LUCREZIA GRASSI

Robotics Engineer

PROFILE

I am a Master Doctor in Robotics Engineering, currently attending a PhD in Bioengineering and Robotics on Cloud Robotics and multiparty interaction between humans and artificial agents. My interests include Social Robotics, autonomous conversation systems, mixed and virtual reality. During the master's degree courses I took part in several group projects gaining a good experience in team work. I am very curious and eager to learn new interesting things.

SKILLS

EDUCATION

2020 - today

PhD in Bioengineering and Robotics — **DIBRIS - University of Genoa**

The PhD program in Bioengineering and Robotics of the University of Genoa is leading edge in education and research, covering multi-disciplinary scientific and technological domains from advanced robotics, to biomedical engineering, to humanoid and interactive technologies and applications. My PhD project focuses on the development of Cloud services for multiparty interaction between humans and artificial agents.

2018 – 2020
110/110 cum laude

Master's Degree in Robotics Engineering — **DIBRIS - University of Genoa**

An international course supported by the European Union. It covers the area of advanced and intelligent robotics: mathematical modelling, control engineering, computer engineering, mechanical design.

2015 – 2018
110/110 cum laude

Bachelor's Degree in Computer Engineering — **DIBRIS - University of Genoa**

The course integrates the essential elements of scientific disciplines with the tools and methods to design, develop and manage hardware and software technologies in application areas such as: management and information processing, computer networks, software production and management, modelling of complex systems and automatic controls.

2010 – 2015
100/100

High School Diploma — **Liceo Scientifico M.L. King**

Scientific Diploma

TEACHING ACTIVITY

2021 – 2022

Biomedical Robotics (ING-INF/06) — **DIBRIS - University of Genoa**

Preparation of the material for the assignments and tutoring activity for the Biomedical Robotics course held during second year of the M.Sc. in Robotics Engineering for a total of 25 hours.

2021 – 2022

Ambient Intelligence (ING-INF/05) — **DIBRIS - University of Genoa**

Preparation of the material for the assignments and tutoring activity for the Ambient Intelligence course held during second year of the M.Sc. in Robotics Engineering for a total of 25 hours.

AWARDS

2019

Acknowledged Top-5 Student — **DIBRIS - University of Genoa**

I received a merit-based fees reduction as I was part of the top-5 students of my course with the highest grades.

2018 **Acknowledged Top-5 Student** **DIBRIS - University of Genoa**
I received a merit-based fees reduction as I was part of the top-5 students of my course with the highest grades.

2017 **Acknowledged Top-5 Student** **DIBRIS - University of Genoa**
I received a merit-based fees reduction as I was part of the top-5 students of my course with the highest grades.

2016 **Acknowledged Top-5 Student** **DIBRIS - University of Genoa**
I received a merit-based fees reduction as I was part of the top-5 students of my course with the highest grades.

2015 **Acknowledged top-ranked high school student** **DIBRIS - University of Genoa**
I received a merit-based fees reduction as I graduated from high school with a vote of 100/100.

PROJECTS

2020 – present **Robot-Induced Group Conversation Dynamics** **DIBRIS - University of Genoa**
The objective of this work is to evaluate the impact of the presence of a robot within a conversation with multiple participants. Specifically, the project aims at analyzing (quantitatively) whether, and to what extent, a robot can influence the level of participation of participants in a group conversation. In addition, a qualitative analysis of the data collected (anonymously) through validated questionnaires will allow us to determine how the different approaches under consideration impact participants' perceptions of the robot.
`Python / HRI / Multiparty interaction / Group conversation dynamics`

2020 **A Knowledge-Based Conversation System for Robots and Smart Assistants** **DIBRIS - University of Genoa**
My master's thesis work has been developed in the ambit of the H2020 EU-Japan CARESSES project, whose goal is to design a cultural competent Socially Assistive Robot to assist elderly people. In this project, the humanoid robot Pepper has been exploited as a robotic platform for interacting with elders in care homes. This work is part of the H2020 EU-Japan CAIRGIVER project, that expands the CARESSES themes and will be presented at the SC1-DTH-04-2020 call, with the deadline on the 18th June 2020. My objective was to improve the dialogue capabilities of the system along two directions: (1) the system shall be able to purposely ask the user to talk freely (about his/her interests, memories, preferences, plans, etc.) in order to detect in real-time concepts and relations which are not yet encoded in the Ontology, as well as the personal view of the user about these concepts. New concepts, properties, and instances of concepts and properties will be used to enrich the ontology and ultimately make the conversation more engaging; (2) the system shall be able to correctly understand, by analysing the utterances of the users through Linguistic and Statistical tools, the conversation topic that the user wishes to talk about, thus allowing context-dependent "chit-chatting" about concepts in the Ontology.
`Python / Ontology / NLP / Dialogflow / HRI`

2020 **Goal Scoring with a 4WD Mecanum Wheel Robot** **DIBRIS - University of Genoa**
This project consisted in assembling and programming a 4WD Mecanum Wheel Robot Kit. This omnidirectional robot has been equipped with an Arduino, a Raspberry, four motors, a RaspiCam, and batteries to power everything. I had to deal with omnidirectional navigation and target tracking as the goal was to make the robot able to detect a ball and kick it inside the football goal. The colour of the ball was known, so that it could be recognized through the previously calibrated monocular camera, mounted on the robot. The dimensions of the football field were given, thus the position of the football goal was known. The position of the robot w.r.t. the world was always available thanks to markers placed in the environment. This information allowed to compute the robot's desired position and orientation to properly being able to score a goal.
`ROS / Python / Gazebo / RViz / Wiring`

2019 **Virtual Robot Assistant for Elderly Care** **DIBRIS - University of Genoa**
Android application featuring a Virtual Character Assistant for Elderly Care in the spirit of CARESSES, the main purpose of which is to make robots culturally competent. The robot is able to talk about different topics while adapting to the individual's preferences during the interaction which occurs through the smartphone screen. The assistant not only chats, but it also takes care of elderly people assisting them in several tasks. The Virtual Robot Assistant, even if not originally included in the CARESSES work plan, has been successfully presented at the final review meeting of the project, and gave rise to two publications (one of them under review).
`Java / Android Studio / Python / CARESSES`

2019 **Components Greasing with Doosan M0609** **Ultraflex Group**
The company asked me to program the newly arrived Doosan M0609 Robotic Arm to automatically perform a task that was previously accomplished by a worker. This cobot has 6 degrees of freedom and a total reach of 900 mm. The aim was to employ it for putting grease on bushings and washers of different types of cylinder link arms: the only thing that the worker had to do was disposing the components in a predefined configuration, and specify the link arm type before running the program. Once the robot completed the greasing of all the elements, he returned to its rest position, waiting for the worker to replace the components.
`Python`

2018-2019 **Gesture-based Interface for Baxter robot** **DIBRIS - University of Genoa**
Control of Rethink Robotics Baxter robot play/record capabilities with the aid of a graphic, menu-based interface. The latter is browsable by a fully configurable and extensible input layer, originally designed for natural discrete interactions such as smartwatch gestures. The system detects the presence of a user and monitors his head orientation in order to determine the attention level, and thus improve safety.
`/ ROSC++17 / Qt5 / Python / Gazebo / RViz`

2018 **UniPlanner** **DIBRIS - University of Genoa**
Android Application developed to make easier and more intuitive the management of the University career. It offers services like the weekly schedule, customisable reminders for upcoming exams and an overall view of the career including the average mark and the projection of the final grades based on the result of passed exams.
`Java / Android Studio`

2018 **BookSwap Website** **DIBRIS - University of Genoa**
Website dedicated to people who like reading books. BookSwap allows the users to register and communicate through a chat for organising book exchanges. The website shows, for each book, a list of the people who are sharing it; in this way, another user who desires that book can contact someone who owns it. The search results in the website are provided by the Google Books API which supplies a wide range of choice and numerous details on each title (cover, plot, ISBN, publication date, pages, etc.)
`HTML / CSS / JavaScript / PHP`

ROBOTS I WORKED WITH

2020-2022 **Nao**
Robot-Induced Group Conversation Dynamics
Knowledge-Grounded Dialogue Flow Management for Social Robots and Conversational Agents
Knowledge Triggering, Extraction and Storage via Human-Robot Verbal Interaction

2019-2022 **Pepper**
Robot-Induced Group Conversation Dynamics
Knowledge-Grounded Dialogue Flow Management for Social Robots and Conversational Agents
Knowledge Triggering, Extraction and Storage via Human-Robot Verbal Interaction
A Knowledge-Based Conversation System for Robots and Smart Assistants
Enhancing Conversational Capabilities of Social Assistive Robots

2019-2020 **4WD Mecanum Wheel Robot Kit**
Goal Scoring with a 4WD Mecanum Wheel Robot

2019 **Doosan M0609 Robotic Arm**
Component Greasing with Doosan M0609

2018-2019 **Baxter**
Gesture-based Interface for Baxter robot

PUBLICATIONS

2022

Gestural and Touchscreen Interaction for Human-Robot Collaboration: a Comparative Study
Bongiovanni A., De Luca A., Gava L., Grassi L., Lagomarsino M., Lapolla M., Marino A., Roncagliolo P., Macciò S., Carfì A., Mastrogiovanni F.

Close human-robot interaction (HRI), especially in industrial scenarios, has been vastly investigated for the advantages of combining human and robot skills. For an effective HRI, the validity of currently available human-machine communication media or tools should be questioned, and new communication modalities should be explored. This article proposes a modular architecture allowing human operators to interact with robots through different modalities. In particular, we implemented the architecture to handle gestural and touchscreen input, respectively, using a smartwatch and a tablet. Finally, we performed a comparative user experience study between these two modalities.
`IAS-17`

2022

Knowledge-Grounded Dialogue Flow Management for Social Robots and Conversational Agents
Grassi L., Recchiuto C.T., Sgorbissa A.

The article proposes a system for knowledge-based conversation designed for Social Robots and other conversational agents. The proposed system relies on an Ontology for the description of all concepts that may be relevant conversation topics, as well as their mutual relationships. The article focuses on the algorithm for Dialogue Management that selects the most appropriate conversation topic depending on the user's input. Moreover, it discusses strategies to ensure a conversation flow that captures, as more coherently as possible, the user's intention to drive the conversation in specific directions while avoiding purely reactive responses to what the user says. To measure the quality of the conversation, the article reports the tests performed with 100 recruited participants, comparing five conversational agents: (i) an agent addressing dialogue flow management based only on the detection of keywords in the speech, (ii) an agent based both on the detection of keywords and the Content Classification feature of Google Cloud Natural Language, (iii) an agent that picks conversation topics randomly, (iv) a human pretending to be a chatbot, and (v) one of the most famous chatbots worldwide: Replika. The subjective perception of the participants is measured both with the SASSI (Subjective Assessment of Speech System Interfaces) tool, as well as with a custom survey for measuring the subjective perception of coherence.
`International Journal of Social Robotics`

2022

Knowledge Triggering, Extraction and Storage via Human-Robot Verbal Interaction
Grassi L., Recchiuto C.T., Sgorbissa A.

This article describes a novel approach to expand in run-time the knowledge base of an Artificial Conversational Agent. A technique for automatic knowledge extraction from the user's sentence and four methods to insert the new acquired concepts in the knowledge base have been developed and integrated into a system that has already been tested for knowledge-based conversation between a social humanoid robot and residents of care homes. The run-time addition of new knowledge allows overcoming some limitations that affect most robots and chatbots: the incapability of engaging the user for a long time due to the restricted number of conversation topics. The insertion in the knowledge base of new concepts recognized in the user's sentence is expected to result in a wider range of topics that can be covered during an interaction, making the conversation less repetitive. Two experiments are presented to assess the performance of the knowledge extraction technique, and the efficiency of the developed insertion methods when adding several concepts in the Ontology.
`Robotics and Autonomous Systems`

2021

Towards Ethics Training in Disaster Robotics: Design and Usability Testing of a Text-Based Simulation

Battistuzzi L., Grassi L., Recchiuto C.T., Sgorbissa A.

Rescue robots are expected to soon become commonplace at disaster sites, where they are increasingly being deployed to provide rescuers with improved access and intervention capabilities while mitigating risks. The presence of robots in operation areas, however, is likely to carry a layer of additional ethical complexity to situations that are already ethically challenging. In addition, limited guidance is available for ethically informed, practical decision-making in real-life disaster settings, and specific ethics training programs are lacking. The contribution of this paper is thus to propose a tool aimed at supporting ethics training for rescuers operating with rescue robots. To this end, we have designed an interactive text-based simulation. The simulation was developed in Python, using Tkinter, Python's de facto standard GUI. It is designed in accordance with the Case-Based Learning approach, a widely used instructional method that has been found to work well for ethics training. The simulation revolves around a case grounded in ethical themes we identified in previous work on ethical issues in rescue robotics: fairness and discrimination, false or excessive expectations, labor replacement, safety, and trust. Here we present the design of the simulation and the results of usability testing. The efficacy of the system will be tested once the simulation has been reviewed by experts of the field for realism and completeness.

`SSRR 2021`

2021

Cloud Services for Autonomous Interaction With Social Robots and Artificial Agents

Grassi L., Recchiuto C.T., Sgorbissa A.

This work presents the design and the implementation of CAIR: a cloud system for knowledge-based interaction devised for Social Robots and other conversational agents. The system is structured in a way that it can be easily expanded by adding new services that improve the capabilities of the clients connected to the Cloud. Another key feature of the system is that it has been designed to make the development of its clients straightforward: in this way, multiple devices (e.g., robots, computers, smartphones, etc.) can be easily endowed with the capability of autonomously interacting with the user, understanding when to perform specific actions, and exploiting all the information provided by services on the Cloud.

`I-RIM 2021`

2021

MEUS: A Framework for Management of Emergencies Through Ubiquitous Sensing

Ciranni M., Grassi L., Baglietto P., Maresca M., Recchiuto C.T., Sgorbissa A.

This article proposes a framework to model a scenario in which First Responders, citizens, and smart devices and/or robots explore the environment in an emergency situation, i.e., after an earthquake, assessing damages, and searching for people needing assistance. While moving, the agents observe events and exchange the information collected with other agents encountered, thanks to common network connections. When some conditions hold, the agents can upload the collected information to a Control Room/database in the Cloud. The model includes a detailed description of how data are exchanged between agents and stored in the database. A simulated experiment has been carried out in a real-world street network, with the aim of evaluating the feasibility and performances of the approach.

`I-RIM 2021`

2020

A Knowledge-Based Conversation System for Robots and Smart Assistants

Grassi L., Recchiuto C.T., Sgorbissa A.

The main objective of this work is to enhance the capabilities of a knowledge-driven conversational system, making them more natural and pleasant. Exploiting several Natural Language Processing (NLP) techniques, a set of algorithms has been developed to improve the quality of the conversation and expand the knowledge base in run-time adding new concepts recognized in the user sentence. Moreover, a mechanism to validate the newly added concepts has been developed.

`I-RIM 2020`

2020

Knowledge-Driven Conversation for Social Robots: Exploring Crowdsourcing Mechanisms for Improving the System Capabilities
Grassi L., Recchiuto C.T., Sgorbissa A.

Social robots and artificial agents should be able to interact with the user in the most natural way possible. This work describes the basic principles of a conversation system designed for social robots and artificial agents, which relies on knowledge encoded in the form of an Ontology. Given the knowledge-driven approach, the possibility of expanding the Ontology in run-time, during the verbal interaction with the users is of the utmost importance: this paper also deals with the implementation of a system for the run-time expansion of the knowledge base, thanks to a crowdsourcing approach.
`AIxIA AIRO 2020`

2020

Physical Embodiment of Conversational Social Robots
Gava L., Grassi L.*, Lagomarsino M.*, Recchiuto C.T., Sgorbissa A.*
∗equal contribution

Achieving natural and engaging verbal interactions is one of the main challenges faced by Social Robotics. In this context, the physical embodiment may be one of the most critical factors: indeed, previous work indicates that physical robots elicit more favourable social responses than virtual agents. However, the effects of physical embodiment have been analysed only in some specific and limited scenarios, where verbal interaction was reduced to basic commands. The current work aims at investigating the effect of robots' physical embodiment in a pure conversation task, by considering some relevant aspects of social interaction, such as usability, speech interface quality, user satisfaction and engagement. To this aim, a pilot experiment where participants were required to chitchat with a robot and a smartphone app, both connected to the same conversation framework, has been carried out. Preliminary results are presented and discussed, and they offer interesting insights about the positive effects of physical embodiment on some of the analysed aspects.
My contribution to this article is related to the carrying out and the analysis of the results of the experiment.
`RO-MAN 2020`

2020

Cloud Services for Culture Aware Conversation: Socially Assistive Robots and Virtual Assistants
Recchiuto C.T., Gava L., Grassi L.*, Grillo A.*, Lagomarsino M.*, Lanza D.*, Liu Z.*, Papadopoulos C., Papadopoulos I., Scalmato A., Sgorbissa A.*
∗equal contribution

This paper introduces a new Cloud platform providing services for culturally competent interaction, that has been developed to expand the capabilities of Socially Assistive Robots and virtual assistants interacting with older persons. The rationale behind the proposed architecture is discussed, by outlining key principles as well as the functionalities provided, with a specific focus on verbal interaction. Three case studies, the humanoid robot Pepper, a robotic medicine dispenser Pillo, and a custom-built Android-based virtual assistant, are analyzed in detail, by showing how robots and other assistants may easily access culturally competent Cloud services to expand their interaction capabilities. Transcripts of conversations are reported and commented, in order to outline both the positive features and the limitations of the system.
I contributed to this article by developing the Android Application that communicates with the CARESSES Cloud. This application is characterized by a Virtual Assistant able to interact with the user by exploiting the connection with the Cloud and the Google Speech-to-Text API.
`UR 2020`

TECH EVENTS

28 March 2019

MECSPE **Parma**
MECSPE is the greatest event focused on innovations for the manufacturing industry.
This visit allowed me to deepen my knowledge about the wide range of applications of robots for industrial automation. In particular, I noticed the heavy diffusion of cobots due to the fact that they can safely share the same space as a human worker, completing tasks independently or sequentially.

I authorize the processing of my personal data pursuant to the GDPR 679/16 for the purposes of research and selection of personnel and business contacts.

LANGUAGES

Italian - native
English - proficient (C1)
Spanish - basic
French - basic

INTERESTS

Nutrition
Biochemistry
Renewable Energy
Psychology

HOBBIES

Gym
Meditation
Yoga
Piano and Guitar

I authorize the processing of my personal data pursuant to the GDPR 679/16 for the purposes of research and selection of personnel and business contacts.