

A New Inspection Technique For Deformation And Crack Analysis In Shield Tunnels

Yifei LIU, Asif AHMED, Wei SONG, Yihai BAO, Xian LIU

Due to the complex construction conditions and long-term deteriorating factors throughout their service life, shield tunnels may experience performance degradation, including large deformation and developments of defects (e.g., cracks). An essential objective of tunnel inspection is to obtain critical information on structural deformation and defects, allowing precautionary safety measures to be taken. Currently, three-dimensional laser scanning and close-range photogrammetry are the most frequently used techniques for tunnel inspection. However, few devices are capable of combining these two techniques. In this study, an automated device was designed, based on the laser triangulation method, to obtain both point clouds and images from shield tunnels. Then, a random sample consensus (RANSAC) based machine learning method was applied to analyze the structural deformation using the point cloud data; and, a computer vision-based machine learning method was used to identify cracks in shield tunnels. The results demonstrate that, (i) the newly developed device with laser triangulation method is capable of obtaining both point clouds and images with considerable accuracy; and, (ii) machine learning-based methods have been successfully applied in the identification of structural deformation and defects in shield tunnel structures, from the obtained point clouds and images.