Modelling urban growth and socio-economic and health inequalities in Sub-Saharan African cities

VERY-HIGH RESOLUTION (FINE-SCALE)
Land-cover maps
Land-use maps
Population density maps

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Land cover vs. Land use

- **Land cover**
  ‘the observed biophysical cover of the earth’s surface’

- **Land use**
  ‘the purpose for which an area of land is being used, such as residential, agricultural, commercial, retail, or industrial’

(source: Oxford Reference)

Often mixed but should be mapped apart
Data and processing chain
Very-high resolution remote sensing

Pléiades (Airbus D&S)
0.5 m spatial resolution
Tristereo
VNIR

Dakar
Semi-Automated Processing Chain

- Development of a semi-automated processing chain to produce maps
- Open source
- Python used to chain Grass GIS and R commands

Article
An Open-Source Semi-Automated Processing Chain for Urban Object-Based Classification
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Land cover – step 1

- Segmentation Parameter optimization
  - Automated process for optimising the segmentation parameters (local optimisation due to high diversity)
  - Objective: avoid under- or over-segmentation
  - Image segmentation into groups of pixels (objects)

OVER-SEGMENTATION  UNDER-SEGMENTATION

Projection: WGS 1984 / UTM zone 30N (EPSG: 32630) © DigitalGlobe, Inc. All Rights Reserved
Land cover – step 2

- Segmentation
  - Statistics computed for each object
    - Geometrical (shape, area, compactness)
    - Spectral (VNIR, NDVI)
    - nDSM
    - Textures
Land cover – step 3

- Classification
  - Random Forest classifier
  - Classification of all the objects

![Map of land cover classification](image)
Land use – step 1: Partition of the city into blocks

Use of OSM

Lines
- Roads, tracks
- Rivers
- Limits
- ...

Polygons
- Residential areas
- Parks
- Water bodies
- Cemeteries
- Military camps

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Land use – step 1: Partition of the city into blocks

- Result refined with GIS commands (removing spurious polygons due to overlaps)
Land use - Step 2: Landscape metrics derived from each block

- Landscape metrics are calculated for each city block, using the land-cover layer as input.

- Different levels:
  - Patch metrics (e.g., mean patch size, fractal index)
  - Class metrics (e.g., mean distance between patches of the same class)
  - Landscape metrics (e.g., proportion of each class)
Land use - Step 3: Classification of the city blocks

- Classification of the blocks using a machine learning (Random Forest) or rule-based approach.
Population density – method

Same method as for high resolution remote sensing data

Population density – prediction

Land Cover

0.5m resolution
Population density – prediction

Binary map
Presence of Built-up
Population density – prediction

First results

Grid cells 50m * 50m
Poverty and Malaria Mapping in SSA cities

- There is an important gap to fill in the study of poverty and disease in an intra-urban context
- Several RS covariates can help in addressing this task

**Very-High Resolution - Pleiades**

- Elevation, Land cover, Land use, Ratios, Indices (vegetation, wetness), Density, Distance, Landscape metrics...
Poverty Mapping

- Demographic Indicators predicted at the national level from Demographic and Health Surveys (DHS)

- Mainly moderate to low RS covariates used (i.e. MODIS LC and EVI, nightlights, aridity)

In **REACT** aiming for modelling intra-urban variations through VHR covariates and DHS surveys
Intra-Urban Malaria Mapping

- Intra-urban Malaria Prevalence in Dar es Salaam (Kabaria et al. 2016)
- Land Cover ratios as input with high-resolution RS products

VHR covariates can push beyond the state of the art further improving malaria predictions (Grippa et al. 2017)
References


