Remote Sensing for Slum Mapping and Characterization in sub-Saharan African Cities

Towards scalable and transferable slum mapping

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Rationale

- About 1 billion people in the world are slum dwellers (30% of urban population)
- In sub-Saharan Africa, slums keep growing
- Spatial data on slums are needed at different levels
  - International level: SDG 11 + New Urban Agenda (UN) ‘By 2030, ensure access for all to adequate, safe and affordable housing and basic services, and upgrade slums’
  - Local level: City planning and slum upgrading programs
  - Community level: Local communities and NGOs
- But data often incomplete, outdated, and/or inconsistent
  - Slum dwellers are excluded from the benefits of urbanization
- Assessment of the potential and limitations of EO to tackle this issue
Case studies

+ 1 secondary city (likely Kisumu, Kenya)
Main objectives

- Developing methods for
  - producing citywide slum maps
  - characterizing slums

- Assessing the contribution of imagery with different spatial and spectral resolutions

- Evaluating their cost-efficiency (costly VHR is not necessarily the optimal solution)

- Designing SoA scalable methods based on FOSS

- Assessing their transferability across several case studies

- Formulating recommendations on the most suitable methods, tools and data
Citywide slum mapping

- S2 (full band set and subsets) & Spot 6/7 (1.5m and resampled to 5 m)
- Evaluating contribution of S1 (cloud cover)
- Pixel-based approach as a starting point – OBIA will be tested
- Machine learning for producing slum probability maps
Slum environment characterization

- Comparing different spectral resolutions
  - WorldView-3 (30cm) 8 XS + 8 SWIR vs. 4 XS (VIS NIR)

- Comparing different spatial resolutions
  - WorldView-3 (30cm) 4 XS bands (VIS NIR)
  - SPOT 6/7 (1.5m)
  - SPOT 6/7 (resampled to 5m)

- OBIA approach

- Challenges: Computational optimization and transferability

- Producing a set of indicators relevant to stakeholders
  (road network, roof materials, built-up density, distance between structures, …)
OBIA toolchain

- Build on toolchain developed by ULB (MAUPP and REACT projects), to be adapted and extended
  - Specifically designed for handling large datasets
  - Performs parallel computing
  - Includes local unsupervised segmentation optimization
  - Computes and selects features for each segment
  - Classifies using ML algorithms (such as Extreme Gradient Boosting or Random Forest)

Source: Grips, 2017
- Outcomes summarized in compendium
- Most suitable scalable and transferable methods for mapping slums in sub-Saharan Africa
- Taking into account cost-benefits and user requirements

Open-access tool for science-based slum policy-making
SLUMAP

http://slumap.ulb.be/

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