REMOTE SENSING FOR PARCEL BOUNDARIES

The 6th Land Administration Domain Model (LADM) Workshop

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Enschede, The Netherlands

Slides partly by Y. Wassie and D. Kohli
Remote Sensing for Parcel Boundaries

Only 30% of the world’s population has access to formal land administration systems to register and protect their land rights.

Mapping cadastral boundaries using traditional, field based methods often proves to be time, cost and labour intensive.
Remote Sensing for Parcel Boundaries

Technological development in photogrammetry, RS, computer vision, machine learning, robotics etc. provide opportunities for automatic feature identification.

NEW opportunities for the domain of fit-for-purpose LA especially where there are still large unmapped areas!

Remote Sensing

HRSI can be used as low-cost and up-to-date solutions for creation and upgrading of cadastral maps.


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Remote Sensing for Parcel Boundaries

HRSI for interpreting parcel boundaries did not require professionals to undertake the fieldwork!

The use of HRSI is estimated to cost 1/3 for rural and 1/5 for urban areas.

SOLUTION – for large unmapped areas with limited number of land professionals.

Automatically extracted from images visible cadastre boundaries can be printed in the office, then taken into the field and edited by communities.

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MSc. Yismaw Abera - Ethiopia

ITC Claims 3rd in European Commissions’ Copernicus Masters ‘Sustainable Living Challenge’

Towards Automated Detection of Visual Cadastral Boundaries

A team from ITC, including MSc alumni Mr. Yismaw Abera (Ethiopia), and Dr. Mila Koeva, and Dr. Rohan Bennett, claimed 3rd place in the European Commission’s (EC) and European Space Agency’s (ESA) Copernicus Masters ‘Sustainable Living Challenge’.
Remote Sensing for Parcel Boundaries

World View – 2 image
0.5 m. spatial resolution 2010

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Mean-shift segmentation plug-in in QGIS was selected for Remote Sensing for Parcel Boundaries.

**Segmentation** is a process of dividing the image into regions or objects of homogeneous pixel values.

- **a)** Testing image
- **b)** Result by canny edge detector
- **c)** Result by Mean-shift segmentation
- **d)** Result by LSD
Reference

Extracted

Reference + extracted

Quantitative assessment

<table>
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<th>Buffer width</th>
<th>Completeness</th>
<th>Correctness</th>
<th>Quality</th>
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<td>1m</td>
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<td>2m</td>
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Percentage of completeness, correctness and quality, 2m buffer width
Professional’s views

Interviews

- Boundaries in rural areas from HRSI are visible/extractable
- Benefits of the automatical methods during difficult weather conditions
- Even if 40% or 50% can be extracted automatically they will appreciate it and will use the others by other methods

However all interviewees underlined the importance of field verification.
Exploration of more methods in other countries

Divyani Kohli

- Ethiopia
- Ghana
- Kenya
- Mozambique
- Rwanda
- Guatemala
- Nepal

**Segmentation using Estimation of Scale Parameters (ESP) tool** - developed by Drăguţ et al. (2014) provides optimal scale parameters based on algorithm that calculates local variance in an image. The tool can be integrated and implemented in the eCognition® software and can be used to segment an image at three levels.

**Multi-resolution segmentation (MRS)** - the size of segments is controlled by the key parameters: scale, shape and compactness (Baatz and Schäpe 2000)
The extracted boundaries resulting from estimation of scale parameter (ESP) in eCognition® software
Extracted boundaries resulting from Multi-Resolution Segmentation
Remote Sensing for Parcel Boundaries

<table>
<thead>
<tr>
<th>Segmentation method</th>
<th>Detection Quality [%]</th>
<th>Localization Quality [%]</th>
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<tr>
<td></td>
<td>Error of Commission</td>
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<tr>
<td>ESP</td>
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Remote Sensing for Parcel Boundaries

Remote-sensing based methods for large-scale application provide fit-for-purpose solutions in land administration by cost-effective and speedy cadastral mapping.
Remote-sensing based methods for large-scale application provide fit-for-purpose solutions in land administration by cost-effective and speedy cadastral mapping.

Using New Technologies

A UAV, especially adapted to land administration activities awaits creation – as does software and worktows integrating UAVs with other land administration processes, including adjudication, demarcation, recording, and dissemination. UAVs and usage proliferated over the last 5 years; however, this proposal provides the private consortium partners the opportunity to adopt the tools to the rapidly emerging markets in sub Saharan Africa – and more globally. There exists no tool like the smart sketchmap in the domain on land administration: the concept is simply not conceived and is untested in the domain. The same applies to automatic feature extraction algorithms – existing approaches cover topographic features like roads or buildings in lower resolved images. These two tools could revolutionize land tenure data collection and analysis – radically reducing costs and time spent in the field. The Land Administration Domain Model (LADM) is now an ISO standard (ISO19152, and its software implementation, the Social Tenure Domain Model (http://www.sdtm.org)) is also open-access and open-source. In this regard, there exists the opportunity to tailor a standardized model for alternative land tenure recording in sub Saharan Africa. This exciting

Rwanda – New Era, New Norms, Keeping Up, and Up Keep

Ethiopia – Transforming Society, Ensuring Equality

Kenya – Sustaining Livelihoods, Conserving Environments
THANK YOU FOR YOUR ATTENTION