SSIP 2016
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Counting refugees tents from satellite images

Ssip 2016 team D

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Who we are?

1

Teaching each other!
Tutorial time

2

Counting refugee tents
on satellite imagery

2. Teaching each other

4 different nations, 4 different scientific backgrounds & levels of experience in programming

Python

MATLAB

Image Processing tutorial

GitHub

SSIP 2016 Team D

1. Initial project → Counting objects → Counting roofs

Oblique Aerial Imagery

Satellite (nadir) Aerial Imagery

Motivation (why we did this?)

Ifo 2: Dadaab refugee camp, Kenya

Counting objects (detect refugees tents) to estimate the no. of population/ refugee camp extension (development).

↓

Useful information for international organizations (NGOs)

State of the art

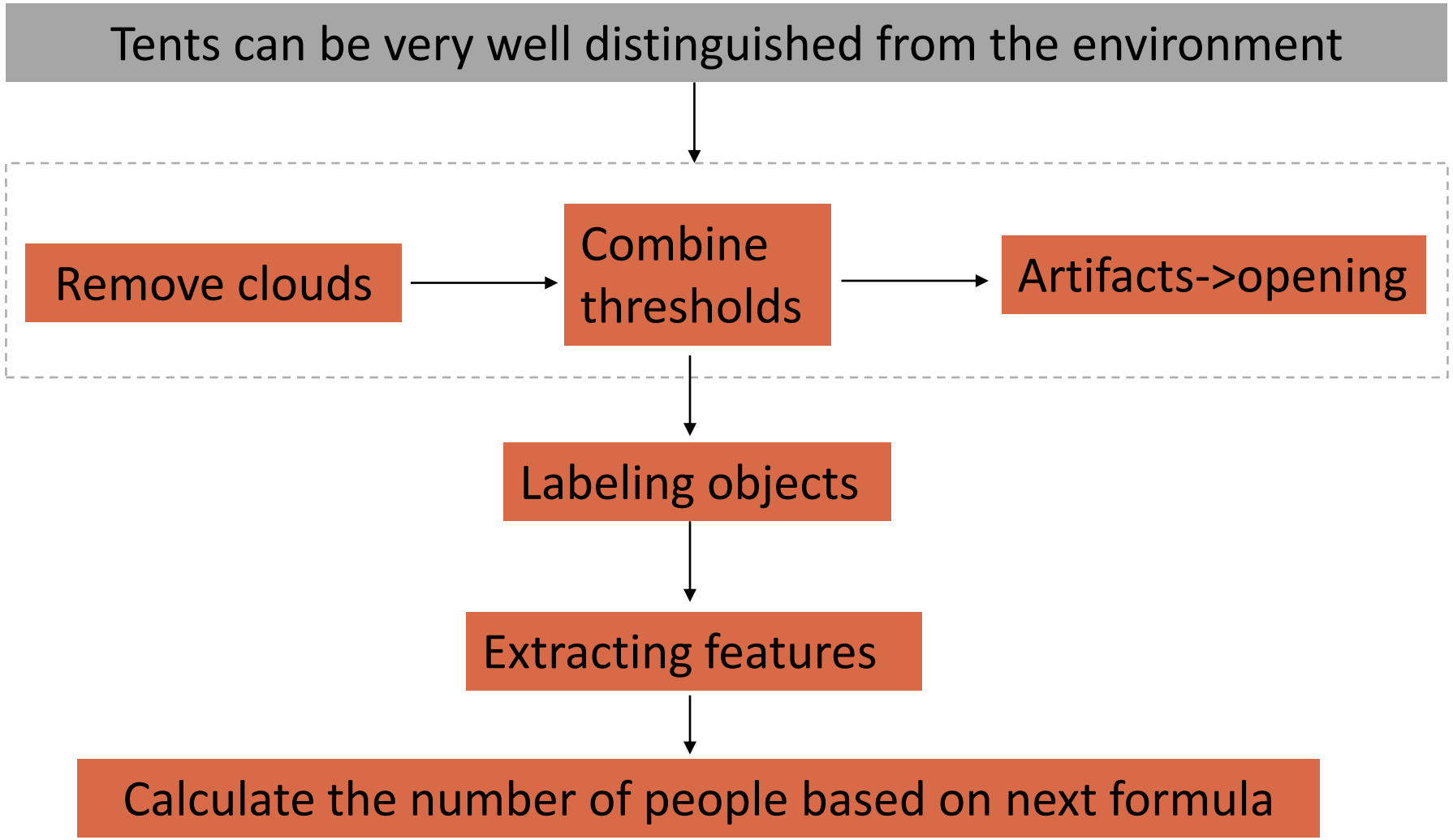
Image segmentation/ buildings detection/ machine learning methods

- Convolutional Neural Network (CNN)
- AdaBoost algorithm
- Linear Discriminant Analysis (LDA)
- Support Vector Machine (SVM)
- Edge Detection (Canny edge detection)
- Corners: Harris corners detection

REFERENCES:

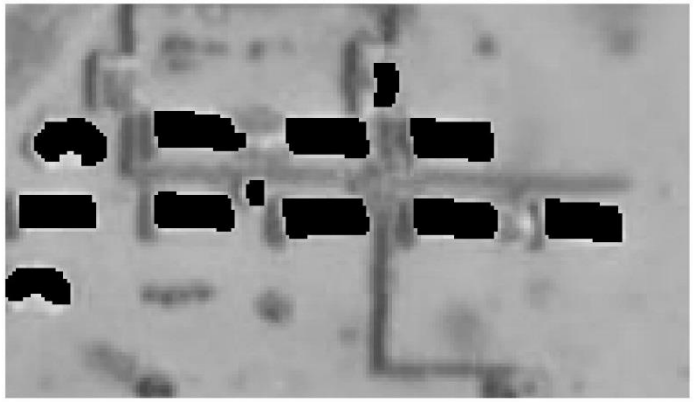
- Castelluccio, M., et al. (2015). "Land Use Classification in Remote Sensing Images by Convolutional Neural Networks." arXiv preprint arXiv:1508.00092.
- Cote, M. and P. Saeedi (2013). "Automatic rooftop extraction in nadir aerial imagery of suburban regions using corners and variational level set evolution." Geoscience and Remote Sensing, IEEE Transactions on 51(1): 313-328.
- Guo, Z., et al. (2016). "Identification of Village Building via Google Earth Images and Supervised Machine Learning Methods." Remote Sensing 8(4): 271.
- Li, E., et al. (2015). "Robust rooftop extraction from visible band images using higher order CRF." Geoscience and Remote Sensing, IEEE Transactions on 53(8): 4483-4495.
- Manno-Kovacs, A. and T. Sziranyi (2015). "Orientation-selective building detection in aerial images." ISPRS Journal of Photogrammetry and Remote Sensing 108: 94-112.

Methodology



$$PPL = total\_pix \cdot \frac{people\_per\_household}{pixel\_per\_household}$$

Results -- Population estimation in Ifo 2 Dadaab refugee camp



the results of our algorithm
+
other information (e.g. average household sizes of Somalis)

Estimate the population of the total camp

Source	Date	Population estimation
Official Estimation according to UNHCR	31.05.2016	46.334
Official Estimation according to UNHCR	30.06.2014	51.685
Our Estimation	**30.06.2014**	**53.958**

Kibera informal settlement - Kenya

- Image complexity = heterogeneity

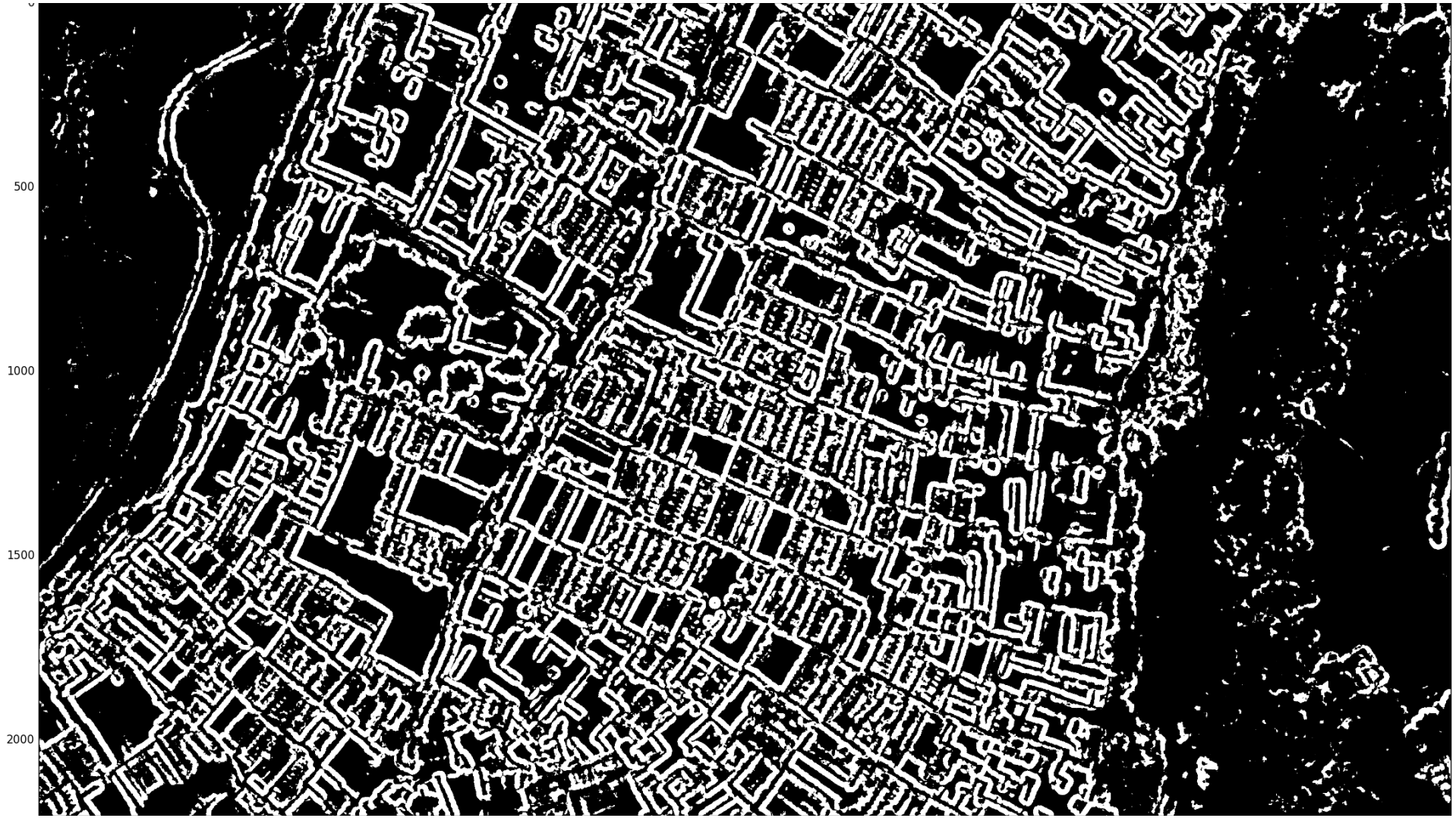
1. Hard to count the building roofs:

- Different types of roofs materials = different texture
- Different roof geometry, size
- Densely build-up urban areas
- Noises like man-made objects

2. Poor spectral features for RGB images

Kibera - ML Segmentation

Kibera - Streets



Conclusion

- Pair programming and tutorial
  - First tastes of…
    - Python/MATLAB
    - Image Processing/ML
    - Web-Dev
- Refugee Camps
  - Results close to official UN numbers
- Kibera
  - Displayed open challenges
  - Limits of pure image processing

Dziękujemy za uwagę!

Анхаарал тавьсан та бүхэнд баярлалаа!

Multumesc pentru atentie!

Köszönöm a figyelmet!