CIVIL AND ENVIRONMENTAL ENGINEERING

PNRR Ammin/WSP Italia - Development of machine learning-based methods for the development of climate services

Funded By	Politecnico di TORINO [P.iva/CF:00518460019] - WSP Italia S.r.l. [P.Iva 03674811009]
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Context of the research activity	The project aims at designing and implementing a system (in the form of a portal or a set of digital tools) for the analysis of past and future climatic conditions, primarily for engineering-related planning purposes, even at local scales Machine Learning methods will be prioritized, understood as that class of algorithms which, in a more or less supervised manner, can extract relevant information from complex data. An integral part of this project is defining the most suitable methods themselves, based on the most recent scientific literature. Progetto finanziato nell'ambito del PNRR - Bando NODES - CUP E13B22000020001
Objectives	Climate Services (Global Framework for Climate Services, WMO, 2011), refer to services aimed at transforming raw climatic data into locally scaled products, which can assist society in its various forms in making informed decisions about current climatic conditions and potential future developments. Due to their intermediary function, Climate Services often encounter significant difficulties related to: 1) data retrieval, standardization, and maintenance, 2) synthesizing the state of the art in climatic knowledge into effective and easily interpretable information for various stakeholders, 3) communicating results through effective channels and methods that enhance the producer-consumer relationship. The research project is based on seeking solutions to the aforementioned issues through the utilization of algorithms and methodologies relevant to Machine Learning (ML) and Artificial Intelligence (AI). Consequently, the following points will be developed as part of the research project: - Compilation of an overview of the needs for the types of data and outcomes required by the most recent regulations and user needs. - Analysis of various types of currently developed Climate Services (commonly identified as passive, intermediate, customized) and defining an approach that enables satisfying point 1) along with maximum possible automation. - Review of the scientific literature concerning methods for analyzing climatic data through ML and AI, defining an innovative methodology based on them,

	and their systematic implementation in a unified tool. These methods should be researched based on the results of points 1) and 2), but generally fall under the category of downscaling climatic data and their subsequent analysis. - Participation in the development tools for disseminating results that align with the need for digital innovation in terms of accessibility, flexibility, speed, and in accordance with the outcomes from the preceding three points.

Skills and competencies for the development of the activity	The Ph.D. candidate must have a background in physics, environmental engineering, earth system science, or similar, and a good level of written and spoken English. Useful competencies include statistics, mathematical methods, numerical methods, physics of complex systems. Programming skills are required, preferably in one of the following languages: Python, R, Julia, Matlab or others.