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Road Network Extraction from High Resolution Airborne Digital Camera Data

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Abstract

Most road network extraction algorithms developed are based on linear analysis methods. These methods involve search of edges through edge filtering, morphological filtering, or gradient modelling. As image resolution increases from 10-30 m to 0.5-2 m, road networks will appear to be narrow areas rather than thin lines. This becomes a challenge for traditional linear analysis methods based on mask operations but creates an opportunity for classification based methods. We experimented with an advanced linear analysis, gradient direction profile analysis, and a few classification algorithms including a maximum likelihood classification, clustering and a contextual classifier for road network extraction using airborne digital camera data acquired over Livermore, California with approximately 1.6 m spatial resolution.

Results indicate that both the linear extraction and image clustering algorithms worked reasonably well. The linear extraction method requires some preprocessing such as filtering of the original image. Best road network results have been obtained by applying the linear extraction algorithm to a morphologically filtered image that was generated by combining the near infrared (NIR) and red (R) image bands through NIR/R+NIR. With this method, the correctly extracted road pixels account for 78.7% of the total road pixels obtained from image interpretation with field verification. The image clustering method resulted in 74.5% correctly extracted road pixels. The contextual classification resulted in relatively noise-free road networks in new residential areas but omitted some roads at older residential areas. When experimenting with the images resampled at approximately 3 m and 5 m resolution, the best overall accuracies for road extraction decreased to 74.6% and 61.6%, respectively.