

Proceedings of the tenth International Conference of the African Association of Remote Sensing of the Environment, University of Johannesburg, South Africa, 27-31 October 2014

Improving settlement type classification of aerial images

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ABSTRACT

The rapid increase in population and migration to urban areas has caused a pronounced increase in human settlements around the world. The diversity of land features, mixed-use settlements, terrain, and heterogeneity of building materials and neighbourhood structure limit the use of a fixed set of indicators to identify these areas. In many parts of the developing world, census and socio-economic data are severely lacking, outdated, or not collected at neighbourhood scales. Using remote sensing data, an automated method can be used to help identify human settlements in a fixed, repeatable and timely manner. The main contribution of this work is to improve generalisation on settlement type classification of aerial imagery. Images acquired at different dates (multitemporal imagery) tend to exhibit pronounced viewing- and illumination geometry effects, which result in a poor generalization performance in settlement type classification tasks. The study investigated the influence of contrast in settlement type classification tasks by measuring classification accuracies using Local Binary Patterns without contrast measures and with local contrast measures (denoted as the extended LBP or LBP/VAR). This was achieved by recognizing fundamental properties of local image texture, i.e., a combination of structural and statistical approaches: the local binary pattern detects micro structures (e.g., edges, lines, spots, flat areas) while variance measures detect the underlying local contrast distribution. The extended LBP method was evaluated using a support vector machine classifier for cross-date (training and test images acquired at different dates) and same-date analysis. The extended LBP results showed strong spatial and temporal generalisation ability thus we can conclude that adding local contrast measures can significantly improve the classification of human settlements from aerial images.