two co-founders of the RICE laboratory (RICE stands for Robots and Intelligent Systems for Citizens and the Environment), a laboratory of the Department of Computer Science, Bioengineering, and Systems Engineering (DIBRIS) at the University of Genoa. The laboratory, as well as my activity, focuses on two main areas of research: the development of “intelligent” humanoid social robots to assist and aid people, and the advancement of terrestrial and aerial autonomous robots for environmental monitoring and search and rescue operations after catastrophic events. My objective is not only to create new technologies centered around humans and their needs but also to disseminate the findings of researchers exploring these aspects worldwide.

Developing robots and artificial agents that should be deployed in real contexts (with real persons, solving real problems) requires a multidisciplinary approach that is one of the core of robotics, and that, as a researcher in this field, has always strongly fascinated me. During my whole career, I have worked with robotics in many different contexts (prosthetic devices, biped locomotion, aerial vehicles, social assistive robotics, elderly care), and in all these cases, good results were only possible thanks to the involvement of researchers belonging to different research areas (clinicians, doctors, nurses, phycologists, biologists, civil protection experts).

In the last few years, my research work has been mainly addressed to develop strategies for the autonomous conversation of robots and artificial agents. In particular, together with other researchers of the RICE lab, we have developed a cloud-based server to manage the conversation and the behavior of an autonomous robot, able to demonstrate cultural competence, i.e., being aware that there is a set of social norms, values, preferred actions, and conversation topics,…, that corresponds to each culture, and using this information during the interaction, also avoiding stereotypes. The system has been developed thanks to the guidance of experts in Transcultural Nursing, who have helped us to define what are the most relevant aspects in this context, as well as the correct strategies to evaluate the robot’s behavior and eventually adapt it to the specific user. The final software framework was developed with the European/Japanese project CARESSES (Culture-Aware Robots and Environmental Sensor Systems for Elderly Support), of which I have been Head of Software Development and Coordinator of Software Integration. CARESSES has been only one of the healthcare-related projects in

which I was involved, being also part of the IENE-10 (Intercultural Education of Nurses in Europe) consortium, and working as a Research Assistant in the European projects NanoBioTact, and NanoBioTouch, aimed at understanding the human mechanotransduction system and developing tissue engineered nanobiosensors.

Currently, I am coordinating the project SONRIE (PRIN – BANDO 2022 PNRR), which aims at defining the new concept of Intercultural Robotics Pedagogy, by developing a software framework for social robots able to operate in kindergartens and primary schools with children of different cultures, the Alzheimer's Association Project ARIA (New To The Field), for the development of a novel generation of socially assistive robots for people with Alzheimer's, the Curiosity-Driven project PROPER, focused on developing a generative model to implement the synthetic personality of robots and artificial agents, and I am the UNIGE PI for the project REVERT, (P.R-FESR), which involves different industrial partners to develop a software architecture for robotics to be used in the context of electronic waste management.
I am also involved in the PNRR project RAISE, particularly for the development of Urban Technologies for Inclusive Engagement.

B. Positions, Scientific Appointments and Honors

July 2024 – ongoing: *Associate Professor – University of Genova*

Research Activities:

- ✓ ARIA project (2024-2027, USA, Alzheimer's Association – New To The Field, coordinated by the University of Genova)
  - Principal Investigator
- ✓ SONRIE project (2023-2025, Italy, PRIN , coordinated by the University of Genova)
  - Principal Investigator
- ✓ PROPER project (2022-2024, Italy, NextGeneration EU, Università di Genova – Curiosity-Driven projects)
  - Principal Investigator
- ✓ REVERT project (2024-2025, Italy, P.R.- FESR)
  - Local coordinator, WP4 Leader
- ✓ RAISE project (2022-2025, Robotics And AI for Socio-economic Empowerment, PNRR)
  - Key person

July 2021 – June 2024: *Assistant Professor – University of Genova*

- ✓ IENE-10 project (2021-2023, EU, Erasmus +, Lifelong Learning Programme)
  - Key person
- ✓ DIONISO project (2016-2023, Italy, PON R&C 2007-2013, Smart Cities and Communities and Social Innovation)
  - Technical Coordinator of Software Development

April 2021 – ongoing: *Founder, Chief Executive Officer – Cura S.r.l.*

January 2014 – June 2021: *Research Assistant / PostDoc Research Fellow – University of Genova*

Research Activities:

- ✓ CARESSES project (2017-2020, EU/Japan, H2020, coordinated by the University of Genova)
  - Head of Software Development for Workpackage 2.
  - Coordinator of the software integration.

- ✓ PRISMA project (Italy, Interoperable cloud platforms for SMArt-government)
    - Head of Software Development
- ✓ MAREA project (Italy, Monitoring And Rescue Automation)
    - Key person

November 2011 – December 2018: *Founder, Chief Executive Officer – Humanot S.r.l.*

Research Activities:

- ✓ BRAINHURO project (Italy, POR CREO FESR 2007-2013)
    - Principal Investigator for Humanot S.r.l.
    - Leader of Workpackage 2
- ✓ SoFAR
    - Key person

March 2009 – December 2013 – Research Fellow – Scuola Superiore Sant'Anna, Pisa

- ✓ RoboSoM project (EU, FP7)
    - Key Person
- ✓ NanoBioTouch project (EU, FP7)
    - Key person
- ✓ NanoBioTact project (EU, FP6)
    - Key person

Other Scientific Appointments

- ✓ Courses Held:
    - Robot Programming with ROS (2018-ongoing) (PhD in Bioengineering and Robotics)
    - Experimental Robotics Laboratory (2019 - ongoing) (Robotics Engineering)
    - Informatics for Human Sciences (2020 – ongoing) (Philosophy and Letters)
    - Research Track 1 (2020 – ongoing) (Robotics Engineering)
    - Research Track 2 (2020 – ongoing) (Robotics Engineering)
    - Foundations of Computer Science (2021 – 2022) (Computer Engineering)
- ✓ Member of the Teaching Staff in the National Doctorate Program DRIM, in the Robotics Engineering degree course, and in Philosophy and Letters degree course.
- ✓ Member of the Quality Assurance Commission for the Robotics Engineering Degree
- ✓ Member of RASES, Interuniversity Center on Robotics and Autonomous System in Emergency Scenarios
- ✓ Associated Editor for the Intelligent Service Robotics Journal, Springer. Impact factor: 1.346. SJR Quartile: Engineering: Q1, Artificial Intelligence: Q2.
- ✓ Associated Editor for the International Conference on Robotics and Automation (ICRA), 2019, 2020, 2021, 2022; 2024; for the European Conference on Mobile Robots (EMCR), 2019, 2021, 2023; 2024; for the International Conference on Intelligent Robots and Systems (IROS), 2020, 2021, 2023. Publication chair for the conference RO-MAN 2022.
- ✓ IEEE, I-RIM, and AIxIA member

Awards and Honors

- ✓ The RICE lab of the University of Genova (where I carry out my research activity) receives the award "Arte, Scienza and Coscienza" in 2017, in the context of the Festival della Scienza, Palazzo Tursi, Genova.

- ✓ The CARESSES project (of which I have been Head of Software Development and Coordinator of Software Integration) is nominated Project of the Month by the European Commission, October 2018
- ✓ CARESSES is included in the list of "Best Breakthrough" obtained by UK Universities in the MadeAtUni campaign (Middlesex University: Care robots for the elderly), November 2018.
- ✓ CARESSES technologies are recognized by the European Commission's Innovation Radar: "Culturally competent robots for residential and domestic healthcare or other application domains" and "Cloud services for culturally competent applications". CARESSES is one of the 10 projects for which the University of Genoa has been recognized as a "key innovator" by the Innovation Radar, 2018
- ✓ CARESSES receives a SMAU Innovation Award during the SMAU Roadshow, Genoa, November, 2019.
- ✓ CARESSES is included among the "100 ITALIAN ROBOTIC & AUTOMATION STORIES" in the new report prepared by the Symbola Foundation and Enel (one of the two projects in the "health" area), Rome, February 2020
- ✓ As leader of the University of Genoa's team, I won the "Most Sociable Robot" Award in the context of SciRoc 2021 - Smart City Robotics Challenge Challenge, Bologna, September 2021
- ✓ Best Paper Award at ROMAN 2024.

C. Contributions to Science

In the following, I will describe the main research activities that I have performed in the last years. For each contribution, a selection of the most relevant research papers has been made.

1) CARESSES (Culture-Aware Robots and Environmental Sensor Systems for Elderly Support). It was a multidisciplinary, international project whose goal was to design the first care robots that adapt the way they behave and speak to the culture of the person they assist. Within the project, I have implemented software modules and libraries for representing culturally competent knowledge for artificial agents [1, 2], following the guidelines proposed by experts in Transcultural Nursing [3], and I have helped in the definition and implementation of clinical tests [4]. The work performed in CARESSES led to relevant results: in particular, the robot developed in the project was proven to increase the emotional and psychological well-being of older adults in care homes [4].

[1] Recchiuto, C. T., Papadopoulos, C., Hill, T., Castro, N., Bruno, B., Papadopoulos, I., & Sgorbissa, A. (2019, October). Designing an experimental and a reference robot to test and evaluate the impact of cultural competence in socially assistive robotics. *In 2019 28th IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)* (pp. 1-8). IEEE.
[2] Bruno, B., Recchiuto, C. T., Papadopoulos, I., Saffiotti, A., Koulouglioti, C., Menicatti, R., ... & Sgorbissa, A. (2019). Knowledge representation for culturally competent personal robots: requirements, design principles, implementation, and assessment. *International Journal of Social Robotics*, 11, 515-538.
[3] Sgorbissa, A., Papadopoulos, I., Bruno, B., Koulouglioti, C., & Recchiuto, C. (2018, October). Encoding guidelines for a culturally competent robot for elderly care. *In 2018 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)* (pp. 1988-1995). IEEE.
[4] Papadopoulos, C., Castro, N., Nigath, A., Davidson, R., Faulkes, N., Menicatti, R., ... & Sgorbissa, A. (2022). The CARESSES randomised controlled trial: exploring the health-related impact of culturally competent artificial intelligence embedded into socially assistive robots and tested in older adult care homes. *International Journal of Social Robotics*, *14*(1), 245-256.

2) Autonomous Conversation. The work performed within CARESSES paved the way for future developments related to the definition of mechanisms for the autonomous conversation of robots and artificial agents, which can be either based on controlled knowledge, or can also make use of novel language generative models [5]. The software, developed as a collection of cloud services [6], has been tested in different domains, such as in

multiparty interactions with kids [7], and in hospitals, where a small humanoid robot was used to verbally interact with people with spinal cord injury [8]. In the latter scenario, the interaction with the robot was highly appreciated, even after the novelty effect had subsided. Finally, the work performed after the project led to the definition of the software CAIR (Culture-Aware AI and Robotics), which was officially registered in April 2023, together with Prof. Antonio Sgorbissa e Lucrezia Grassi.

[5] Grassi, L., Recchiuto, C. T., & Sgorbissa, A. (2022). Knowledge-grounded dialogue flow management for social robots and conversational agents. International Journal of Social Robotics, 14(5), 1273-1293.
[6] Recchiuto, C. T., & Sgorbissa, A. (2020). A feasibility study of culture-aware cloud services for conversational robots. IEEE Robotics and Automation Letters, 5(4), 6559-6566.
[7] Grassi, L., Recchiuto, C. T., & Sgorbissa A. (2023). Robot-Induced Group Conversation Dynamics: A Model to Balance Participation and Unify Communities. Accepted for presentation in 2023 IEEE/RSJ International Conference on Intelligent Robots and Systems (IROS)
[8] Grassi L., Canepa D., Bellitto A., Casadio M., Massone A., Recchiuto C. T., Sgorbissa A. (2023). Diversity-Aware Verbal Interaction between a Robot and People with Spinal Cord Injury. Accepted for presentation in 2023 IEEE International Conference on Robot and Human Interactive Communication (RO-MAN)

3) Culture-Aware robots. The promising results obtained with the CARESSES project and its further developments encouraged me to explore other domains where culture-aware robotics may play a relevant role. While the investigation of the importance of culture-aware gestures in human-robot interaction led to interesting insights [9], I am also exploring the wider concept of diversity-aware robotics [10], and analyzing the possibility of exploiting culture-aware social robots in primary schools and kindergartens, with the final aim of fostering the integration between children [11].

[9] Gjaci, A., Recchiuto, C. T., & Sgorbissa, A. (2022). Towards Culture-Aware Co-Speech Gestures for Social Robots. International Journal of Social Robotics, 14(6), 1493-1506.
[10] Recchiuto, C., & Sgorbissa, A. (2022). Diversity-aware social robots meet people: beyond context-aware embodied AI. arXiv preprint arXiv:2207.05372.
[11] Recchiuto C., Bartolini A., Sgorbissa A., Milella M. (2023). Intercultural Robotics Pedagogy: Challenges and Opportunities. Accepted for presentation in 2023 International Conference on Child-Robot Interaction (CRI23).

The aforementioned contributions represent only a part of the work that I have performed in the last years which has also involved different domains. Among these, I have also explored the possibility of teleoperating a social robot to remotely interact with patients in healthcare settings [12], analyzed ethical concerns related to rescue robotics [13], and helped to develop tactile sensors to be integrated into prosthetic hands [14].

[12] Porta, F., Recchiuto, C. T., Casadio, M., & Sgorbissa, A. (2022, December). Towards a Framework for the Whole-Body Teleoperation of a Humanoid Robot in Healthcare Settings. In International Conference on Social Robotics (pp. 288-298). Cham: Springer Nature Switzerland.
[13] Battistuzzi, L., Recchiuto, C. T., & Sgorbissa, A. (2021). Ethical concerns in rescue robotics: a scoping review. Ethics and Information Technology, 23(4), 863-875.
[14] Muhammad, H. B., Recchiuto, C., Oddo, C. M., Beccai, L., Anthony, C. J., Adams, M. J., ... & Ward, M. C. (2011). A capacitive tactile sensor array for surface texture discrimination. Microelectronic Engineering, 88(8), 1811-1813.

Genova, 26/11/2024