Automatic Vision Based Probabilistic Condition Assessment of Bridges

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Problem Statement

Uncertainties associated with sensing technologies, sensing environments, modeling and detection can impact condition assessment

Research Vision

Uncertainty Representation Model, NBE Defect Specification – BrIM
- Enriched as-is BrIM with defect and uncertainty details
- Extract defect and uncertainty quantities
- Tag the quantities with BrIM elements

Defect identification and quantity estimation
- Analyzed with respect to condition

Research Objectives

1. Determine a methodology to represent (at defect-level, element-level and system-level) and account for different types of uncertainties arising due to data collection, pre-processing and modeling
2. Determine a technique to translate information from images and laser scans into condition ratings; identify existing uncertainties with reasonable precision and recall, as well as accurately quantify identified uncertainties
3. Determine under what conditions does probabilistic assessment work better than deterministic approaches by leveraging information from images/scans and data capture context

Research Method

1. Case studies using real bridge (scan and image data + 3D model) and with simulated data
2. Prototype development and testing to incorporate uncertainty representation model and reasoning mechanism to deal with uncertainty accumulation
3. User studies – To generate ground truth for validating probabilistic reasoning mechanisms