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Estimating Human Weight from Video on Pedestrian Suspension Bridges

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ABSTRACT

Pedestrian weight is a critical factor in structural health monitoring (SHM) of pedestrian suspension bridges, influencing both safety and long-term performance. Accurate weight estimation is essential for system identification, which has traditionally relied solely on structural response data, thereby limiting the accuracy of input loads. This study proposes a vision-based approach to predict pedestrian weight using RGB video data, offering a non-contact alternative to conventional sensors.
The proposed method consists of two main steps. In Step 1, body dimensions are extracted from video frames using human parsing and 2D skeleton estimation techniques. These features are used as predictors in a regression model trained with the 8th Korean Anthropometric Survey dataset using the XGBoost algorithm. In Step 2, to estimate 3D skeletons from the 2D skeletons, a temporal-aware model, MotionBERT, is utilized. The predicted 3D skeletons are then applied to inverse dynamics to calculate body weight distribution.
The predicted weight can serve as input data for system identification, enabling indirect monitoring of pedestrian-induced dynamic loads. By providing accurate input information, the proposed approach enhances the reliability of SHM while eliminating the need for physical sensors. This offers a cost-effective and scalable solution for real-world applications on pedestrian bridges. Integrating vision-based weight prediction into SHM systems can advance infrastructure monitoring toward more resilient and efficient practices.

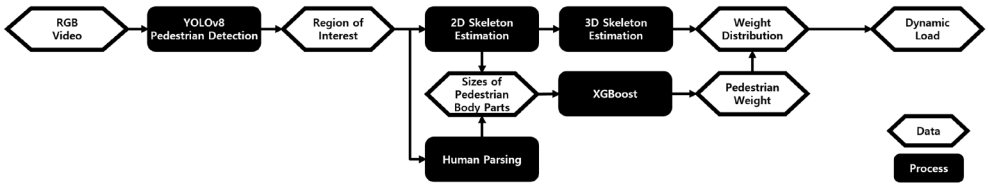

Fig. 1 Overview of the Proposed Framework

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