Title :	Robust intelligent control of a quadrotor	
Institution name and address :	Labo-Imvia, 12 rue de la Fonderie, Le Creusot, France	
Training place :	Labo-Imvia	
Dates of internship : MSCV2 Dates (01 Feb. to 30 June 2024)	From 01/02/2024	To 30/06/2024
Supervisors (names and emails):	ABADI Amine Amine.abadi@u-bourgogone.fr	
Stipend:	550 € /month	
Other benefits (free accomodation, ...) :	subsidized lunches	
Deadline for application: (Note that paperwork may take up to 10 weeks)	Nov. 30th	

Brief Description of the project

A quadrotor, or quadcopter, is a small unmanned aerial vehicle (UAV) with four rotors arranged in an X or "+" shape. These agile aircraft are renowned for their stability, versatility, and ability to perform tasks in various fields. Quadrotors come equipped with sensors such as accelerometers and gyroscopes, enabling them to maintain stable flight. They find applications in areas such as aerial photography, surveillance, agriculture, and recreational flying, owing to their ease of use and maneuverability. Continuous technological advancements further expand their capabilities and applications.

Despite their versatility and agility, quadrotors are particularly sensitive to uncertainties in their operating environments. These uncertainties can stem from various sources, including wind disturbances, sensor noise, imprecise state estimation, and communication delays. To ensure reliable performance in the face of such uncertainties, robust control strategies must be developed.

Robust intelligent control represents a state-of-the-art approach to managing complex systems with resilience and adaptability. This methodology integrates the power of artificial intelligence and advanced control algorithms to optimize system performance even when uncertainties and disturbances are present. Unlike traditional control methods, robust intelligent control leverages machine learning techniques to learn from data and dynamically adapt to changing conditions. In the literature, there are some instances of robust intelligent control applied to quadrotors [1-4]. Therefore, the primary objective of this master's thesis is to propose a new robust intelligent tracking controller for a quadrotor subjected to uncertain parameters and external disturbances. The proposed approach will be validated through simulations and laboratory experiments.

The work plan for this master is defined as follows:

- Bibliographic study of non-intelligent robust control.
- Developing a robust intelligent tracking control of a quadrotor and applying it."

[REF]

[1] Yogi, S. C., & Behera, L. (2021, October). An Intelligent Robust Control Strategy for an Uncertain Quadrotor. In 2021 IEEE International Conference on Systems, Man, and Cybernetics (SMC) (pp. 1985-1991). IEEE.
[2] Hua, H., & Fang, Y. (2022). A novel reinforcement learning-based robust control strategy for a quadrotor. IEEE Transactions on Industrial Electronics, 70(3), 2812-2821.
[3] Din, A. F. U., Mir, I., Gul, F., Al Nasar, M. R., & Abualigah, L. (2023). Reinforced learning-based robust control design for unmanned aerial vehicle. Arabian Journal for Science and Engineering, 48(2), 1221-1236.
[4] Sankaranarayanan, V. N., Satpute, S., & Nikolakopoulos, G. (2022). Adaptive robust control for quadrotors with unknown time-varying delays and uncertainties in dynamics. *Drones*, *6*(9), 220.

Software/Hardware needs and skills

Matlab/Simulink, Python, C++, Ros(Robotic Operating System).
Applications whose CV does not match these skills or whose cover letter is not adapted to the proposed topic will not be considered.