Object Detection for Energy Resource Assessment

Benjamin Brigman
Sebastian Lin
Sophia Park
Yue Xi

Main Objective

Estimate building and transportation energy consumption at a disaggregated level

Identify built infrastructure location and size as a proxy for energy demand.

Detailed disaggregated data is valuable to energy planners, researchers, and policy makers

Data+ Goal

Create a large dataset of images, building and road annotations, and height for machine training.

Develop machine learning algorithms to extract these objects rapidly and cheaply from remotely senses images.

Estimate geospatial building and transportation energy consumption.

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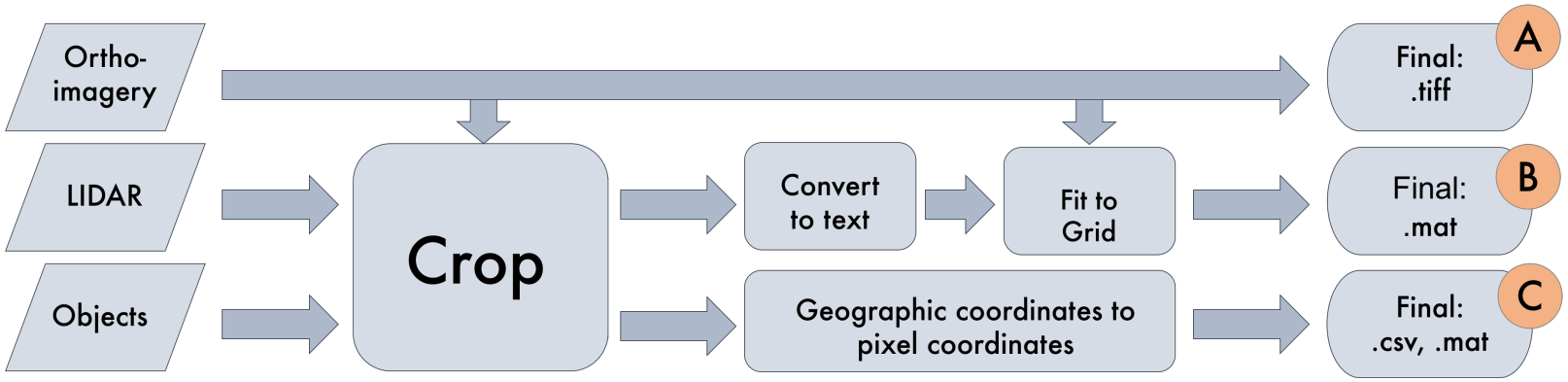
Approach to Building and Road Dataset Creation



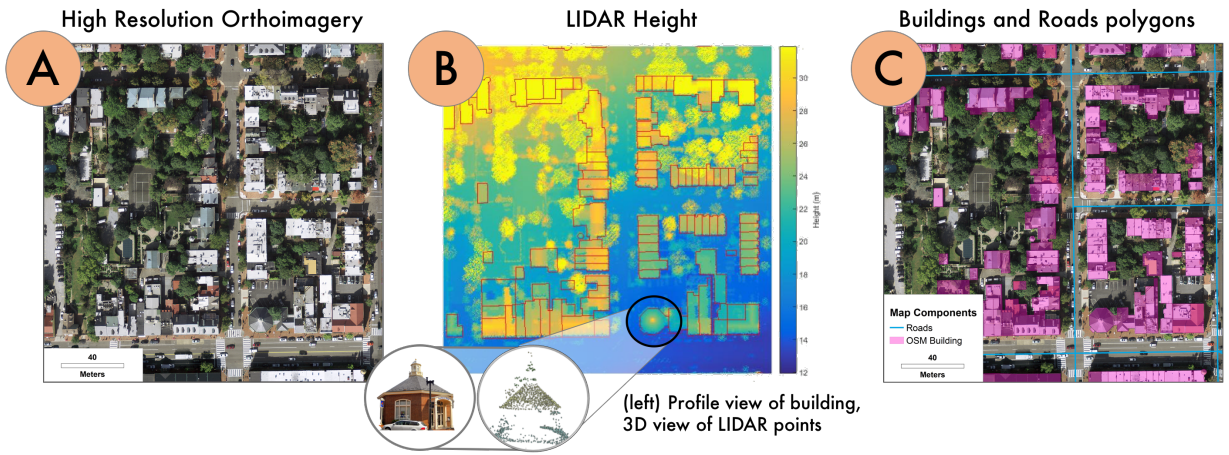
We wrote ArcGIS and MATLAB code to run through all these steps. Code and documentation is included in our final output.

Step 1. Select candidate cities with readily available building and road annotations, LIDAR and high resolution orthoimagery (0.3 meters or finer).

Step 2. After collecting the raw data, crop the large LIDAR files and shapefiles to the orthoimages.

Step 3. Convert cropped LIDAR, which comes in a binary .las file, into a text format to be read in Matlab. Interpolate the LIDAR to fit in a grid corresponding to the orthoimage pixel locations (see figure below).

Step 4. Geographic coordinates of the building and road shapefiles are converted to pixel indices to make overlaying them on orthoimagery in Matlab more convenient.

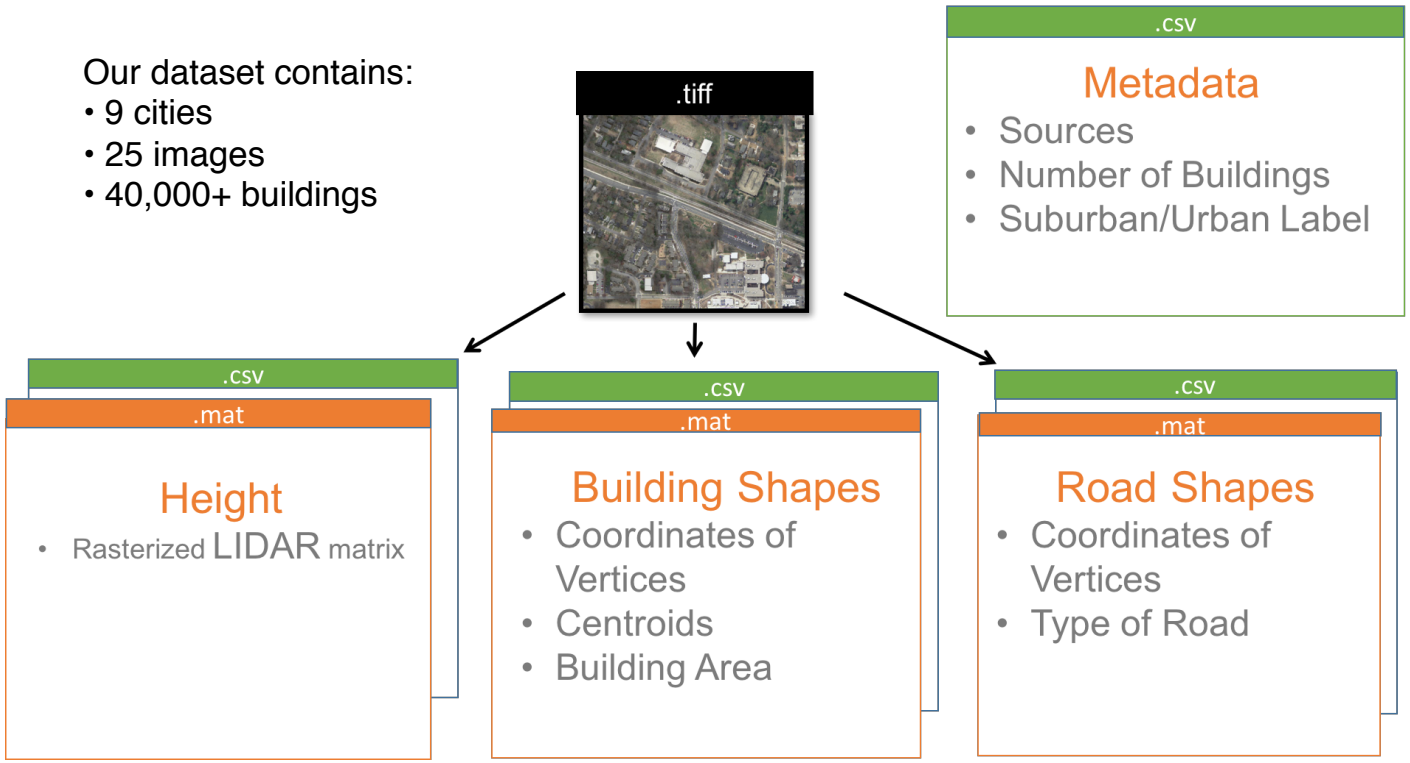


Processed files include the high resolution imagery, interpolated height information, building and road annotations, all cropped to the same extent.

figshare Database

Completed dataset optimized for reading into MATLAB, to make future machine learning work more convenient.

Our dataset contains:
- 9 cities
- 25 images
- 40,000+ buildings



Final dataset is published at figshare

where it is publicly available to the research community. Our code, tools, and documentation are also included.

This rich dataset is one of the first of its kind in terms of image diversity and scale that has been released for public use.

In the fall, a Bass Connections team will use it to explore building detection and volume estimation.

The project will benefit both the machine learning community – by creating a detailed ground-truth dataset on which to teach algorithms – and energy resource planners and policy makers – by providing information on disaggregated energy end-use and consumption.