Automated Processing Techniques for the generation of a National Forest Plantation Mask for 1972 using Historic High Resolution Imagery from Corona, Aerial Photography and Landsat MSS.

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In 1972 an act was passed in the South African parliament requiring forestry companies to obtain afforestation permits for any areas to be newly planted. The Department of Water Affairs and Forestry is currently populating a database with areas under plantation forestry pre 1972, to access the legality of current operations. The CSIR Satellite Applications Centre has been requested to provide this information. The challenge was to achieve the acquired mapping accuracy for an analysis scale of 1:50 000 under the given time and budget constraints.

The only imagery available for the given time period 1972 -5 years +3 years consists of aerial photography, Landsat MSS imagery and declassified Corona satellite imagery. This data needs to be geometrically and radiometrically corrected and classified using semiautomatic procedures to adhere to the given budget constraints.

This paper presents the automated geometric correction techniques applied to historic analogue aerial photography scanned at low resolutions (300 dpi) with little information on the camera model. With rough exterior and interior sensor orientations derived from flight-plans, imagery is stitched together using automated tie point collection which improves the exterior orientation after a bundle block adjustment. This then enables the orthorectification and mosaicking of imagery to provide a seamless product. Declassified Corona imagery as obtained from the USGS with a spatial resolution of 20 – 30 feet has unknown interior and exterior orientation parameters. Rational polynomial coefficients are calculated for this data collecting ground control points (GCPs) in a semiautomatic procedure from orthophotos acquired in the late 1990s. Landsat MSS imagery is geometrically corrected in a similar fashion with an additional georeferencing iteration using polynomial splines to get an acceptable fit.

All multispectral imagery is radiometrically normalised matching spectral signatures to land cover types and spatially fused to provide an image layer suitable as input for image segmentation in Definiens software. Aerial photography is radiometrically normalised using an moving window approach and a reference image as proposed by Tuomininen & Pekkarinen (2004). Multitemporal MSS scenes are used to discriminate clear felled forestry plantation areas and permanently not afforested areas. Tasselled Cap (Crist and Kauth 1986) parameters calculated for MSS imagery provide a normalised information layer suitable for automatic classification. A rule base is developed in Definiens Software to provide an

automated classification using spectral ratios and texture to generate a forest mask. Accuracy assessment is undertaken using visual interpretation of aerial photography in a stratified sampling design.

References:

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