



PhD in INGEGNERIA AMBIENTALE E DELLE INFRASTRUTTURE / ENVIRONMENTAL AND INFRASTRUCTURE ENGINEERING - 40th cycle

Research Area n. 3 - Environmental and Hydraulic Engineering and Geomatics

**INTERDISCIPLINARY Research Field: BAYESIAN LEARNING METHODS FOR A DRINKING
WATER TREATMENT WISE-MANAGEMENT**

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	
<p>Motivation and objectives of the research in this field</p>	<p>Interdisciplinary PhD Grant</p> <p>The PhD research will be carried out in collaboration with research groups of the PhD programme in "MATHEMATICAL MODELS AND METHODS IN ENGINEERING".</p> <p>See https://www.dottorato.polimi.it/?id=422&L=1 for further information.</p> <p>SDG linked to the research: 06 - Clean Water and Sanitation</p> <p>Ensuring chemically and microbiologically safe drinking water requires a sequence of treatments, including disinfection before and during distribution. This asks for a careful process control, especially in climate change scenarios. The project's objective is to leverage Bayesian learning techniques to enhance the value of water quality data and harness the potential of real-time monitoring to optimize the management of both water treatment processes and distribution network.</p>
<p>Methods and techniques that will be</p>	



<p>developed and used to carry out the research</p>	<p>The proposed approach is based on advanced analysis of multivariate functional data using Bayesian statistical methodologies and machine learning. A methodology will be developed for the statistical modelling of drinking water quality data derived from water treatment plant monitoring databases, to guide the Integrated Water Service (IWS) managers in making optimal choices for monitoring, in terms of both type and frequency of quality parameters measurements. Based on appropriately designed monitoring campaigns, proxy parameters, easily measured online, will be identified to assist the process management and/or the formulation of early-warning systems. Machine learning will be adopted for this aim, since processes intrinsic complexity is regulated by variables correlated in a non-linear manner, making traditional control techniques inefficient.</p> <p>The integration of three disciplines (environmental engineering, statistical sciences, and machine learning) for environmental data processing is now not exploited by the IWS, especially in a sensitive field like drinking water production. The goal is to develop advanced tools for process control and early-warning, valuable and applicable to other geographical (Italy, Europe) and technological contexts (e.g., wastewater, industrial water), to enhance the resilience of water treatment systems. The outcomes of the PhD research are expected to contribute to some of the Sustainable Development Goals (SDG), in details: SDG6 by providing tools to increase resilience of drinking water production and distribution systems, SDG3, SDG9, SDG11, and SDG12, related to the safety of distributed water and the more efficient use of resources.</p>
<p>Educational objectives</p>	<p>The main objective is the formation of professionals that can develop autonomous research and become experts in environment-related topics, exploiting the potential of advanced data analytics to support a sustainable use and management of resources.</p> <p>The young researcher will take advantage from internal know-how transfer and from the continuous exchange with the experienced senior members in the research group and from the collaborating research groups.</p>



	Moreover, the researcher will have the opportunity to combine expertise collaborating with experts of water utilities, managing the integrated water system from which case studies are selected.
Job opportunities	Research agencies, Research Institutions, industrial sector, public Bodies and Authorities involved in environmental policies and senior consultants for engineering companies.
Composition of the research group	0 Full Professors 2 Associated Professors 3 Assistant Professors 3 PhD Students
Name of the research directors	M. Antonelli, I. Epifani, F. Trovò

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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
<p><u>Educational activities</u> (purchase of study books and material, funding for participation to courses, summer schools, workshops and conferences): financial aid per PhD student per year: max 1902.40 euros per student on average.</p> <p><u>Teaching assistanship</u> (availability of funding in recognition of support to 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.</p> <p><u>Computer availability and desk availability</u>: 1st year +2nd year +3rd year: individual use.</p>

