



POLITECNICO
MILANO 1863

DIPARTIMENTO DI ELETTRONICA
INFORMAZIONE E BIOINGEGNERIA

Kick-off tesi 2025

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Merlin Lab

Aspetti logistici

ACCESSI AL LABORATORIO E AL DIPARTIMENTO

- Inviare Codice Persona al vostro supervisore per essere abilitati ← **TODO 1**
- **Merlin Lab @ Edificio 7, Piano Terra**



- Creare un account e inviarmi il vostro Username per avere accesso al Github Merlin
- Take a look at the wiki: <https://github.com/MerlinLaboratory/wiki>

← **TODO 2**



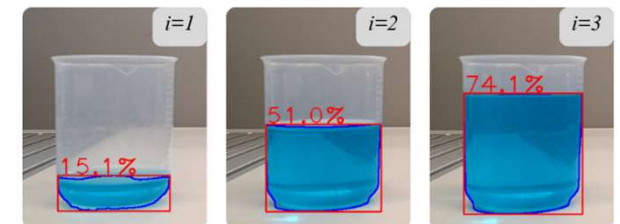
- Usiamo spesso Slack per comunicazione diretta tra tesista e referente
- Create an account and join the Merlin Slack team at [this link](#)

← **TODO 3**

#3 Planning and learning for robotized liquid handling (Barutta)

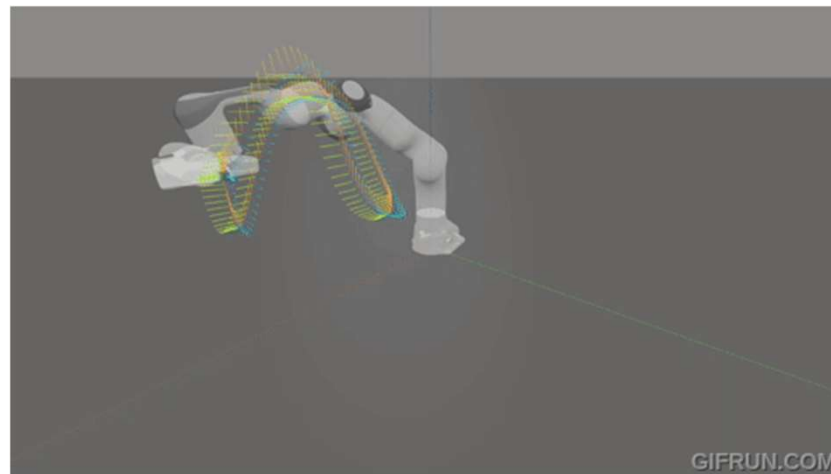
- Robotized **manipulation of liquids** impacts biomedical, industrial, and domestic applications, however, the uncertainty in liquid modeling is a bottleneck to precise liquid handling.
- The thesis will propose an approach to pouring liquid material with a robotic arm. Expected activities:
 - identification and localization of containers (with different sizes and shapes) through **vision** and **Deep Learning**
 - Implement **a planning algorithm** to perform simple tasks under modeling uncertainty.
- **Experimental** validation at Merlin Lab (Leonardo Campus)
- SW tools: Ubuntu, **ROS**, Python or C++

Source: Yaskawa.eu



#4 Planning and learning for robotized liquid handling (Barutta)

- Robotized **manipulation of liquids** is a challenging task with possible impacts in biomedical, industrial, and domestic applications.
- The work will propose an approach to perform manipulation tasks such as **pouring and transportation** of liquid material with a robotic arm.



Source: TUM

#5 Planning and learning for robotized liquid handling (Barutta)

Challenges:


- Accurate liquid simulation is slow and it is hard to properly model real-world containers
- We can learn simplified models (e.g., with Neural Networks or Gaussian Processes) but they come with a large uncertainty (especially with small datasets)

Approach:

- We developed uncertainty-aware planning methods in previous thesis:
 - One for pouring
 - One for transportation
- Good but needs real data to learn the model
- **NEW:** learn an approximated model offline in simulation and use the uncertainty-aware planning to address the model uncertainty



Attività

1. Literature review + ROS tutorials: 
 - Read as many scientific paper as you can on the topic
 - I'll share some papers with you in a shared OneDrive folder
 - **Do it with the “Related Works” section of your thesis in mind**
2. Simulation environment (ROS, C++/Python)
3. Design methodology
 - Formalization of the problem
 - Solve the problem
4. Simulation comparison with baselines
5. Design of experiments
6. Real experiments (on robot manipulator, e.g. UR5e / Fanuc)
7. Thesis writing (~1 month)





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