POLITECNICO DI MILANO

PhD in INGEGNERIA DELL'INFORMAZIONE / INFORMATION TECHNOLOGY - 39th cycle

Research Area n. 1 - Computer Science and Engineering

PARTENARIATO PNRR Research Field: ROBUST ESTIMATORS IN MACHINE LEARNING

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	Kernel methods are a powerful mathematical framework that is extensively used in the design of learning algorithms. Via the representer theorem, we can describe predictors that minimize the empirical risk as linear combinations of kernel functions centered on training points. However, when the data distribution is heavy-tailed, or in the presence of outliers, the empirical risk fails to provide a good estimate of the true risk. In these cases, more robust estimators are needed that are also efficient to compute. The goal is to design new robust estimators for kernel algorithms and compare them with respect to their statistical and computational efficiency.
Methods and techniques that will be developed and used to carry out the research	The work will start from the classical Median-of-Means estimator from which different variants will be derived. The statistical and computational properties will be studied with respect to robustness against heavy-tailed distributions (i.e., assuming only finiteness of the second moment) and against the presence of outliers.We will also investigate the conditions under which the different estimators may become equivalent. Different tasks, such as regression and density estimation, will be considered. The theoretical results will be supported by experiments on synthetic and real-world datasets.

Educational objectives	The main educational objectives include: - development of technical skills in statistics, optimization, and large-deviation analysi - expertise in the use of kernel methods for machine learning - hands-on experience in the empirical analysis of kernel methods
Job opportunities	During the PhD study: - Research visits at ETH (Andreas Krause), University of Amsterdam (Tim van Erven), and EPFL (Volkan Cehver) After the PhD study: - Postdoc in cutting-edge research group
Composition of the research group	1 Full Professors 1 Associated Professors 4 Assistant Professors 0 PhD Students
Name of the research directors	Nicola Gatti, Nicolò Cesa-Bianchi

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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

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:

- Laboratory of AI and Learning Algorithms, Dipartimento di Informatica, Università degli Studi di Milano
- DEIB, Politecnico di Milano

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.

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.

This project research is in the framework
FAIR
PARTENARIATO ESTESO FUTURE ARTIFICIAL INTELLIGENCE RESEARCH -
 D53C22002380006
D.D. 1555 del 11/10/2022

D.D. 341 del 15/03/2022 Avviso pubblico per la presentazione di Proposte di intervento per la creazione di "Partenariati estesi alle università, ai centri di ricerca, alle aziende per il finanziamento di progetti di ricerca di base" – nell'ambito del Piano Nazionale di Ripresa e Resilienza, Missione 4 "Istruzione e ricerca" – Componente 2 "Dalla ricerca all'impresa" – Investimento 1.3, finanziato dall'Unione europea – NextGenerationEU