UNIVERSITÀ DEGLI STUDI DI BERGAMO
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Control system and automation lab.

The first work is related to the development of a fault detection and isolation method for electromechanical actuators (EMAs) in aerospace environment. The motivation follows the "More electric aircraft" trend, in order to replace the existing hydraulic actuators, for motion of aerodynamic surfaces like flaps, with electromechanical ones. The test campaign is made possible by means of a test bench, composed by two EMAs and one hydraulic piston, connected to them, which simulates the acting loads. The linear motion is made possible by a rollerscrew transmission. The project investigates various mechanical faults on three types of actuators: a five-phases Brushless DC (BLDC) motor, a three-phases Brushless DC motor, and a geared Brushless AC (BLAC) motor. The proposed method is a combination of model-based and model-free fault detection schemes. In the former, a model of the system is developed, and by means of a Kalman Filter or a Particle Filter, the unknown model states are estimated. The output of the model and the real model are then compared. In the latter method, machine-learning techniques will be employed in order to extract pattern from the different data, acquired in healthy and faulty conditions.

The second work consists of the development of a recommender system for a digital journey. A magazine issue is composed by a number of different articles, which users can purchase. The aim of the project is to develop an algorithm which is able to recommend articles to users, personalized for each of them. The main approach consist in the so-called "contend based recommender systems" and "collaborative filtering recommender systems". In the latter case, the taxonomy further splits the methods in memory-based vs. model-based, and user-based vs. item-based collaborative filtering. A mandatory object in order to develop such algorithms is the rating that each user gives to the items. A further duty is to infer this score from other sources without having the user to explicitly rate an item. Once the method is developed, an assessment phase will be useful to assess if the algorithm is working correctly. This could be by means of statistical tests.

A desired work would be focusing on machine learning methods in the dynamical system identification community and direct data-driven control design, by specifying specific priors which can encode a desired property of a feedback loop control system.