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Exploring the usefulness of available experimental data: a machine learning-focused approach to predicting seismic capacity

by

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Venue:	GC G1 515 (Map)
Language:	English

Abstract

A fundamental understanding of the knowledge that can be gained from data-driven models within the realm of civil engineering will have a translational impact on the analysis, design, maintenance, and construction of civil infrastructure. With models firmly grounded in real-world data, material and structural properties and behavior can be precisely predicted from each other without computationally expensive analytical or empirical evaluations. Moreover, by integrating data-driven and physics-based models, transformative insights into the behavior of materials and structures their relation to one another can be discovered, actuating next-generation modeling approaches, experimental methods, empirical relations, designs, and construction methods. With the recent rapid development of machine learning (ML) techniques, various ML based approaches have been successfully applied in the general realm of structural engineering and have been validated as effective in reproducing accurate and robust results from experimental tests. In this presentation, a general framework for data-driven understanding of structural performance will be demonstrated and two novel machine learning models aimed at predicting the shear capacity and overall performance of reinforced concrete (RC) columns under reversed cyclic loading will be introduced. An exploration of various existing machine learning models and their application and suitability within the realm of civil engineering (CE) will be discussed, demonstrating the significant potential impact machine learning approaches could have on conventional CE methods and practices. Furthermore, a comprehensive comparison of the novel machine learning approaches with traditional empirical and modeling approaches popularly used in the field.

About the speaker

Dr. Paal is a tenure-track Assistant Professor in the Zachry Department of Civil Engineering at Texas A&M University. She joined the faculty at Texas A&M in the Fall of 2016 after completing a three year post-doctoral fellowship in the School of Architecture, Civil and Environmental Engineering at the École Polytechnique Fédérale de Lausanne (EPFL). She received her Master's and Doctoral degrees in Civil Engineering from the Georgia Institute of Technology in Atlanta, Georgia in 2011 and 2013, respectively. Additionally, she received a B.S. in Architectural Engineering from the University of Texas at Austin in 2011.

Dr. Paal has extensive background knowledge and expertise in machine vision and machine learning and applications of these technologies in infrastructure and structural condition assessments and other infrastructure-related practices. Her research focus is on mitigating the effects of natural and man-made disasters on our built infrastructure by integrating traditional civil engineering practices with emerging techniques and technologies such as machine vision, machine learning, augmented reality, unmanned aerial systems, and additive manufacturing. Her current research interests are towards machine vision and machine learning applications in civil engineering design, analysis, and evaluation operations and developing advanced modeling approaches grounded in real-world data. She teaches classes on 'Structural Analysis' and 'Structural Dynamics' at Texas A&M University, and recently introduced a new graduate course on 'Machine Intelligence and Applications in Civil Engineering' to the Civil Engineering graduate program. This course focuses on both machine vision and machine learning within the realm of civil engineering. Her research has been supported by numerous state and federal agencies such as the National Cooperative Highway Research Program, Texas Department of Transportation, the National Association of Home Builders, and the National Science Foundation.

For more information, kindly visit the IMAC seminar website or contact
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