Satsense: a python library for land-use and land-cover classification of earth observation data

Bouwe Andela¹, Berend Weel¹, Elena Rangelova¹, Niels Drost³, Maximilian Filtenborg¹, Derk Barten², Debraj Roy², and Mike Lees²

¹ Netherlands eScience Center ² University of Amsterdam

**Satsense**

Satsense is an open source Python library for patch based land-use and land-cover classification, initially developed for a project on deprived neighborhood detection. However, many of the algorithms made available through Satsense can be applied in other domains, such as ecology and climate science.

Satsense provides:
- Easy use of satellite images
- A number of standard features
- Parallel feature extraction
- Performance evaluation metrics
- Convenience functions for shape/mask files

Easy installation through pip:

- pip install satsense

Read the documentation online at [https://satsense.readthedocs.io](https://satsense.readthedocs.io)

**Features**

The following features are available

- Histogram of Oriented Gradients
- Built-up presence index: Pantex
- Normalized Difference Indices: NDVI, NDSI, NDWI, WVSI
- Lacunarity
- Scale Invariant Feature Transform (SIFT)
- Texton
- Contribute your own!

**Patch Generation**

Using our generators you can extract patches from the satellite image for your own calculations. Such patches can be used to calculate features on a local scale.

Our feature extraction methods use a block grid approach similar to [1] that extracts features at various scales and assigns them to each block.

Example output of a patch generator

**Feature Extraction**

We provide an easy to use method to extract features from a satellite image, including a parallel implementation that works well for very large satellite images.

The result of feature extraction can be saved in GeoTIFF and NetCDF formats and are readily usable in for instance QGIS. These can then be used for further processing, for instance machine learning.

Example output of pantex feature extraction

**Machine Learning**

After feature extraction machine learning techniques, such as those provided by the scikit-learn package, can be used with the calculated features to train a classifier.

**Performance Evaluation**

Performance evaluation metrics are a work in progress.

We currently provide convenience methods for converting shapefiles to masks and vice-versa and Jaccard Similarity Index metric for either shapefiles or mask files.

Illustration of Jaccard Index

The area of the intersection between the 2 multi-polygons is 3.0
The area of the union between the 2 multi-polygons is 6.0
The Jaccard index between the 2 multi-polygons is 0.5

Illustration of Jaccard Index