PhD at the Genetics and Epigenetics of Behavior research group, IIT.

Title:
Machine learning approaches in preclinical phenotypes

Tutor:
Valter Tucci

Background:
Preclinical models are important means in modern medicine. The aim of this project is to conduct a multi-step high-level analysis of preclinical phenotypes to advance the translational research in rare genetic diseases. The project includes a comprehensive and descriptive analysis of all phenotypes; the use of artificial intelligence (AI)-driven computational approaches to extract biomedical features and to build predictive models based on the genotypes. Moreover, you will create 'Digital Twins' of the preclinical lines that can be analyzed independently of their physical entity. Through Digital Twins, phenotyping can be used to detect early signs of the disease and the effects of disease treatment, providing new solutions in the therapeutic approaches.

Description:
The successful candidate will investigate the collected phenotypic data. Based on the studies already carried out in our lab, he/she is expected to develop and apply machine-learning techniques on these data. The chosen model will address several issues in machine learning in the interpretation of preclinical data.
The second objective of the PhD project is the development of a so-called digital twin, which is a computational model of the animal to theoretically predict the impact of different gene alterations and to detect possible medication targets (Currie, 2023). Starting from the model developed to analyse the data from above and incorporating genetic information, the successful candidate will determine possible strategies, which then ultimately can be tested with experiments carried out by the in-vitro and in-vivo experts in our lab.

References:

- Bervini, S. & Herzog, H. Mouse models of Prader–Willi Syndrome: A systematic review. Frontiers in Neuroendocrinology 34, 107–119 (2013).
- Currie, G. M. The emerging role of artificial intelligence and digital twins in pre-clinical molecular imaging. Nuclear Medicine and Biology 120–121, 108337 (2023).
- GARD. Prader-Willi syndrome - About the Disease (2013).

Requirements:
We are looking for highly motivated candidates with a degree in Mathematics, Physics, (Bio-)informatics, computational sciences or related fields that are keen to work in an interdisciplinary environment. The candidate must have

- a strong theoretical background of machine-learning techniques,
- skills in programming (python) and
- expertise in big data analysis including basic plotting, statistical interpretation.

Language: all candidates must be able to talk, listen and write in English at an academic level.

Experience in machine-learning techniques are expected and knowledge in biology are considered a plus.

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