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Giovanbattista Gravina

EDUCATION AND TRAINING

15/09/2021 – 25/03/2024 Rome, Italy

M.SC. IN ARTIFICIAL INTELLIGENCE AND ROBOTICS Sapienza University of Rome

- Modeling and control of robotic systems: manipulators, mobile robots, aerial vehicles, legged robots, multi-robot systems
- Robust control of nonlinear systems
- Software programming in Matlab, Python and C++; robot programming in ROS environment and simulations in CoppeliaSim and Gazebo
- Probabilistic Robotics: state estimation, calibration, robot localization and mapping (SLAM)
- Knowledge of Medical Robotics systems and Neuroengineering basics
- Computer Vision and Perception: classical methods and Deep Learning based approaches
- Artificial Intelligence: knowledge representation, searching and planning
- Knowledge of Machine Learning and Deep Learning techniques and applications: TensorFlow or PyTorch frameworks

Website https://corsidilaurea.uniroma1.it/it/corso/2021/30431/home |

Field of study Artificial Intelligence and Robotics | **Final grade** 110/110 cum Laude | **Level in EQF** EQF level 7 |

Type of credits ECTS | **Number of credits** 120 |

Thesis Safe robot navigation in a crowd: Application to the TIAGo mobile manipulator

15/09/2018 – 15/11/2021 Aversa, Italy

B.SC. IN ELECTRONIC AND COMPUTER SCIENCE ENGINEERING University of Campania "Luigi Vanvitelli"

- Basics of Mathematical Analysis, Algebra, Geometry and Physics
- Software development skills: Matlab, C, Java, Python, HTML, PHP, JavaScript
- Foundamentals of electronics and electrical engineering, signal processing
- Basics about database managing, network and internet protocols, cybersecurity
- Knowledge about modeling, control and stability of linear systems. Basics on nonlinear systems
- Notions concerning Artificial Intelligence, Machine Learning and Deep Learning

Website https://www.ingegneria.unicampania.it/didattica/corsi-di-studio/ingegneria-elettronica-e-informatica |

Field of study Information Technology Engineering | **Final grade** 110/110 cum laude | **Level in EQF** EQF level 6 |

Type of credits ECTS | **Number of credits** 180 |

Thesis Object Detection with Neural Networks for Robotics Applications: the YOLO Solution

LANGUAGE SKILLS

Mother tongue(s): **ITALIAN**

Other language(s):

	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken production	Spoken interaction	
ENGLISH	B2	B2	B2	B2	B2

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

COMMUNICATION AND INTERPERSONAL SKILLS

Teamwork and presentation skills

The multitude of teamwork I have been involved in has given me the opportunity to interface with colleagues from diverse backgrounds, allowing me to develop flexibility and ability to analyze things from different perspectives.
In my presentations I always aim to explain things clearly and rigorously, to avoid misinterpretation and allow even non-experts to have an insight into the subject matter.

PROJECTS

15/11/2023 – CURRENT
Crowd Navigation with TIAGo

The project goal is to implement a sensor-based scheme for the safe TIAGo robot navigation through a real-world crowd of moving humans. Using on-board sensor information, the crowd motion prediction is performed using Kalman Filters (KFs), managed via Finite State Machines (FSMs). Then, the robot motion is generated combining a nonlinear Model Predictive Control (NMPC) algorithm with Control Barrier Functions (CBFs) to formulate collision avoidance constraints. The communication with the real robot is handled using the ROS framework and the code is implemented in Python. Acados package is used to solve the optimal control problem.

08/08/2023 – 12/09/2023
Collision Detection with Energy Residual using a Velocity Observer

Group project (2 people) in the context of the Human-Robot Interaction course. The collision detection problem is addressed in case of rigid manipulators via a scalar monitoring signal of the system kinetic energy. The solution relies on proprioceptive sensors only and assumes only the robot joint positions are available, hence velocities are estimated using a reduced-order observer. The code implementation is done using Matlab.

01/05/2023 – 25/07/2023
Video prediction on Moving MNIST and KITTI datasets

Group project (2 people) realized for the Deep Learning course. It consists in a PyTorch Lightning implementation of a fully convolutional architecture to solve the SpatioTemporal predictive learning task. The model performance are evaluated considering the Moving MNIST and KITTI datasets.

06/04/2023 – 10/05/2023
Dynamic Balance Force Control for Humanoid Robots

Group project (3 people) for the Underactuated Robots course. The project objective is to achieve stable balance of a humanoid robot directly computing the full body joint torques that generate the required contact forces. The computation of the contact forces is based on their influence on the CoM dynamics. The simulation environment used is DART, a C++ library and three different force control task are investigated: simple balance, torso posture control and maintenance of balance while lifting a payload.

01/03/2023 – 30/04/2023
Planning Throwing Motions for Mobile Manipulators

Group project (3 people) for the Autonomous Mobile Robots course. The goal is to plan a thorwing motion for a planar Mobile Manipulator, attempting to increase its workspace or reduce the time needed for a pick and place task. The motion planning problem is formulated as an Optimal Control Problem and solved using numerical optimization via the Optimization Toolbox of MATLAB.

08/01/2023 – 19/02/2023
Visual Odometry for calibrated camera

Individual project for the Probabilistic Robotics course. Given as input the camera parameters and an image sequence, the aim is to estimate the robot trajectory and the position of fixed 3D points in world.

01/09/2022 – 30/01/2023
Visual Servoing for the da Vinci Surgical robot

Group project (4 people) developed for the Medical Robotics course. The goal is to implement visual servoing control technique to allow the Endoscopic Camera Manipulator (ECM) to autonomously follow the Patient Side Manipulators (PSMs) of the da Vinci Surgical robot.
The code is developed in C++ and validated using the CoppeliaSim simulator for the da Vinci Research Kit (dVRK), and two Geomagic devices and an Oculus Rift device for the master-side of the teleoperation.

01/02/2022 – 20/03/2022

Normal-based ICP

Group project (2 people) for the Robot Programming course. It consists in a normal-based matcher implemented in C++ and integrated in the ROS environment. Given measurements from a 2D laser scan the aim is to build a map of the mobile robot's surroundings using 4-dimensional KD-trees and running ICP.

01/06/2021 – 15/11/2021

Object Detection and Recognition using Yolov3

This is a group project (3 people) I worked on for my B.Sc. thesis in Computer Science. It consists in a MATLAB implementation of a multi-class object detector based on real-time Yolov3 technique. The goal is to recognize within an image one or multiple objects, detecting also their coarse orientation among a set of six possibilities. This task has to be intended as the first necessary step for an intelligent system in order to understand the best way to grasp the object of interest, in the context of shelf replenishment task. The used network is the *darknet53* pre-trained on the *COCO* dataset. The network has been fine-tuned considering a custom dataset made of images containing typical retail items in various orientations.