POLITECNICO DI MILANO

PhD in DATA ANALYTICS AND DECISION SCIENCES - 41st cycle

THEMATIC Research Field: CODON-DRIVEN AND STRUCTURE-AUGMENTED RNA LANGUAGE MODEL

Monthly net income of PhDscholarship (max 36 months)
1750.0 In case of a change of the welfare rates during the three-year period, the amount could be modified.

Context of the research activity	
Motivation and objectives of the research in this field	mRNA stability is a key determinant of gene expression and therapeutic mRNA design, yet current prediction models lack both accuracy and interpretability. This project will develop a codon- and structure-aware RNA language model that integrates coding frame semantics, regulatory motifs, and secondary structure constraints to predict RNA half-life with unprecedented reliability. The project lies at the intersection of computational genomics, machine learning, and molecular biology, and will contribute to both fundamental RNA biology and the development of predictive models for therapeutic RNA design.Current deep learning approaches to RNA modeling often ignore codon structure and RNA folding, leading to limited biological interpretability. We aim to design hybrid tokenization and representation learning strategies that reflect RNA’s dual nature as sequence and structure, improving predictive performance and mechanistic insight. The resulting model will not only elucidate sequence–structure–stability relationships but also accelerate the rational design of synthetic and therapeutic RNAs.
Methods and techniques that will be developed and used to carry out the research	Artificial Intelligence, Deep Learning (Transformers, VAEs, Diffusion Models), Computational Genomics, RNA Structure Prediction, Model Explainability, Python/PyTorch programming, large-scale data processing.

	processing.
Educational objectives	The student will acquire a strong interdisciplinary profile in computational biology and AI, gaining expertise in analyzing high-throughput RNA sequencing data and developing interpretable machine-learning models for molecular data. They will learn to handle large-scale biological datasets, train and evaluate deep learning models and RNA language models, and collaborate effectively across wet- and dry-lab environments.At Human Technopole the student will be supervised by Dr. Ivano Legnini with the collaboration of Dr. Florian Jug, jointly providing a unique combination of expertise in RNA and AI.
Job opportunities	Graduates will be well-positioned for careers in academic research, biotech and pharma R&D, or AI-driven health data science. Expertise in generative modelling and computational biology will be directly applicable to roles in data-driven drug discovery, RNA therapeutics, and machine learning for life sciences.
Composition of the research group	1 Full Professors 3 Associated Professors 1 Assistant Professors 8 PhD Students
Name of the research directors	Marco Masseroli (Polimi), Ivano Legnini (HT)

Contacts
POLIMI: Prof. Marco Masseroli: marco.masseroli@polimi.it https://www.deib.polimi.it/ita/personale/details/266220 Fondazione HT: Ivano Legnini, ivano.legnini@fht.org https://humantechnopole.it/en/people/ivano-legnini/

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents	--

Scholarship Increase for a period abroad	
Amount monthly	850.0 €
By number of months	12

Additional information: educational activity, teaching assistantship, computer availability, desk availability, any other information

List of Universities, Companies, Agencies and/or National or International Institutions that are cooperating in the research:
Centre for Genomics; Centre for Computational Biology (Fondazione Human Technopole)

Additional support

Educational activities (purchase of study books and material, funding for participation in courses, summer schools, workshops and conferences):
financial aid per PhD student per year:
1st year: max 2.378,02 euro per student
2nd year: max 2.378,02 euro per student
3rd year: max 2.378,02 euro per student
Teaching and lab assistantship: availability of funding in recognition of supporting teaching and lab activities by the PhD student.
Further support is available for students who engage in activities of teaching or additional lab duties coherent with their academic mission and doctoral training.
The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.
Computer availability:
1 st year:individual use
2 nd year: individual use
3 rd year: individual use
Desk availability:
1 st year:individual use
2 nd year: individual use
3 rd year: individual use