

ARTIFICIAL INTELLIGENCE

DM 630/Masera Engineering Group - ARTificial Intelligence for STructural end Infrastructural design (ARTISTI)

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| Context of the research activity | <p>The project aims to integrate artificial intelligence (AI) into structural and infrastructural design. The key goals are in developing advanced AI techniques using machine learning (ML) and generative AI for optimizing structures and materials, predicting structural performance, and improving safety. A specific focus is on parametric design using generative algorithms for design support in both preliminary and detailed phases. The impact would be in achieving a significant improvements in the efficiency and safety of structures with long-term economic and social benefits.</p> <p>Progetto finanziato dal PNRR a valere sul DM 630/2024 - CUP: E14D24002330004</p> |
| | <p>Artificial intelligence (AI) is a wide-ranging branch of computer science concerned with building smart machines capable of performing tasks that typically require human intelligence. AI wants to see if the answer to Alan Turing's question is a resounding yes.</p> <p>Although the increase in knowledge has shown to numerous branches in recent decades, structural engineering was born before the development of many modern sciences. Modern structural engineering was conducted over two centuries ago and used the first mathematical physics applications to analyze structures. The development of specific analysis and calculation methods for a wide range of structural problems has allowed over the last two hundred years to revolutionize the world of construction, be it tall buildings, bridges, or towers. What the community currently perceives as a "mature" technology is, in fact, the result of a development in the methods of designing and using materials that have revolutionized our cities and all infrastructural systems. The long history and the development of well-established analysis methods for design have made civil engineering hardly permeable to new approaches different from those based on traditional</p> |

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| Objectives | <p>physics-mathematical formulations. Over the decades, techniques have been defined that allow us to analyze a wide range of problems, although approximate.</p> <p>Artificial-intelligence-based solutions can often provide valuable alternatives for efficiently solving problems in the Structural Engineering.</p> <p>The research project titled "ARTificial Intelligence for STructural end Infrastructural design" (ARTISTI) aims to integrate artificial intelligence (AI) into structural and infrastructural design.</p> <p>ARTISTI aims to develop innovative solutions for the design and monitoring of structures and infrastructure using advanced artificial intelligence techniques based on ML and Generative AI. The main aim is focused on optimizing structures and materials, predicting structural performance and improving safety.</p> <p>The project plans to use machine learning and data analysis algorithms to collect and interpret relevant information. These algorithms are designed to identify patterns in structural and infrastructure data, allowing potential problems to be predicted and mitigated before they occur.</p> <p>At the same time, generative algorithms (GANs, Transformers etc.) are expected to be used to develop design support systems in both preliminary and detailed design development.</p> <p>The solutions developed in the context of ARTISTI can be applied in various fields including civil engineering and retrofitting of existing structures. For example, AI can help design more earthquake-resistant buildings or monitor the state of bridges and roads in real time to prevent collapse.</p> <p>These techniques will involve the integration within optimization frameworks of structural cost, economic and environmental impact indicators evaluated on the basis of Life-Cycle-Cost (LCC) and Life-Cycle-Assessment (LCA) methodologies</p> <p>The project involves collaboration between universities, research centers and design companies in the structural sector that are Masera Engineering Group srl and Speri srl. Additionally both domestically and internationally collaborations are planned during the phd</p> <p>The expected impact is a significant improvement in the efficiency and safety of structures, with long-term economic and social benefits.</p> |
| Skills and competencies for the development of the activity | <p>Structural analysis and design, mathematics and materials mechanics, basics of programming and coding in python, MATLAB or other general scientific languages.</p> |