

# Edoardo Ghini

## Robotics Engineer

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## CAREER MOTIVATION

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I am striving to develop my career in the direction that will bring me to work at the most interesting topics. Having a passion for robotics and programming makes me love to create complex things with code. I consider myself extremely curious and always ready to understand deeply how things work. Always trying to be involved in the most interesting and fascinating ideas in the field.

## EDUCATION

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### 2013 – 2016 **Computer Engineering**

FINAL GRADE 95 /110  
Bachelor of Science  
*Roma Tre University*

This course covered all the fundamentals of computer engineering introducing me to programming. The thesis covered what I learnt in the brief internship as a PHP back-end developer.

**Thesis:** *Unit testing avoiding regression in CI*

### 2016 – 2019 **Master in Artificial Intelligence and Robotics**

FINAL GRADE 103 /110  
MScEng  
*La Sapienza, University of Rome*

This degree had a pivotal role in me figuring out what was my passion. It covered extensively the foundation of Robotics such as rigid body kinematics and dynamics, autonomous navigation, filtering and of Artificial intelligence teaching first-order logic and planning and reasoning. A lot of practical experience came alongside the theory in the form of several deeply invested projects.

My thesis was in internal to the university, and consisted in implementing a 3D Lidar **SLAM** pipeline: I used a probabilistic approach (**Gaussian assumption**) in a **Least Square** formulation extracting High-level geometric features. Everything was implemented in C++ using ROS.

**Thesis:** *Position tracking using high order primitives*

## WORK EXPERIENCE

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### Translated **Back-end developer**

During this internship, I was responsible for the codebase of a web application (**Matecat**), written in PHP. I developed unit-tests to certify the correctness of the core of the application. Dealing with databases, caching and client-server communications: **MySQL**, **Redis**, and **Apache**. Learner advanced testing techniques: **mock objects**, **reflection**, and **TDD**.

## SUBJECTS

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CALCULUS  
PHYSICS  
OPERATIVE SYSTEMS  
DATABASES  
NETWORK PROTOCOLS  
ALGORITHMS  
SOFTWARE ARCHITECTURE

## SUBJECTS

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PROBABILISTIC ROBOTICS  
COMPUTER VISION  
CONTROL THEORY  
MULTIAGENT SYSTEMS  
PATH PLANNING  
FIRST-ORDER LOGIC  
COMPUTER GRAPHICS  
NEURAL NETWORKS  
DRONES CONTROL  
MACHINE LEARNING  
ROBUST CONTROL  
HUMANOID GAIT

MAR 2016 – JUL 2016 (FULL TIME)

## INRIA, French national research institute

### **Robotics Engineer**

I developed from scratch a system to **teleoperate** an industrial robot in hazardous environments.

Each module of the pipeline was written in C++ and containerized with **Docker** and communicating through **ROS**.

The dynamics of the system was simulated in a **digital twin** using *dart* and *gazebo*. Joint-space and Cartesian control of the robot were using *pinocchio* and *tsid* libraries. I designed a **GUI** for teleoperation with the C++ library *ImGui* where I used quaternions extensively and designed a state machine to introduce **automation** of the task.

Learned the formulation of the Dynamic Programming problem used to solve control problems on humanoid robots. I also developed experience in URDF creation, modern C++ frameworks and acquaintance with robots of the lab: the manipulator *franka* and the humanoid robot *talos*. This project resulted in the publication of this **paper** in the conference **IEEE ARSO**, Jun 2023, Berlin.

JUN 2022, NOW (FULL TIME)

## Kudan

### **Software Engineer**

I am working in an R&D team focussing on SLAM both LiDAR and camera based.

Maintaining and enhancing a C++ library deployed on multi-platform. I am working hard to transform promising academic results in production ready code and became more aware of depths of the software cycle (planning, code reviews, deployment). Constantly strengthening my theoretical knowledge base in state estimation and graph optimisation.

Working with pose constraints (GPS, INS) and IMU data. Getting to know the intricacies of *Lie algebra* to deal with  $SE(3)$  manifolds and enforce the probabilistic approach with covariance estimation and propagation.

Frequently using templates and design patterns (e.g. factory pattern) in development.

Always applying best practices according to the C++ standard such as move semantic.

## PERSONAL PROJECTS

### **Spiking network CNN for classification**

I implemented a custom tensorflow layer to obtain a NN of spiking neurons to be used in image classification.

### **Chess endgames RL engine**

I developed in python a reinforcement learning strategy to achieve autonomous playing on a three by eight board with only Kings and Pawns.

### **3D game in WebGL using shaders and lighting techniques**

I created an imitation of the game *Slander man* using computer graphics primitives in Javascript.

### **Multi agent algorithm for camera field of view coverage**

I implemented an article in C++ to solve the problem of multiple cameras at the corners of a room trying to minimise blind spots. With visualisation in OpenGL.

## INTERESTS

- The mystery of consciousness
- RUST programming language
- Simulation and reinforcement learning
- Containerisation in Docker
- NEOVIM as code editor
- Strategy games and video games
- All kind of sports
- Fantasy and sci-fi books

## REFERENCES

### **Dr. Serena Ivaldi**

Research scientist

**INRIA**

serena.ivaldi@inria.fr

### **Dr. Giorgio Grisetti**

Professor

**La Sapienza, University of Rome**

grisetti@diag.uniroma1.it

## WORK EXPERIENCE

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CURRENT, FROM OCT 2020 (FT)

INRIA, French national research institute  
**Robotics Engineer**

Developed a system from the ground up to **teleoperate** an industrial robot in hazardous environments. Each module of the pipeline is written in C++ and it is containerized with **Docker** and communicate through **ROS** middleware. Dynamics of the system is simulated in a **digital twin** using *dart* and *gazebo*. Joint-space and Cartesian control of the robot through *pinocchio* and *tsid* libraries. Designed a **GUI** for teleoperation with C++ library *ImGui* that introduces interactive **automation** of the task. Experience in URDF creation, modern C++ frameworks and libraries interfacing and acquaintance with robots of the lab: *franka* manipulator & *talos* humanoid robot.

FEB 2019 – OCT 2019 (FT)

La Sapienza, University of Rome  
**Master's Thesis**

Implemented a robotic system to achieve autonomous navigation (**SLAM**) in an urban environment of a mobile robot equipped with a **3D-LIDAR** laser sensor. The whole project has been implemented in C++ adopting the ROS build system. High-level features are extracted from the 3D-point cloud and categorized in geometric primitives. The sensor data is processed using the primitives in order to compute the trajectory of the robot. Used a probabilistic approach that involves using the **Gaussian assumption** and a **Least Square** formulation. The work has been developed in collaboration with the Robotics Laboratory of La Sapienza University.

MAR 2016 – JUL 2016 (FT)

Translated  
**Back-end developer**

During this internship, I was responsible for the code-base of a web application: **Matecat**, written in PHP. I developed unit-tests to certify the correctness of the core of the application. Brought code coverage percentage from 0% to 25%. Worked with databases and client-server communications: **MySQL** and **Apache**. Learned how to work in **agile** teams, following **scrum** principles. Acquired deep knowledge of advanced testing techniques: **mock objects**, **reflection**, and **TDD**.

**Bachelor thesis link**

Languages: **Italian:** native **English:** IELTS academic cert. Overall band score **7.0** CEFR level **C1**

## EDUCATION

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### PROGRAMMING SKILLS

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LANGUAGES	C++, python, L <sup>A</sup> T <sub>E</sub> X, Javascript Java, bash, MATLAB, PHP
C++20	variadic templates, move semantic smartpointers, concepts, lambdas
DESIGN	OOP, polymorphism, functional programming
TESTING	TDD, reflection, mock objects, googletest
LIBRARIES	OpenCV, tensorflow, OpenGL, dart, ImGui
DEVOPS	cmake, Docker, git, vim, gdb, valgrind

### THEORETICAL SKILLS

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ROBOTICS	dynamic systems evolution, quaternions
CONTROL	inverse dynamics, robust control
ROBOTIC	SLAM, trajectory planning
NAVIGATION	obstacle avoidance, filtering
MACHINE	bioinspired networks, CNN
LEARNING	spiking neurons, LSTM
ARTIFICIAL	multiagent systems, reinforcement learning
INTELLIGENCE	first order logic, planning and reasoning
COMPUTER	operative systems, network protocols
SCIENCE	algorithms design, databases

## REFERENCES

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**Dr. Serena Ivaldi**

POSITION Research scientist  
EMPLOYER **INRIA**  
EMAIL serena.ivaldi@inria.fr

**Dr. Giorgio Grisetti**

POSITION Professor  
EMPLOYER La Sapienza, University of Rome  
EMAIL grisetti@diag.uniroma1.it

**French:** level **A2**