POLITECNICO DI MILANO

PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 38th cycle

Research Area n. 1 - Computer Science and Engineering

PARTENARIATO PNRR Research Field: HOW TO VALORIZE THE INNOVATION IN THE COMPUTER SCIENCE FIELD: GRAPH-BASED COMPUTATIONAL METHODS FOR GENOMIC ANALYSIS AT SCALE

Monthly net income of PhDscholarship (max 36 months)
€ 1400.0
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	Information technology and data analysis are at the forefront of academic research and industry development across multiple and interdisciplinary fields of technology. In the recent years, Politecnico Technology Transfer Office has provided researchers and students with specific tools and support for the economical exploitation of scientific results, through the protection of Intellectual Property, the licensing of patents, and the creation of spin-off companies. However, despite the excellent results achieved both in terms of number of patents and licensing agreements, most inventions regarding Information Technologies require new and ad-hoc protection and valorization strategies. Within this context the PhD candidate will map the generation, growth and Technology Transfer initiatives already existing in the Information technology department and will implement new concepts and possible standardization for enhancing the innovation deal-flow by focusing him/herself on the computational genomics field, dealing with the whole process of creation and protection of innovation, fundraising strategies, valorization opportunities and startup constitution.More precisely, from a pure research perspective, this work will focus on the development of novel computational strategies and methods to integrate

	the use of graphs in the genomic practice. In particular, graphs can find several applications to different steps of the genomic pipeline, such as in the evaluation of the quality of assembled genomes and more strictly in the alignment of genomic sequences to reference genome graphs. This last process, known as *sequence-to-graph* alignment*,* represent the core technology of graph-based genomic analysis and, as declared in the state-of-the-art, it still suffers for low accuracy and prohibitive execution time and memory footprint.This PhD project meets the programmatic directions of different of the main horizontal pillars of the PNRR-Next Generation Italy, and in particular the issue of "Deep Tech: Entrepreneurship &Technology Transfer" and also the Big Data-Open Data in Life Sciences
Methods and techniques that will be developed and used to carry out the research	The research program aims at developing new tools for the valorization of intellectual property in the field of computer science. Such program will be carried on in collaboration between DEIB and TTO. The candidate: -will learn the good practice from literature example and will map the department activities. -will learn the software protection and licensing strategies -will propose new way for enhancing the deal flow of innovation towards investment funds and corporates -will focus on a specific project in the bioinformatics field, to be developed from the idea generation to the market output All the above objectives will be met by proving their effectiveness developing methods and tools for leveraging the potentiality of graph-based representation of genomic data. Such integration will focus on: - Graph-based genome assembly evaluation - Sequence-to-graph alignment tools (implementing novel algorithms or working on state-of-the-art solutions with the aim of improving accuracy and performances) - Sparse graph partitioning based on different areas' complexity - Variant calling on genome graphs

Educational objectives	The research will be carried out in the NECSTLab. This will be done because, over the years the NECSTLab has proven itself as a rich environment for generating entrepreneurship ideas both as startups and IPs transferred to other companies. Because of this, the collaboration in between the lab, the Technology Transfer Office of the Politecnico has been already proven to be successful and fruitful but lacking of a replicable and formalize methodology, which the motivation behind this proposal.Furthermore, because of the collaborations established through the years, working within this lively and stimulating academic and research environment, the doctoral student will become a skillful system designer, with expertise in both advanced computer architectures and computer science methods.
Job opportunities	The candidate, at the end of his/her PhD will have several job opportunities, just two present two examples: continuing working on the methodology aspects of the ideas' valorization, by being hired by the Technology Transfer office, starting his/her startup on the research topic developed during the PhD.
Composition of the research group	0 Full Professors 1 Associated Professors 1 Assistant Professors 1 PhD Students
Name of the research directors	Marco Santambrogio

Contacts
marco.santambrogio@polimi.it

Additional support - Financial aid per PhD student per year (gross amount)	
Housing - Foreign Students	--
Housing - Out-of-town residents (more than 80Km out of Milano)	--

Scholarship Increase for a period abroad	
Amount monthly	700.0 €
By number of months	6

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

This PhD is fully funded within the National Recovery and Resilience Plan (NRRP), Mission 4, Component 2 Investment 1.4, funded from the European Union - NextGenerationEU.
Call for Strengthening of research structures and creation of R&D "innovation ecosystems", set up of "territorial leaders in R&D"

NAME OF THE INNOVATION ECOSYSTEM: MUSA - Multilayered Urban Sustainability Action

MUSA (Multilayered Urban Sustainable Action) is a challenging proposal with the ambition to turn Milan Metropolitan Area (MMA) into an ecosystem of innovation for urban regeneration, comprehensive of all levels of intervention, from social to technological, able to scale at the regional and national level and to become a model at the European level. The ecosystem intends to grow on the synergy between Academia, Industry, Local Government Entities and Civil Society. One of the pillars of the project is the Deep Tech: Entrepreneurship &Technology Transfer will enhance entrepreneurship through the transfer of research and technological innovation and the development of innovative services for local businesses, especially for SMEs. This will be achieved through the implementation of a process of transforming ideas into companies (open innovation), developing industrial research and realizing new joint labs with established firms that will train future industrial researchers and technology entrepreneurs.

LIST OF UNIVERSITIES, COMPANIES, AGENCIES AND/OR NATIONAL OR INTERNATIONAL INSTITUTIONS THAT ARE COOPERATING IN THE RESEARCH: Berkeley; MIT; NVIDIA; AMD-Xilinx

EDUCATIONAL ACTIVITIES (purchase of study books and material, including computers, funding for participation in courses, summer schools, workshops and conferences): financial aid per PhD student
5.707,13 Euro per student

TEACHING ASSISTANTSHIP: (availability of funding in recognition of supporting teaching activities by the PhD student)
There are various forms of financial aid for activities of support to the teaching practice. The PhD student is encouraged to take part in these activities, within the limits allowed by the regulations.

COMPUTER AVAILABILITY: individual use

DESK AVAILABILITY: individual use