# Sergi **Sanchez Orvay**

Robotics Research Intern at BMW Group (RoboTac Lab) - MSc Robotics Student at ETH Zürich

*Munich, Germany*

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## Education

### MSc in Robotics, Systems and Control, ETH Zürich - Zürich, Switzerland

Academic Supervisor: Prof. Dr. Roland Siegwart *Sept. 2024 - Present*

Pursuing advanced training in robotics with a focus on **embodied intelligence** and **robot learning & perception**.

- Strong theoretical foundation in **deep learning**, **robot control**, **probabilistic AI** and **computer vision**, combined with extensive hands-on project experience.
- **Semester Project:** Gaussian Belief Propagation for Continuous-Time SLAM with the Vision for Robotics Lab.
- **Research Project:** Towards Depth-Guided Self-Supervised World Models with the Computer Vision and Geometry Group.
- **Internship** at BMW Group (RoboTac Lab) conducting research in cross-modal perception and tactile intelligence.

### BSc in Electronic Eng. & Telecommunications, Universitat Politècnica de Catalunya - Barcelona, Spain

Bachelor's Thesis Supervisors: Dr. Juan Andrade-Cetto, Prof. Dr. Montse Nájar *Sept. 2020 - July 2024*

Obtained fundamental foundations in **mathematics**, **physics**, **information theory**, **electrical engineering** and **control theory**.

- **Ranked 1st of the class** (GPA: 9/10) receiving the **Best Academic Transcript Award**.
- **Honors in +30% of the courses**.
- **Research internship** at IRI-CSIC working on **vision algorithms for event-cameras** that lead to my **bachelor's thesis**: Event-based egomotion estimation **(Grade: 9.8/10)**.

## Experience

### Robotics Research Intern, BMW Group (RoboTac Lab) - Munich, Germany

Supervisor: Prof. Dr. Mohsen Kaboli *Sept. 2025 - Present*

Research at the intersection of **embodied intelligence**, **cross-modal perception** and **robotic manipulation**.

- Building **robotic foundation models** that unify **tactile sensing**, **visual observations** and **action sequences** into a shared representation using transformers in PyTorch, enabling a **pre-trained and generalizable model for diverse downstream tasks**.
- Contributing to the PHASTRAC project (Horizon Europe), using **Oscillatory Neural Networks** to advance efficient edge intelligence for robotics.

### Student Researcher, ETH Zürich (Vision for Robotics Lab) - Zürich, Switzerland

Supervisors: Xinyi Li, William Talbot, Dr. David Hug, Dr. Cornelius Von Einem, Prof. Dr. Margarita Chli *Feb. 2025 - July 2025*

Advancing **continuous-time SLAM** through **Gaussian Belief Propagation** (GBP).

- Focused on **analyzing and resolving the numerical instabilities** of Hyperion (the first open-source continuous-time GBP solver) that prevented its deployability.
- Designed and implemented **improved regularization strategies**, including diagonal and Levenberg-Marquardt regularization, message damping and spline tail-fixing, **enabling stable online optimization**.
- Improvements yielded **millimeter-level trajectory accuracy**, **consistent convergence** across synthetic and indoor sequences, and **runtime reductions of more than 100× compared to Ceres-based Non-Linear-Least-Squares solvers**, demonstrating the viability of GBP as an efficient continuous-time state estimation framework.
- **Project report:** Gaussian Belief Propagation for Continuous-Time SLAM.

### Robotics Research Intern, Institut de Robòtica i Informàtica Industrial (IRI-CSIC) - Barcelona, Spain

Supervisor: Dr. Juan Andrade-Cetto *Sept. 2023 - July 2024*

Research on lightweight, interpretable algorithms for motion and feature estimation using **event cameras in an aerial robotic platform performing agile motion** (accelerations of up to 40 rad/s$^2$ and 15 m/s$^2$).

- Developed and implemented methods for **event-based optical flow** estimation using plane-fitting techniques on surfaces of active events.
- Implemented a state-of-the-art **robust corner detection algorithm in Python**.
- Designed a geometric model-based pipeline for **egomotion estimation**, combining normal flow, inverse depth optimization and RANSAC-based motion recovery using MATLAB and ROS2.

### Research Assistant, Universitat Politècnica de Catalunya - Barcelona, Spain

Supervisor: Dr. Manuel Domínguez-Pumar *Nov. 2022 - March 2023*

Collaborated with the MNT-MarsLab research group on the development of an **Electrostatic Dust Shield (EDS)** to remove dust from surfaces using **controlled electrostatic fields in space missions** to maintain the performance of solar panels, sensors and lenses in dusty environments such as Mars.

- Designed the **EDS system** and custom **PCBs to drive and control the electrodes**.
- Assembled the PCBs and **successfully tested the system** across **different conditions** to characterize its behavior.
- Derived a **dynamic model** of the EDS system as a basis for implementing a **suitable control strategy**.

## Awards & Scholarships

**Nova Talent Member (professional network connecting and mentoring top talent)**, Nova - Nov. 2024, Madrid, Spain
**JAE Intro ICU - Robotics Research Scholarship**, Consejo Superior de Investigaciones Científicas (CSIC) - 2023, Barcelona, Spain
**Top 10 in the Rohde & Schwarz International Engineering Competition**, Rohde & Schwarz - 2023, Munich, Germany
**Best student award in the Initial Phase of Electronic Eng. & Telecommunications degree**, UPC - 2021, Barcelona Spain
**Academic Excellence Award - Full financial support for the first university year**, Govern de les Illes Balears - 2020, Ibiza, Spain

## Extracurricular Activities

### Rohde & Schwarz International Engineering Competition 2023

2023, Munich, Germany

Rohde & Schwarz hosts an annual international competition where students from all over the world participate. We were provided with a C++ hardware signal processing code which we had to optimize taking into account the hardware architecture. My team classified to the final stage in Munich by ranking top 10 internationally. Further information:
`https://github.com/EngineeringCompetition/qualifiying_2023`

### HackUPC

2020, Barcelona, Spain

Implemented an encrypted hardware communication system protocol in Arduino in order to find a solution to roll jam attacks using CBC algorithm for signal encryption. Further information: `https://devpost.com/software/433com`

### RobotIB

2018-2019, Ibiza, Spain

Participated in a training program that aims to enhance the introduction of robotics among the students in the Balearic Islands. The final project involved assembling a robot from scratch for a sumo-battle competition among schools.