

Visual Analytics and Human-Machine Collaborative Remote Assessment Approach for Infrastructure Management

Jongseong Brad Choi¹

¹Department of Mechanical Engineering, The State University of Now York, Korea, Republic of Korea

Images have become a ubiquitous and efficient data form to record information. Use of this option for data capture has largely increased due to the widespread availability of image sensors and sensor platforms (e.g., smartphones and drones), the simplicity of this approach for broad groups of users, and our pervasive access to the internet as one class of infrastructure in itself. Despite recent advances in computer vision and machine learning techniques extracting information from an image, automation of these real-world tasks has been limited thus far. This is partly due to the variety of data and the fundamental challenges associated with each domain. Due to the societal demands for access to and steady operation of our infrastructure systems, this class of systems represents an ideal application where automation can have high impact. Extensive human involvement is required at this time to perform everyday procedures such as organizing, filtering, and ranking of the data before executing analysis techniques, consequently, discouraging engineers from even collecting large volumes of data. In this dissertation, big visual data collection and analysis methods are developed with the goal of reducing the burden associated with human manual procedures. The automated capabilities developed herein are focused on applications in lifecycle visual assessment and are intended to exploit large volumes of data collected periodically over time. To demonstrate the methods, various classes of infrastructure, commonly located in our communities, are chosen for validating this work because they: (i) provide commodities and service essential to enable, sustain, or enhance our lives; and (ii) require a lifecycle structural assessment in a high priority. However, this research can be adapted to many other applications where monitoring and maintenance are required over their lifecycle.