The Department of Civil and Environmental Engineering at the University of Houston presents...

CIVE 6111 Graduate Seminar

AI Inspector: Developing autonomy in structural inspections through computer vision and graphics

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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.

Bio
Vedhus Hoskere is an Assistant Professor in the Department of Civil and Environmental Engineering at the University of Houston. He received his PhD in Civil and Environmental Engineering and an MS candidate in Computer Science from the University of Illinois, Urbana-Champaign. His research is mainly focused on developing artificial intelligence, machine learning and computer vision solutions for rapid and automated civil infrastructure inspection and monitoring. For his work toward automated post-earthquake building inspections, Dr. Hoskere received the Liu Huixian Earthquake Engineering Scholarship in 2018. He received the Will K. Brown Endowment Scholarship from the University of Illinois to visit Mexico City immediately after the September 2017 earthquake, where he collected data from aerial surveys at several damaged buildings. Dr. Hoskere also works with the US Army Corps of Engineers to develop solutions for automated inspections and monitoring of navigational locks and dams using computer vision and machine learning. Dr. Hoskere has won multiple awards for his work including “best poster” at SHMII-9 and “best paper” at the ASCE EMI Structural Health Monitoring and Control competition.