

Computer Vision for Automating Civil Infrastructure Inspections



Dr. Vedhus Hoskere

Assistant Professor

Department of Civil and Environmental Engineering
University of Houston

(Dr. Hoskere's lab website: <https://sail.cive.uh.edu/>)

Abstract

Current practices for inspection of civil infrastructure involve visual assessments conducted by trained inspectors. Most guidelines for inspections require the identification of multiple damage types and describe evaluating the significance of damage based on the associated structural component and location. Thus, the inspector utilizes knowledge about the world, the structure, and the damage types to make visually-informed decisions. These inspections are typically high-risk, time consuming and laborious. The availability of unmanned aerial vehicles (UAVs) for data acquisition coupled with advances in deep learning for data-processing offer the possibility of increased autonomy in the inspection process. A central task is to develop algorithms that can automatically extract visual information about damage and present them in the necessary context to reduce the burden on inspectors. Such algorithms can have multiple applications ranging from post-disaster inspections where time is of the essence, to routine inspection of structures that are large in area or number. In this seminar, I present a framework to extract actionable information from images of damaged structures using a combination of a series of deep neural networks and geometrical computer vision methods. I demonstrate the proposed framework with application to post-earthquake inspections using data I acquired after 2017 Central Mexico earthquake in Mexico City. In the second part of the talk, I investigate the potential benefits of using computer-generated imagery (CGI) from physics-based graphics models to further improve the inspection process. I demonstrate the benefits of using physics-based graphics models taking the specific example of inspections of inland navigation infrastructure managed by the US Army Corps of Engineers.

Speaker Biography

Dr. Vedhus Hoskere is an Assistant Professor in the Department of Civil and Environmental Engineering at the University of Houston (UH) and holds a joint appointment in Electrical and Computer Engineering. Dr. Hoskere received his Ph.D. in Civil Engineering in 2020, after an MS in Computer Science in 2020, and an MS in Structural Engineering in 2016, all from the University of Illinois at Urbana-Champaign. At UH, Dr. Hoskere is the Director of the Structures and Artificial Intelligence Lab. (<https://sail.cive.uh.edu/>) Dr. Hoskere's research interests are interdisciplinary, at the intersection of structural engineering, machine learning, computer vision, and robotics. His doctoral work focused on developing artificial intelligence, machine learning and computer vision solutions for rapid and automated civil infrastructure inspection and monitoring. His research at UH looks at building on his prior experience to develop systems for autonomous infrastructure management including incorporation of physics-based modelling, autonomous robotic data acquisition, deep learning-based data to decision frameworks, and autonomous robotic manipulation systems for infrastructure repair. Dr. Hoskere has published 14 journal papers and 29 conference papers. Dr. Hoskere has received awards for his research at prestigious avenues including "best poster" at SHMII-9 and "best paper" at the ASCE EMI Conference.