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Title of the paper: First Phase of Suitable Model for 2d Building Extraction in Thailand: Bangpli District, Samut Prakan Province
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Abstract

Most of the recent work in Thailand on building extraction from ortho image of aerial photo or high-resolution satellite imagery such as IKONOS and QuickBird is based on 3D building extraction and photogrammetry techniques that are a standard for the geodatabase of urban planner but it takes time, hardware, software and peopleware to process.

Automatic and/or semi automatic building extraction was interested to develop model and algorithms for building extraction. The proposed system works in two different phases: the first phase, this paper, is to evaluate simple technique of supervised classification to select the suitable remote sensing data for automatic and/or semi automatic 2D building extraction in Thailand, and the second phase, future work, is to evaluate and compare 2 different methods between expert analysis and feature analyst extension of ARCGIS.

This paper was the first phase which was proposes 3 methods of automatic and/or semi automatic building extraction of building features with different rooftops from different remote sensing data in 1 sq.km. of urban prawn with mixed area which is approximately 40% of the study area is residential and commercial area while another 30% is plant area, in a part of Bangpli District, Samut Prakan Province, Central of Thailand. They were single ortho image of QuickBird, LIDAR (Light Detection and Ranging) and the combination of QuickBird and LIDAR data which were implemented on the basis of function of PCI Geometica and ArcGIS software. The building extraction results were compared with manually delineated and percentage of the result. In this study, the result of QuickBird can extract approximately 42.5% of buildings image properly and the combination of QuickBird and LIDAR can extract approximately 50%. In the other hand, only LIDAR data is too difficult to extract rooftops than other methods because it cannot remove plant areas with more than 2 meters of height that can extract exactly building less than 40%.

Keywords: Single ortho image, Extraction building, Feature extraction

1. Introduction

Previously, a method used for formulating geodatabase for urban planners in Thailand is based on 3D building extraction and photogrammetry techniques ortho image of aerial photo. While, most of recent works on Thailand are not only extract from ortho image of aerial photo but also ortho image of high-resolution satellite imagery, in particular IKONOS and Quickbird. Though this high-resolution satellite imagery is typically based on 3D building extraction and photogrammetry techniques, a standard for geodatabased of urban planners, it takes more time, high technological advance of hardware, software and more manpower to generate building extraction.

To decrease all difficulties, this research emphasizes on developing model and algorithm for building extraction. The proposed system is divided into 2 different phases. The former is to evaluate simply technique of supervised classification. It is used for selecting the most suitable remote sensing data for automatic and/or semi automatic 2D building extraction in Thailand. The later is to evaluate and compare 2 different methods between expert analysis and feature analyst extension of ARCGIS. As described, this proposes model can achieve rapidly analyst by spending less time about 2-3 days. Although, the spending time of the model extraction is seemed not much different by manual extraction that is spend less time about 4-5 days. Moreover, the model extraction has needed more the quality control than manual. Nevertheless, automatic and/or semi automatic 2D building extraction might be useful for monitor building or rooftops in the urgent case such as forest encroachment area, suspicious areas, unsaved zone area or pre-updating urban building. For further study, it should apply for other rapidly image extraction project; road line, plants area, surface water, etc.

2. Study Area

The study area is about 1 sq.km. of urban prawn with mixed area which is approximately 40% of the study area is residential, commercial area while other 30% is plant area, in a part of Bangpli District, Samut Prakan Province, Central of Thailand. The location of the study area shows in Figure 1.

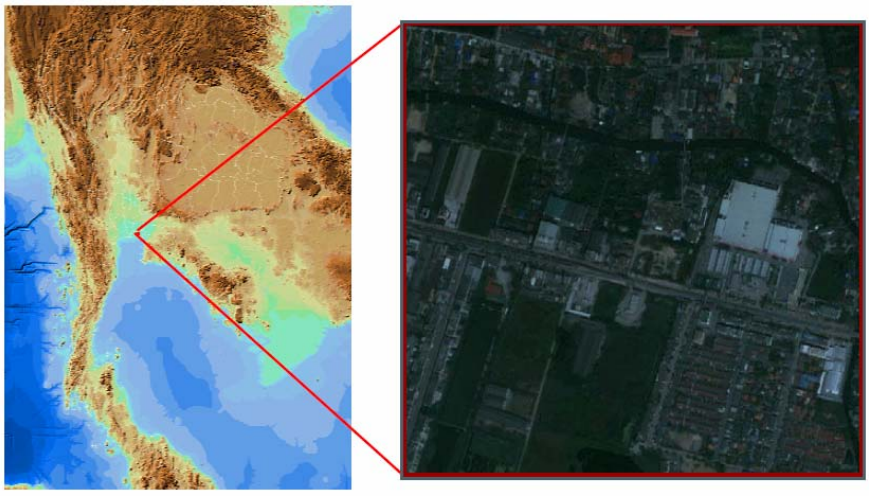


Figure 1 Location map of the Study Area

3. Available Data

The digitally based inventories of important input data themes in the study area are:

- The single ortho image of QUICKBIRD was acquired on Nov 5, 2006**.**
- LIDAR data

This paper used the LAS file format of LIDAR data, which were calibrated from (1) GPS of Airborne Laser Scanner ATLM 2050 which was 150 KHz, 500 m. of flight height and 1 m. of grid spacing and (2) 15 cm. of the accuracy of GPS base station.

4. Data Processing Method

This paper was the first phase, which was, proposes 3 approach of automatic and/or semi automatic building extraction of building features with different rooftops from different remote sensing (as shows in Figure 2). They were single ortho image of QuickBird, LIDAR (Light Detection and Ranging) and the combination of QuickBird and LIDAR data, which were implemented on the basis of function of PCI Geometica and ArcGIS software. The building extraction results were compared with percentage of the result.

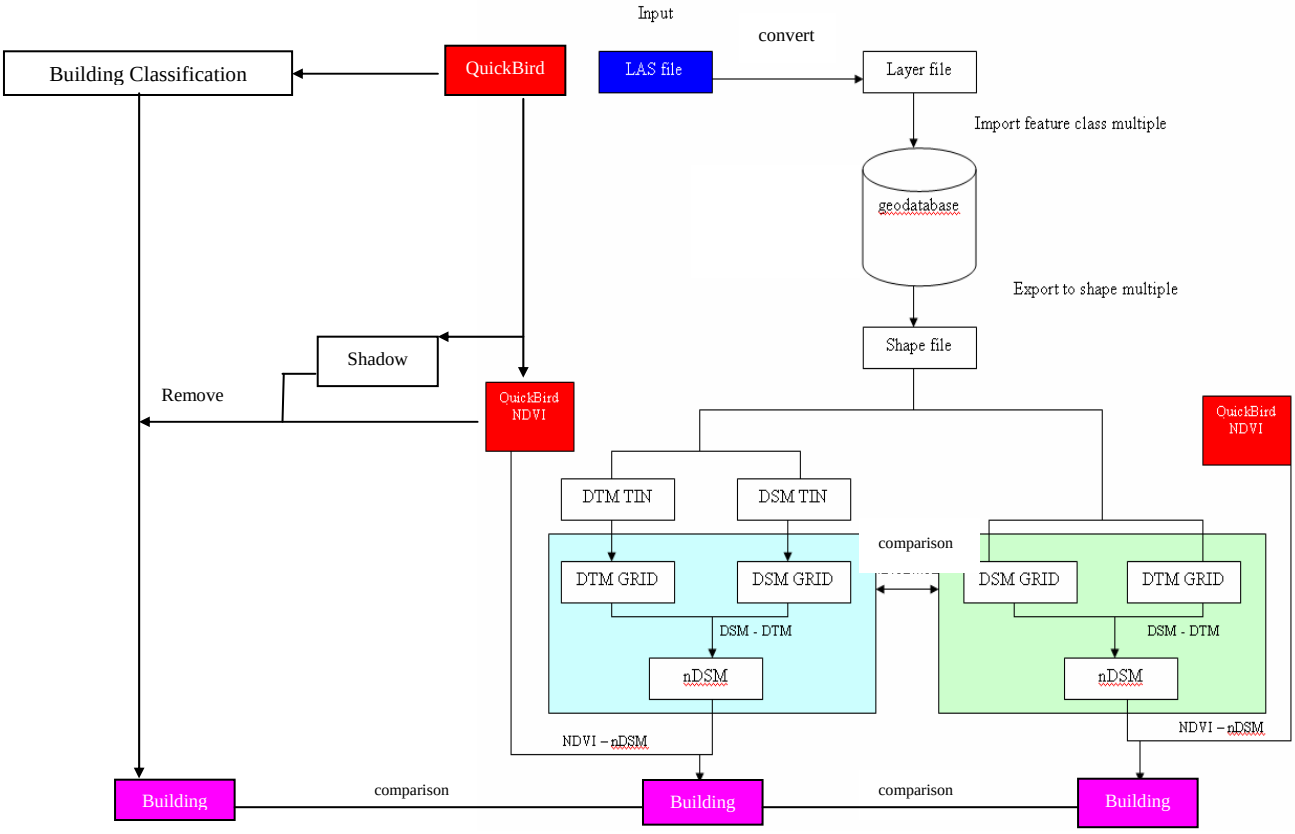


Figure 2 The schematic diagram illustrating the research methodology system

1. First Method used single ortho image of QuickBird. The step is following:
   - Building Classification (B) using the QuickBird image was classified by Supervised Classification method using PCI Geomatica version 10. Carefully to select sample area one by one of the different types of rooftops were done.
   - NDVI classification (N) using PCI Geomatica version 10
     Red band and Near Infrared (NIR) band of QuickBird were used for NDVI formular.

$$NDVI = \frac{NIR - R}{NIR + R}$$

   - Shadow of object classification (S)
     DN value of Near Infrared (NIR) band between 0-300 was selected for shadow using Thresholding method.

   - Building Extraction = B – (N+S)

Figure 3 The result of building extraction from different rooftops

2. Second Method used LIDAR data. The step areas following:
   2.1 Preparation
   Convert LAS file format to Point in Shapefile format which have 3 field of table data that they were Elevation field, Class field (Class 1 = Multi return and Class 2 = Last return) and Intensity field

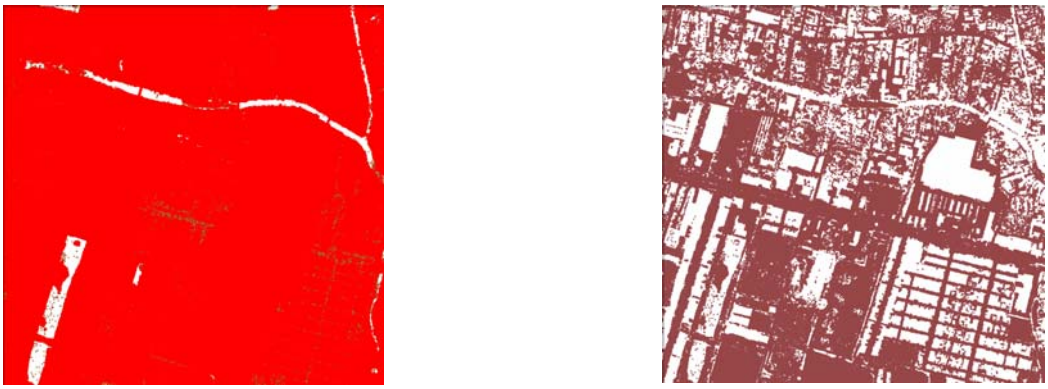
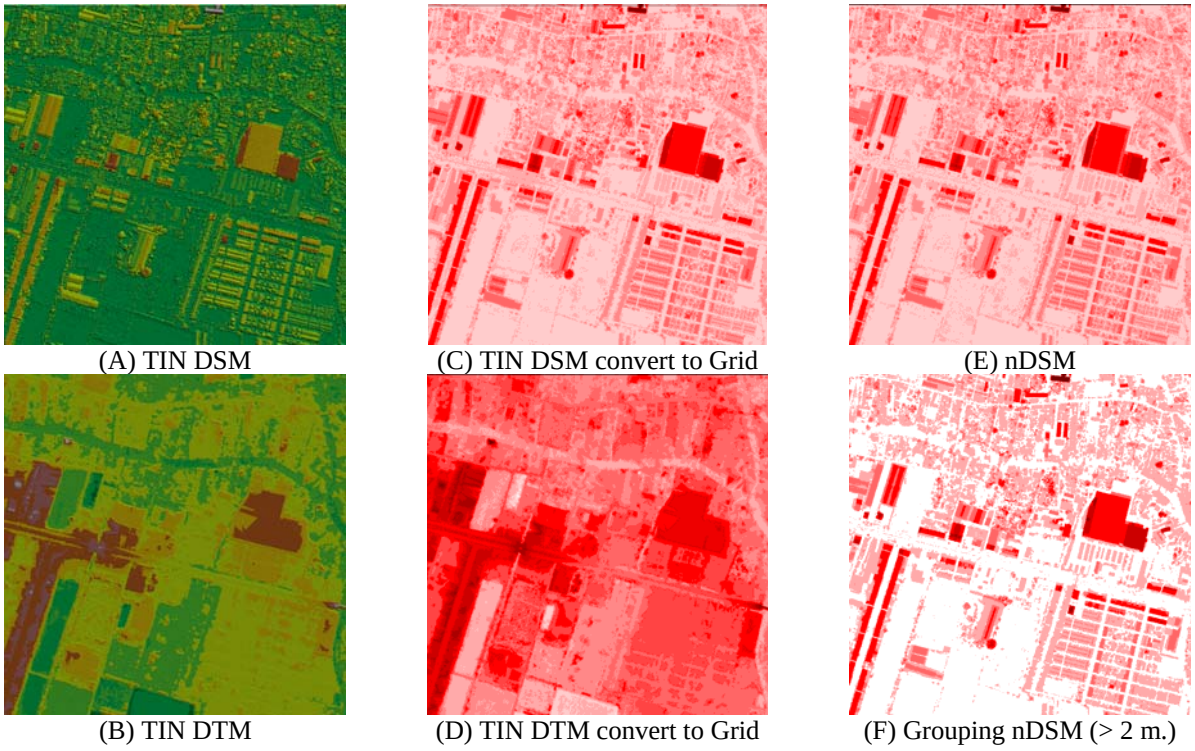


Figure 4 LIDAR (first return and last return) shown on the left and LIDAR (only last return) shown on the right

2.2 Processing

- Interpolate Triangular Irregular Network (TIN) from Multi return Point to DSM and only last return to DTM
- Convert both TIN to Grid
- Generate LAS point shape file to Grid file directly. Follow up the comparison of http://www.technion.ac.il/~dalyot/docs/Intro-DTM.pdf
- nDSM = DSM – DTM
- Select only nDSM grid value > 2 m. that is the average of standard height of building in Thailand.



(A) TIN DSM (C) TIN DSM convert to Grid (E) nDSM

(B) TIN DTM (D) TIN DTM convert to Grid (F) Grouping nDSM (> 2 m.)

Figure 5 The result of each process of LIDAR data (A-F)

3. Third Method used the combination of QuickBird and LIDAR data. The step is following:

The result of building extraction from LIDAR data was still remained many trees that can't remove by LIDAR data only. NDVI of QuickBird can remove all remained trees of it.

Lidar Building - NDVI

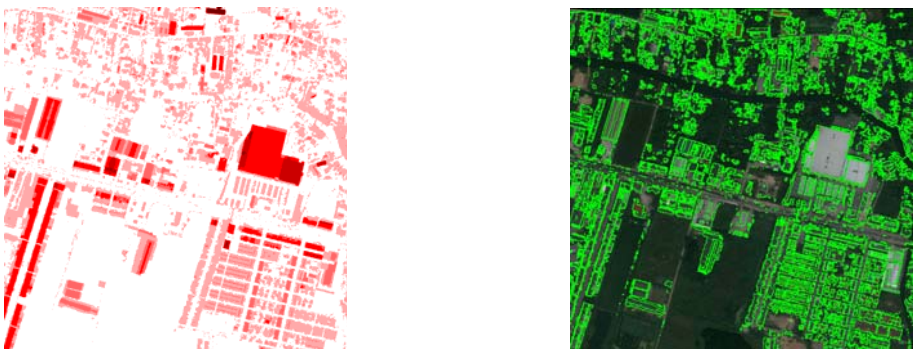
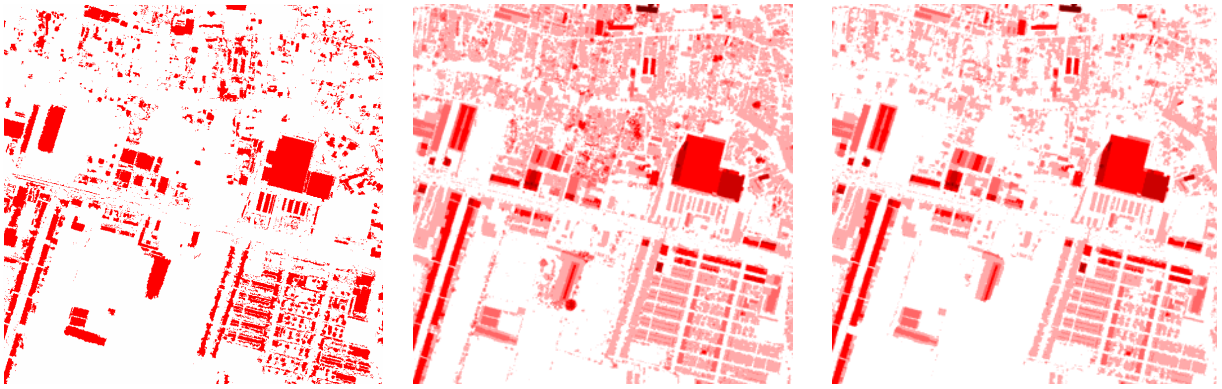


Figure 6 The result of group building – grouping NDVI

5. Results and Conclusion

The result of QuickBird can extract approximately 42.5% of buildings image properly and the combination of QuickBird and LIDAR can extract approximately 50%. In the other hand, only LIDAR data is too difficult to extract rooftops than other methods because of this phase cannot remove plant area with more than 2 meters of high trees that can extract exactly building less than 40%.

The result of 3 methods is seemed not much different. Although LIDAR data is an important data input of building extraction but it is very useful when is combined with high resolution image only. At the same way, high resolution image might be finished the extraction by itself when it was classified by expert classification method.



(A) The result of QuickBird (B) The result of LIDAR (C) The result of combination data

Figure 7 The comparison of 3 method (A-C)

6. Future Work

The second phase, future work, is to evaluate and compare 2 different methods between expert analysis and feature analyst extension of ARCGIS using high resolution image such as QuickBird only.

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