POLITECNICO DI MILANO

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

Research Area n. 1 - Computer Science and Engineering

THEMATIC Research Field: BANDIT ALGORITHMS FOR ENVIRONMENTS WITH MULTIPLE STATES

Monthly net income of PhDscholarship (max 36 months)
€ 1250.0 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	In online machine learning there is gap between bandit algorithms applying to problems where the environment can only assume a single state and reinforcement learning (RL) where the environment can be described with an arbitrarily Markov decision problem. In particular, bandit algorithms are very data efficient, but they apply to problems that are too simple, whereas RLRL techniques require a huge amount of data that can the adoption of their techniques unaffordable in online settings. The research proposal aims at initiating the study of problems in the middle of these two fields, in the attempt to develop algorithms dealing with environments with multiple states that can be effectively used in online settings.
Methods and techniques that will be developed and used to carry out the research	This research will develop no-regret techniques applying to environments with multiple states. In particular, different classes of environments will be analyzed and, for each class, ad hoc algorithms will be developed and the corresponding upper and lower regret bound will be derived. Furthermore, the algorithms developed in the research will be evaluated in real-world settings.
Educational objectives	The objective is to provide the candidate with [1] technical skills in statistics, statistical learning, machine[2] learning, online algorithms, and optimization. The education

	program fits with a standard program in computer science and engineering with a specialization in artificial intelligence and machine learning.
Job opportunities	The candidate will get expertise in machine learning and data science and will be capable of designing algorithms to make, e.g., economic transactions automatic. In the previous years, lastminute.com and PoliMi had collaborations in research and some PhD students were hired by lastminute.com after the graduation (e.g., Stefano Paladino). Other job opportunities are in companies working in online advertising and ecommerce.
Composition of the research group	0 Full Professors 1 Associated Professors 2 Assistant Professors 1 PhD Students
Name of the research directors	Nicola Gatti

Contacts
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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	625.0 €
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: Lastminute.com 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 5.095,96 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