Image localization for computer-enhanced visual inspection of civil infrastructure

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Low-cost, high-performance vision sensors are providing new avenues for achieving autonomous visual inspection in our infrastructure when used in conjunction with aerial sensing platforms. Large volumes of images may rapidly be collected to enable computer-enhanced visual inspection.

Spatial and temporal limitations can be removed in the human-based inspection process. Although researchers have explored several algorithms and techniques for vision-based inspection in recent decades, past implementations are limited in their ability to deal with a high volume of images while only a small fraction of them are important for actual inspection. Because processing irrelevant images can generate a significant number of falsepositives, automated visual inspection techniques should be used in coordination with methods to localize relevant regions on the images. When combined, computer-enhanced visual inspection will be able to meet the objectives and quality of human visual inspection. Here we develop and validate a novel image localization technique to automatically extract regions of interest (ROIs) on each of the images before utilizing vision-based damage detection techniques. ROIs are the portions of an image that contain the physical region of the structure that are more vulnerable and need visual interrogation, denoted as the targeted region of interest (TRI). ROIs are determined using the geometric relationship between each image collected and the TRIs. Analysis of the most highly relevant and localized images would enable efficient and reliable visual inspection. We successfully demonstrate this technique for the extraction of the ROIs on a full-scale highway sign structure. Here the welded connections serve as the TRIs.

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