Extraction of human settlement data using SPOT 6 satellite imagery

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OVERVIEW OF SANSA

SANSA’s mandate

“...provide for the promotion and use of space and co-operation in space-related activities, foster research in space science, advance scientific engineering through human capital, support the creation of an environment conducive to industrial development in space technologies within the framework of national government policy...”
EARTH OBSERVATION ACQUISITION

- Direct reception
  - SPOT 5, 6, 7
  - Landsat 7, 8
  - MODIS
- Archive
  Dated back to 1972, Including Landsat, SPOT, SumbandilaSat
INTRODUCTION

- South Africa and other countries in Africa are experiencing land degradation at alarming rates due to unsustainable land use, agricultural practices, deforestation, *rapid urbanizations* and population pressures amongst other causes.
- In developing countries, urban population growth has exceeded the capacity of the cities to provide adequate basic services due to lack of understanding of current and future urban patterns.
- The proportion of people living in urban areas in South Africa increased from 52% in 1990 to 62% in 2011.
- Smaller towns are experiencing the highest growth rates in South Africa owing to a growing economic activity.
- Understanding urban spatial growth is critical for sustainable urban infrastructure and service planning.
INTRODUCTION

• Remote sensing provide the capability to map human settlement development over larger areas

• Advancement in remote sensing technology provides high spatial and temporal resolution imagery required:
  – detail urban growth assessment
  – extraction of information required in the management of urbanisation

Available high resolution satellite imagery for human settlement mapping

• SANSA acquires SPOT imagery through government multi-user agreement
  – SPOT 6 & 7: 2013– now
Human settlement developments observed from SPOT 5 imagery

Human settlement development impact:
- Natural environment
- Services
Need for accurate up-to-date human settlement data

Applications
- Administration boundaries
- Assess service demand and forecast
- Settlement/urban growth trends
- Assess impact of settlement development on the environment
- Support census planning
- Link demographic data spatially
...

Projects
- Informal settlement upgrade
- Rural development
- Infrastructure development
- Service delivery
- Environmental management

Goals
- Job creation
- Economic development
- Poverty alleviation

Sustainable Human settlements
National human settlement data extraction projects

SPOT Building Count

Settlement boundaries: Administrative boundaries, village layer, Informal settlements, EA

land cover/use

Methods:
- Manual digitisation
- Pixel based classification
EXTRACTION OF HUMAN SETTLEMENT DATA FROM SPOT 5

• Objective
  – Automatically extract human settlement data from SPOT 5

• SANSA-JRC collaboration
  – Customisation of GHSL system
  – 2012 layer was developed
  – Methodology is currently being finalised
  – The application of the layer is currently being evaluated by users
FLOOD PREPAREDNESS
EXTRACTION OF HUMAN SETTLEMENT DATA FROM SPOT 6

- Objective
  Develop methodology to (semi) automatically extract human settlement data using SPOT 6

- Current study area
  Pretoria, South Africa

Date of acquisition: 2013-03-17
Pan: 1.5m
Multispectral: 5m
STUDY AREA

New development

Industrial

Smallholdings

Dense-formal

Informal

CDB: High rise buildings

Formal residential

Rural
METHODOLOGY

Image pre-processing

image sub-setting

Segmentation

Classification

Non-Built-up
  Radiometric values

Building structures
  Morphological properties

Erdas Image

Definiens
Results

Original image

Dense formal/township

Informal settlement
Results

Original image

Informal
Results

Original image  township

Transformed
Results

Original image

New development

Results

Dense formal/township

Industrial
Results

Pretoria- CBD

Results
Results

Original image

Human settlement data
Results

Smallholdings
CONCLUSION

- The current methodology (SPOT 6) produces acceptable results
- Need to perform a thorough assessment of the results
- Improvement will be done using other morphological parameters
- Methodology needs to be:
  - tested over a larger area, full scene
  - integrate existing SA-GHSL algorithms or vice versa
- Quality assurance to be done
- Create historical maps using SPOT 6/7
- Create awareness on the use of the product
Thank you
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