

WOODHEAD PUBLISHING SERIES IN CIVIL AND STRUCTURAL ENGINEERING



**INTERPRETABLE MACHINE LEARNING  
FOR THE ANALYSIS, DESIGN, ASSESSMENT,  
AND INFORMED DECISION MAKING  
FOR CIVIL INFRASTRUCTURE**



**Edited by  
M. Z. NASER**

# **Interpretable Machine Learning for the Analysis, Design, Assessment, and Informed Decision Making for Civil Infrastructure**

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Woodhead Publishing Series in Civil and  
Structural Engineering

# Interpretable Machine Learning for the Analysis, Design, Assessment, and Informed Decision Making for Civil Infrastructure

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# Preface

The civil and environmental engineering field is undergoing a transformative shift as the integration of machine learning revolutionizes how we approach the analysis, design, assessment, and decision-making processes for civil infrastructure. With the cascading impact of extreme loading conditions and environmental challenges on our built environment, the need for innovative, interpretable, and data-driven solutions has never been more apparent. It is within this context that *Interpretable Machine Learning for the Analysis, Design, Assessment, and Informed Decision Making for Civil Infrastructure* emerges as a timely and essential contribution to the field.

This edited volume brings together a diverse and accomplished group of researchers and practitioners who share their expertise and insights into the applications of machine learning in our domain. The chapters encompass a wide range of topics, from the practical application of Generative Adversarial Networks in the design of shear wall structures to the use of deep learning for damage inspection of concrete structures. The book also delves into explainable machine learning, exploring methods for evaluating damage to structures and predicting the behavior of structural members.

As we navigate the complexities of smart building fire safety design, large-scale evacuation, and dynamic maintenance scheduling for thermal energy storage chiller plants, the role of machine learning becomes increasingly evident. The potential of these technologies to enhance our understanding of road transport infrastructure, monitor liquefaction potential, and harness benchmark testing data for spalling detection is explored in depth within these pages.

The overarching goal of this volume is to provide the readers with a comprehensive understanding of the current state of machine learning and to inspire further research and innovation in this rapidly evolving field. Each chapter serves as both a valuable resource and a source of inspiration for engineers, researchers, students, and professionals seeking to leverage the power of machine learning to address the multifaceted challenges of civil infrastructure.

The journey of creating and publishing *Interpretable Machine Learning for the Analysis, Design, Assessment, and Informed Decision Making for Civil Infrastructure* has been both rewarding and educating. With immense gratitude, I acknowledge the many individuals and organizations that have contributed to the successful completion of this volume.

First and foremost, I would like to extend my sincere appreciation to all the contributing authors for their exceptional work and dedication to advancing civil and environmental engineering through the integration of machine learning. Their expertise, insights, and commitment to excellence are reflected in each chapter, and their contributions have been instrumental in shaping this volume into a valuable resource for the engineering community.

I am deeply grateful to Elsevier for their unwavering support and guidance throughout the publication process. Special thanks are due to John Leonard and Gwen Jones for their outstanding support and collaboration. Their meticulous attention to detail, editorial expertise, and constructive feedback has been instrumental in ensuring the quality and coherence of this volume.

I would also like to acknowledge the broader engineering and academic community for their continued interest and engagement in the field of machine learning for civil infrastructure. Through the collective efforts of researchers, practitioners, educators, and students, we continue to push the boundaries of innovation and make meaningful contributions to society.

Finally, I extend my heartfelt gratitude to my colleagues, friends, and family for their encouragement and support throughout this endeavor. My colleagues and I hope that *Interpretable Machine Learning for the Analysis, Design, Assessment, and Informed Decision Making for Civil Infrastructure* will serve as a catalyst for continued exploration, collaboration, and discovery in this dynamic and rapidly evolving field.

M.Z. Naser  
Clemson, SC (2023)