MESMA Of DESIS Data to Identify Rooftops in Kigali City

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Overview

- Introduction
- Methods
- Results
- Discussion
Introduction: Rapid Planning

- Future Megacities Research Program.
  → German Federal Ministry for Education and Research (BMBF)

**DEVELOP AND TEST**

- Trans-sectoral urban planning methodology.
  → Supply & disposal Infrastructure (Water, Waste and Agriculture)
Introduction: Rapid Planning

- DA NANG, VIETNAM.
- KIGALI, RWANDA.
- ASSIUT, EGYPT.
Introduction: Co-authors

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Introduction: Data

Institute of Optical Sensor Systems - DESIS DLR Earth Sensing Imaging Spectrometer.

EKUT, Geoinformatics group.
• Jakob Schwalb-Willmann.
   → Mesma function

RStoolbox made it to CRAN (bleutner.github.io)
Methods
Methods: Case Study

Mugiraneza et al. (2019)
Methods: Case Study

- Capital & biggest city of Rwanda.
- Total area: 730 km²

Mugiraneza et al. (2019)
Methods: Field Data.

- SR-3500 Spectroradiometer.
- 350-2500nm spectral range.
- UV/VIS/NIR/SWIR.

EKUT, Geoinformatics group.
• 15 Roof materials
• Different number of samples per material.
Methods: Field Data.

EKUT, Geoinformatics group.
Methods: Field Data.
Methods: Field Data.

- Preprocessing in R.
  → “Pavo”
  → “hsdar”
- Aggregate samples.
- 10 roof materials.
- Vegetation (hasel)
Methods: Building Types.

EKUT, Geoinformatics group.
Methods: Field Data.
Methods: Field Data.
Methods: Field Data.
Methods: EO Data.

- DESIS Image acquired in February 2020

EKUT, Geoinformatics group.
Methods: Multiple Endmember Spectral Mixture Analysis.

- Decompose spectral signature
- Mixed Pixel
  ➔ Several Endmembers
  ➔ Respective Abundances

Linear Spectral Unmixing (Image Analyst)—ArcGIS Pro | Documentation
Methods: Multiple Endmember Spectral Mixture Analysis.

- Well defined mixture.
- Single reflection of the illuminating solar radiation.

- Randomly distributed homogenous mixture.
- Multiple reflections of the illuminating radiation.

Methods: Multiple Endmember Spectral Mixture Analysis.

Spectral unmixing in R using RStoolbox | Jakob Schwalb-Willmann (schwalb-willmann.de)
RESULTS

10/5/2021

24
• Similar reflectance.
• Reduced Endmembers.
• Added Vegetation
• Metal bright.
Results

- Result for bright metals in Ndera sector of Kigali.

- (blue: 0%, yellow: 50%)

Ground map source: WorldView-3 from 04.08.2018
Results

- Root Mean Square Error.

- Measures the difference between values predicted by a model and the values observed.

- High distribution of errors between probabilities ranging from 0 to 0.05.
Results

- High density in Low probability.
- NNLS (Non-statistical)
- Threshold selection
- Validation.
THANK YOU

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