NATIONAL CONSORTIUM FOR REMOTE SENSING EDUCATION, RESEARCH, AND APPLICATIONS

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Building Type Identification Using High Resolution Imagery and LiDAR Data

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This project aims at identifying building types using remote sensing-derived morphological attributes for Marion County, IN. Buildings were classified into three categories: non-residential buildings (e.g., commercial/industrial buildings, churches, etc.), apartment/condo, and single-family houses (including buildings with less than three units). The Random Forest Classifier was used to classify building types. The metrics used for classifier training were the basic statistics of LiDAR-derived surfaces, geometric features of buildings, and landscape background information of each building, e.g., grass, tree, and impervious surface, which were derived from high-spatial-resolution orthophotography.

Figure 1 shows that 500 trees were sufficient to obtain a stable classification accuracy of 75%. The slope of building roof, certain shape indexes, and building area and volume ratio significantly contributed to building type classification. Although building background metrics were found useful to building type depiction, most of them contributed less than 1%. The building classification result is demonstrated in Figure 2. The most significant metrics was specifically selected for future building type identification. The methodology could be further applied to block and tract scale urban classifications.

The generated building type data can be further used for the studies of:

- Fine-scale population estimation, which utilizes the area and volume of non-residential buildings as the independent variables;
- Fine-scale energy consumption estimation, in which building type information is an essential variable; and
- The relationship between anthropogenic light and surface imperviousness, in which building type information is a strong factor.

FOR FURTHER READING:

Lu, Zhenyu, et al. "Building type classification using spatial and landscape attributes derived from LiDAR remote sensing data." *Landscape and Urban Planning* 130 (2014): 134-148.

Du, Shihong, Fangli Zhang, and Xiuyuan Zhang. "Semantic classification of urban buildings combining VHR image and GIS data: An improved random forest approach." *ISPRS Journal of Photogrammetry and Remote Sensing* 105 (2015): 107-119.

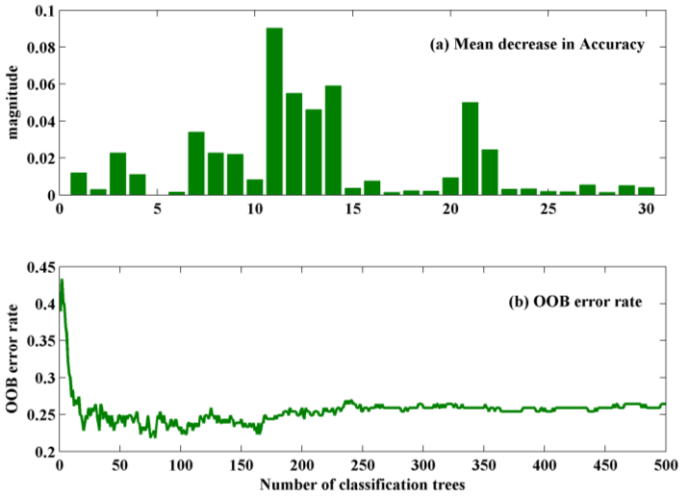

Figure 1. The importance of morphological metrics (a) and Out Of Bag error rate for building type classification (b). Note: the numbers in (a) refer to (1)-(6): mean and standard deviation of the first, last return height, and the intensity of a building; (7-10): mean and standard deviation of the slope of building roof and height; (11-15): building area, perimeter, volume, compactness, and shape index; (16): the nearest building for a building; (17-18) overall building area and volume in a block; (19): area of a block; (20) number of building in a block; (21-22): ratio of area and volume for a building in a block; (23-25): area of impervious, grass, and trees in a block; (26): tree volume in a block; (27-30): ratio of impervious surface, building area, grass area, and tree area to block area.

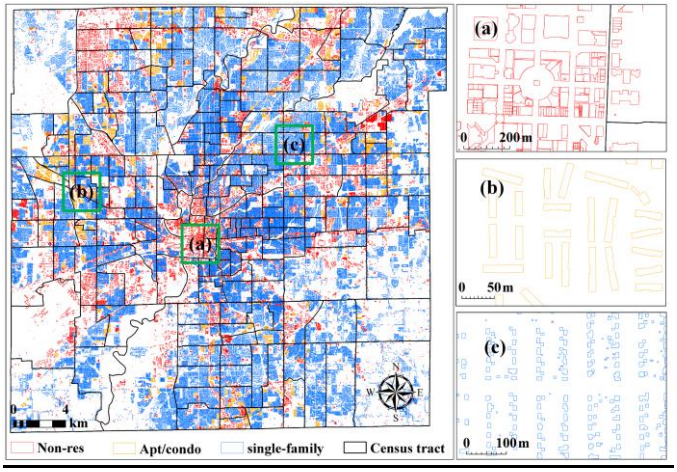

Figure 2. Building type classification result. Note: buildings were classified as: (a) non-residential usage, (b) apartment/condo, and (c) single-family house.