



UNIVERSITÀ DEGLI STUDI DI NAPOLI
FEDERICO II

itee^{PhD}
information technology
electrical engineering



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PhD student Julien Mellet

**Haptic control for remote teleoperation of
cooperative aerial manipulators**

Tutor: prof. Lippiello

Cycle: XXXVII

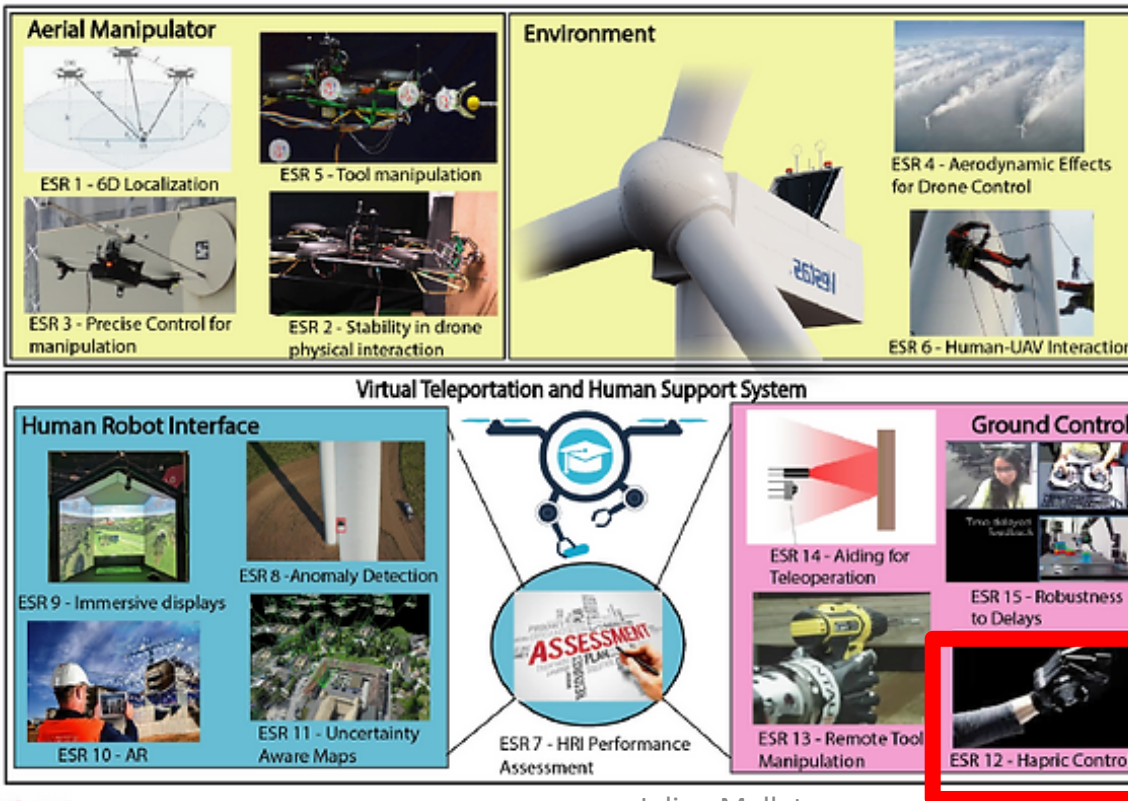
Year: 2022

My background

- MSc degree
 - Industrial Engineering (INSA, France) → **System**
 - Navigation, Guidance and Control (NPU, China) → **Control**
- Experience
 - Software Developer for **Ground Control** of drone swarm, Thales, France
- Research group/laboratory
 - PRISMA Lab → **Aerial Robotics Group**
- PhD start date
 - November 1st, 2021
- Scholarship type
 - Horizon 2020 Marie Skłodowska-Curie Innovative Training Network (ITN)

Research field of interest

- **Operations & Maintenance** industry of civil and industrial infrastructures
- Innovative **aerial robotic** solutions
 - Reduce risks and costs associated to field operations by humans



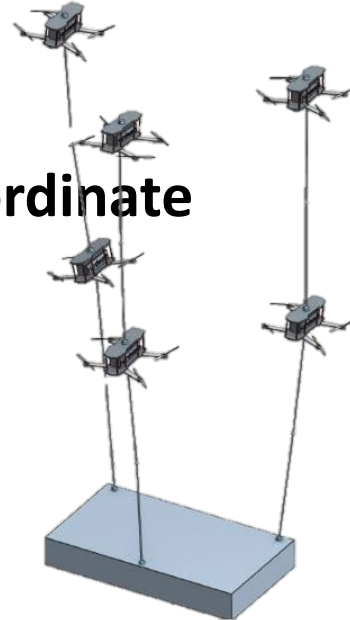
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Summary of study activities

- Briefly summarize the study activities of the academic year
- Courses
 - *UNINA: Field of Service Robotics & Robotic Lab*
 - *Sant'Anna Pisa: Machine Learning and Deep Learning*
- Seminars
 - *Control with delay, Vine robots, Deep natural language processing...*
- Workshop
 - *Shared Autonomy at ICRA*
- Training Schools
 - *TS1 & TS2 from AERO-TRAIN*
 - *IEEE RAS Summer School*

Research activity: Overview

- Problem → Multi-drone Haptic aerial Manipulation
- Why to build bigger machine while we can **coordinate** multiple entities?
 - Distribute the workload at cost of complexity
- **Touch** sensing is one of our main sense
 - Somatosensory areas of the brain occupies a significant part
 - Homunculus
- **Telemanipulation** is a hot research topic
 - Extend grasp abilities into another environment



Research activity: Overview

- Problem
- Objective
 - Develop a control framework
 - Low-level control
 - higher-level controllers
 - Multi-modal control strategies
 - Several joysticks controller implementation
 - Control strategies
 - Effect of time delay
 - Strategies to overcome delay

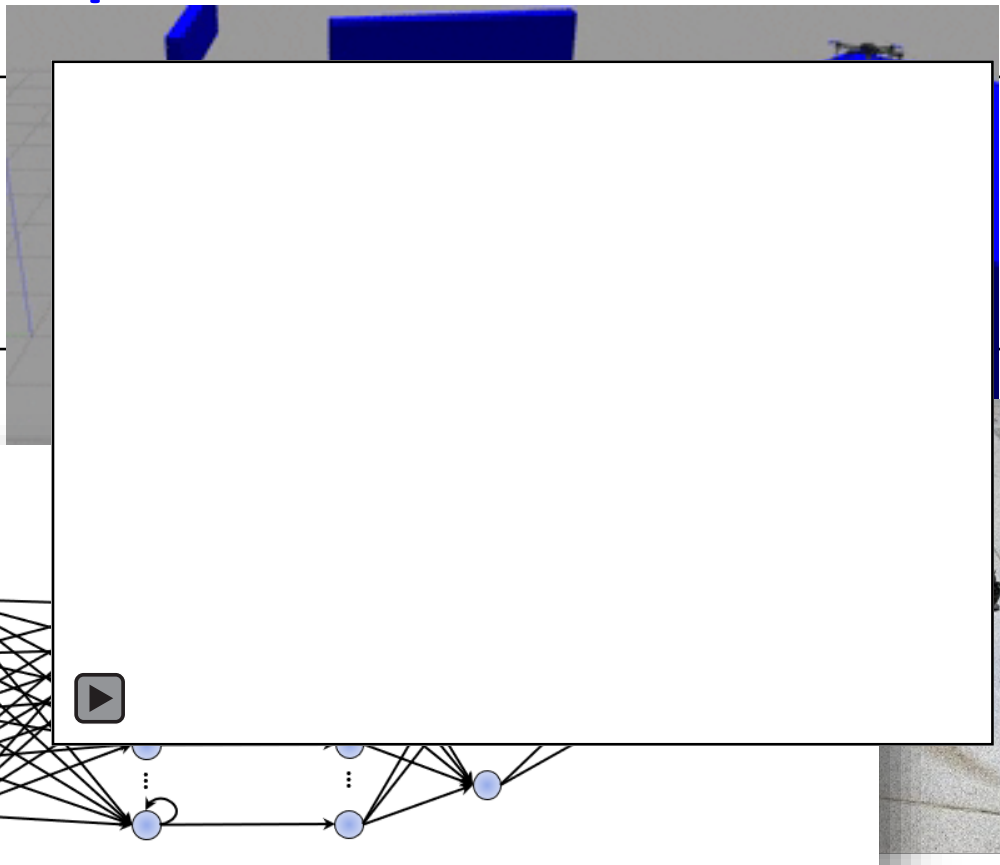
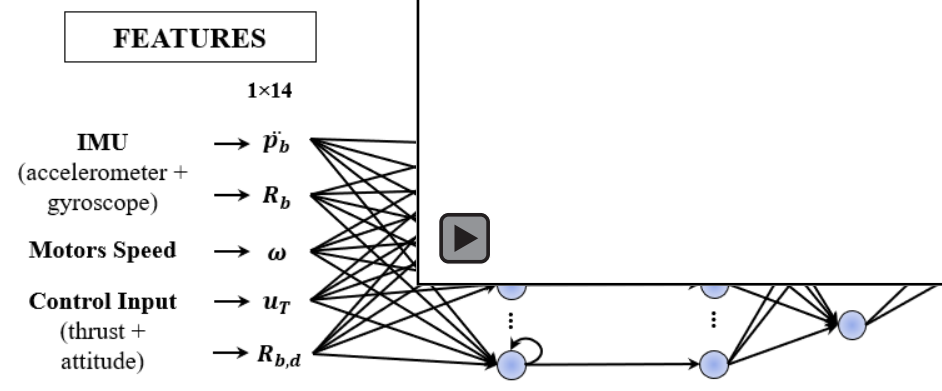


Research activity: Overview

- Problem
- Objective
- Methodology
 1. Preliminary Study → State-of-the-art
 2. Control Framework → Simulation implementation
 3. Multi-Modal Control Strategies → Joy control comparison
 4. Effect of time delay → Prediction & decentralization
 5. Use of case application → Integration & technical adjustments

Developments

| | |
|------|---|
| [P1] | <i>Prototype: Simulation setup</i> |
| [P2] | <i>Prototype: Control framework</i> |
| [P3] | <i>Prototype: Aeri</i> |
| [P4] | <i>Prototype: Neural network for estimation</i> |





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Thank you