An Automatic Method for Matching 2D ADS40 Images onto a 3D Surface Model

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Abstract
An automatic method is developed here to paste aerial images onto an urban 3D surface model for more realistic visualization. In this study we extracted different side views of urban constructions from an aerial image acquired with an airborne linear scanner sensor. We then matched those sideview images onto a 3D surface model according to the correspondence between the image and model. Side view feature extraction from images and matching those features to 3D models are two key steps in developing an automatic 3D image modelling technique. Here we present a new line-extraction approach using a multiple-level feature filter, which consists of the following: a Canny edge detector, an edge phase filter, an edge direction filter with fault tolerance, a Hough transformer, and a neighbouring line-segment fuser. We propose a base-line segmentation and parallelogram extraction algorithm based on perceptual organization. The algorithm employs uncertainty reasoning and is based on part forms for shape expression. It is computationally less intensive and noise free. Matching 2D images to 3D models requires finding a transformation matrix to minimize error. A lot of algorithms have been presented to solve the matching problem. However, there is still no good solution to the problem as it has too many unknown parameters. In this research, we first project images based on the camera model after a partial matching between the extracted parallelogram and the 3D model is carried out. Then, the Hausdorff distance is calculated between edges in the original image and the projected image, based on which sideview feature mapping is realized to obtain 3D virtual views based on a 3D surface model and a 2D image.
Keywords
3D model, ADS40 image, Feature extraction, Feature matching