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Review Article

# Extraction of Gable Sites Using Satellite Remote Sensing and GIS Technology in Baghdad, Iraq

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## Abstract

Extraction of gables from remote sensing sources and GIS application has been the subject of slight research. An accurate gable inventory is required for applications such as GIS database number of shanties town, impervious surfaces mapping and Know the places of the displaced through the use of shanties. A methodology for automatic gables extraction that integrates remote sensing sources and GIS data was proposed, where it was consists of a series of image processing (Conversion of DNs to Top, apply tasseled cap transformation (TCT) Brightness). The extraction process was implemented and tested on gable (including commercial and residential) type. In addition, google earth data from Baghdad city, Iraq was identified for the testing and validation of the results. The automatic extraction process was tested and evaluated on multiple feature segments and proved to be successful. The research identifies, recommendations algorithm extraction scenario and drawbacks of the process.
**Keywords:** Gables, TCT, Remote sensing, Baghdad city.



## INTRODUCTION

From establishing and managing a GIS system for a city to urban planning, where can greatly benefit from an updated gable database that provides reliable information about the displaced through the use of shanties. An attempt is put into the evolution of building data sets for cities and counties all over the world, but this study depend on algorithm to extraction gables.

The study of Fiset & Cavayas [1], aims to a map production to automatically extract the road network from SPOT-HRV images, where production allows highly accurate outcomes to be obtained independently of the shape and the density of the road network. Therefore, this approach is believed to remove the problems associated with edge intervals and the grey level.

The research of Bückner [2], showed The approach used treats the segmentation of roads (linear objects) in different sensor data (SAR, IR, VIS, and maps) which the information from the Geographic Information Systems (GIS) is used by the registration to reference the tie points.

The work of Mayer [3], focuses on condition-of-the-art automatic object extraction methods from aerial imagery, where proposing well-defined standards for their assessment, characteristic approaches based on their models and strategies.

The report of Bückner *et al.*, [4], aims that the system GEOAIDA is allowed an intelligent, flexible control and concise of a scene interpretation by utilizing a semantic scene specification. In addition, the system generates a hierarchic, pictorial description of the results. Finally, the output can be used map generation and update GIS.

The report of Haverkamp [5], aims to develop a fully automatic way to extract building footprints from imagery, where based on edge maps derived from IKONOS data. The study used Edge chains that built individual sides of buildings are intended to be represented by single chains. The results are quite good over a set of geographic areas. Also, The condition for extracting buildings as small as ten meters on a side.

The study of Baltsavias [6] the extraction of significant topographic objects, like roads and buildings. Where aerial imagery is considered as main input data. In addition, other data (laser scanner, SAR, and high-resolution satellite imagery) can be also used.

Also, the paper coverage on aspects of knowledge that can be used for object extraction. Finally, a review of commercial systems regarding automated object extraction.

The research of Mayunga *et al*., [7], developed a new way to extract buildings in urban informal dominion areas using high-spatial-resolution imagery, where suggest way uses radial casting algorithm to the fine measurement of building outlines and initialize snakes contours. The results are satisfactory with an extraction rate of 94%.

## MATERIALS AND METHODS

### Study Area

The study area is located in central part of Iraq, within Desert climate sector, which performs the western part of the unstable shelf, between latitudes (33°25'-33°44') and longitudes (44°16'- 44°29') as shown in Figure-1. Tigris River runs through the city of Baghdad in the mature stage forming river meandering and a number of islands due to increase in sedimentation and decrease of river velocity. Tigris River divides Baghdad into two parts (Karkh and Rusafa). On the other hand, the city of Baghdad consists of nine units, four to the Karkh district and the other five of them belong to Municipality of Rusafa, and each unit contains a number of small municipal districts and linked to all units of the municipal network of highways. The amount of its population is about 8.5 million in 2016. The area of the Municipality of Baghdad is about (869.031) km2 [8]. In the summer, the temperature rises to more than (50°C), while the weather is very dry. In addition, The city exposed to severe dust storms, due to global warming.

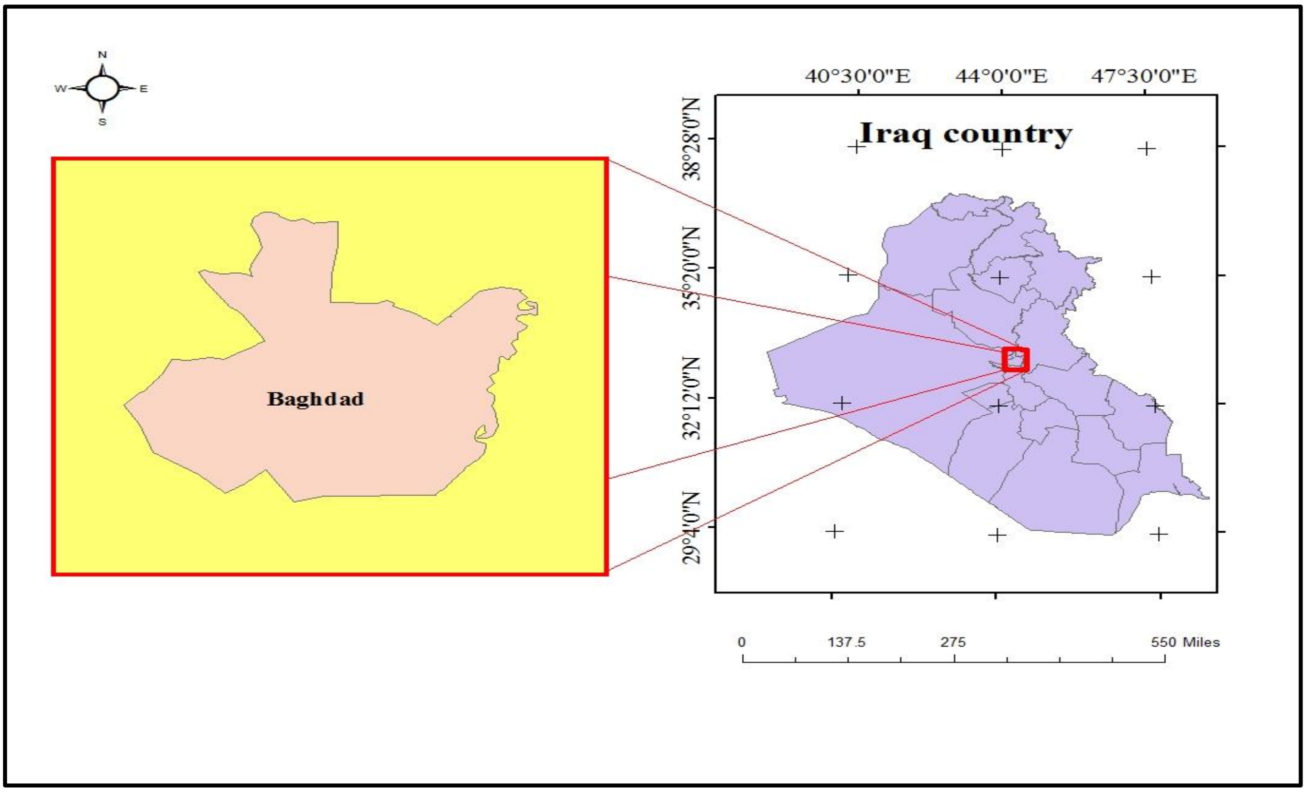


**Fig-1: Study area**

### Remotely Sensed Data

Landsat-8 was launched in FEB/2013 and in comparison with former Landsat imageries. Portal of Global visualization viewer (http://glovis.usgs.gov/) of USGS. In this study, one image of Landsat-8 from the study area (Baghdad-Iraq) was selected and downloaded from this database, as shown in Table-1.

**Table-1: The detailed information of Landsat-8 images used for this study**

| Path/Row | Location | Acquisition Date | Scene ID |
|---|---|---|---|
| 168/38 | Baghdad-Iraq | 2018-06-06 | LC81680372018157LGN00 |

# METHODOLOGY

In this section, the proposed methodology for extracting gables outlines from Landsat-8 imagery is presented. There are two main features of our process, image pre-processing and apply tasseled cap transformation (TCT) Brightness.

### Image Pre-Processing

The first step included performing required pre-processing an operation to correct satellite image before they can be applied algorithm. This means that Conversion of DNs to Top should be completed in advance. Especially for Landsat images, the main coefficients are provided in a metadata file which is obtainable to download with other files. In this study, the ArcGIS10.2.2 software was used to complete the image processing analysis.

Conversion from DN to reflectance was done according to the method mentioned, as follows. OLI band` converted to TOA planetary reflectance using reflectance rescaling coefficients.

$\rho\lambda' = M_p{*}Qcal + A_p$ …………………. (1)

Where:

$\rho\lambda'$ = Top-of-Atmosphere Planetary Spectral Reflectance, without correction for solar angle.
$M_p$ = Reflectance multiplicative scaling factor for the band (REFLECTANCEW _ MULT_BAND_n ).
$A_p$ = Reflectance additive scaling factor for the band (REFLECTANCE _ ADD_BAND_n).
Qcal = pixel value in DN.

Note:
That $\rho\lambda'$ is not true TOA Reflectance because it does not contain a correction for the solar elevation angle.

$P\lambda = \rho\lambda'/\sin(\theta)$……………………………. (2)

Where:

$P\lambda$ = Top-of-Atmosphere Planetary Reflectance.
$\theta$ = Solar Elevation Angle.

### Tasseled Cap Transformation (TCT)

Group of Landsat has been widely used remote sensing satellite, where has collected a historical archive in earth observation and made significant contributions to environmental change, disaster monitoring, and global ecosystem. The TCT is the conversion of the satellite bands into a set of weighted sums of split up channel readings. One of these weighted sums measures roughly the brightness of each pixel in the scene [9]. In our present research, the OLI image bands will be corrected to the Top of Atmospheric (TOA) reflectance. Because the Landsat-8 sensors take reflected the solar energy of 16-bits data (range from 0 → 65536), specific weights have been developed to compute the TCT components.

In a paper [9], derived the TCT coefficients for the newly operational land imager (OLI) sensor onboard Landsat-8 for at-satellite reflectance. We have utilized the Blue, Green, red, NIR, SWNIR1 and SWNIR2 bands of Landsat-8 to classify the Land cover components of the study area. In this paper, a new automatic extraction of Gable classification method will be introduced based on utilizing the TCT components of the calibrated bands of the Landsat-8 (OLI).

# RESULTS

By following the methodology above-mentioned, TCT coefficients are derived for different gable type in different time periods to make the derived scenes representative of the sort of important feature.

$$\text{Brightness} = 0.30\text{Blue} + 0.27\text{Green} + 0.47\text{Red} + 0.55\text{NIR} + 0.50\text{SWINR}_1 + 0.18\text{SWINR}_2 \ \ldots\ldots\ldots\ldots\ (3)$$

The equation (3) shows The Brightness is determined using the TCT weights. These coefficients are very close to the coefficients of the dummy target image created through TM, and ETM+-based TCT coefficients. it is evident that Brightness has all positive loadings. It means that all six bands share in for its overall value with bands 4 (Red), 5 (NIR) and 6 (SWIR1) as a maximum contribution.

Figures 2 & 3 illustrates the google earth image was utilized for calibration of the proposed models. The original calibrated OLI bands and the brightness algorithm of the TCT.

 

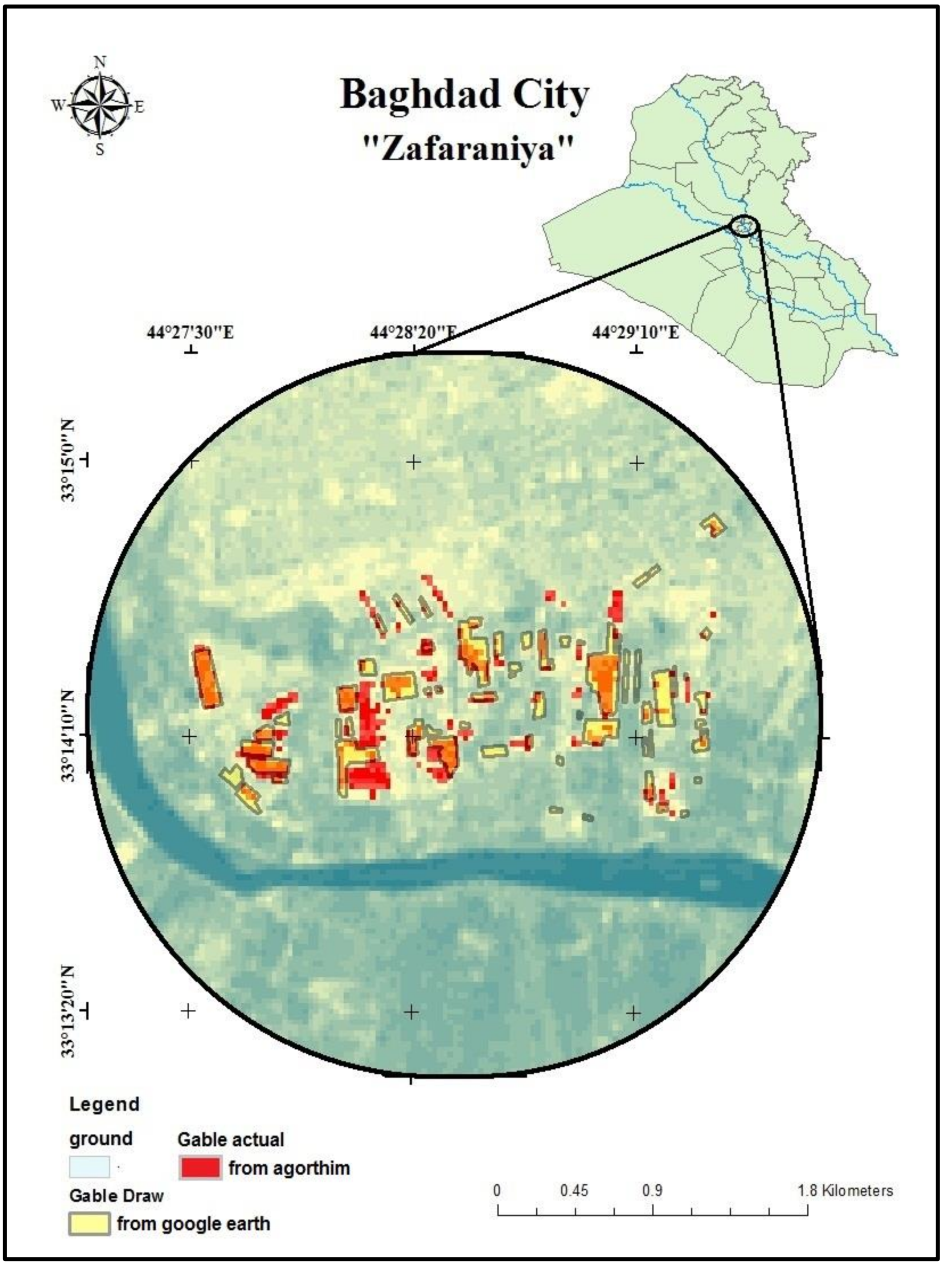


**Fig-2: Illustrate Gable actual and Gable draw from the google earth image for calibration of the proposed models (Zafaraniya)**

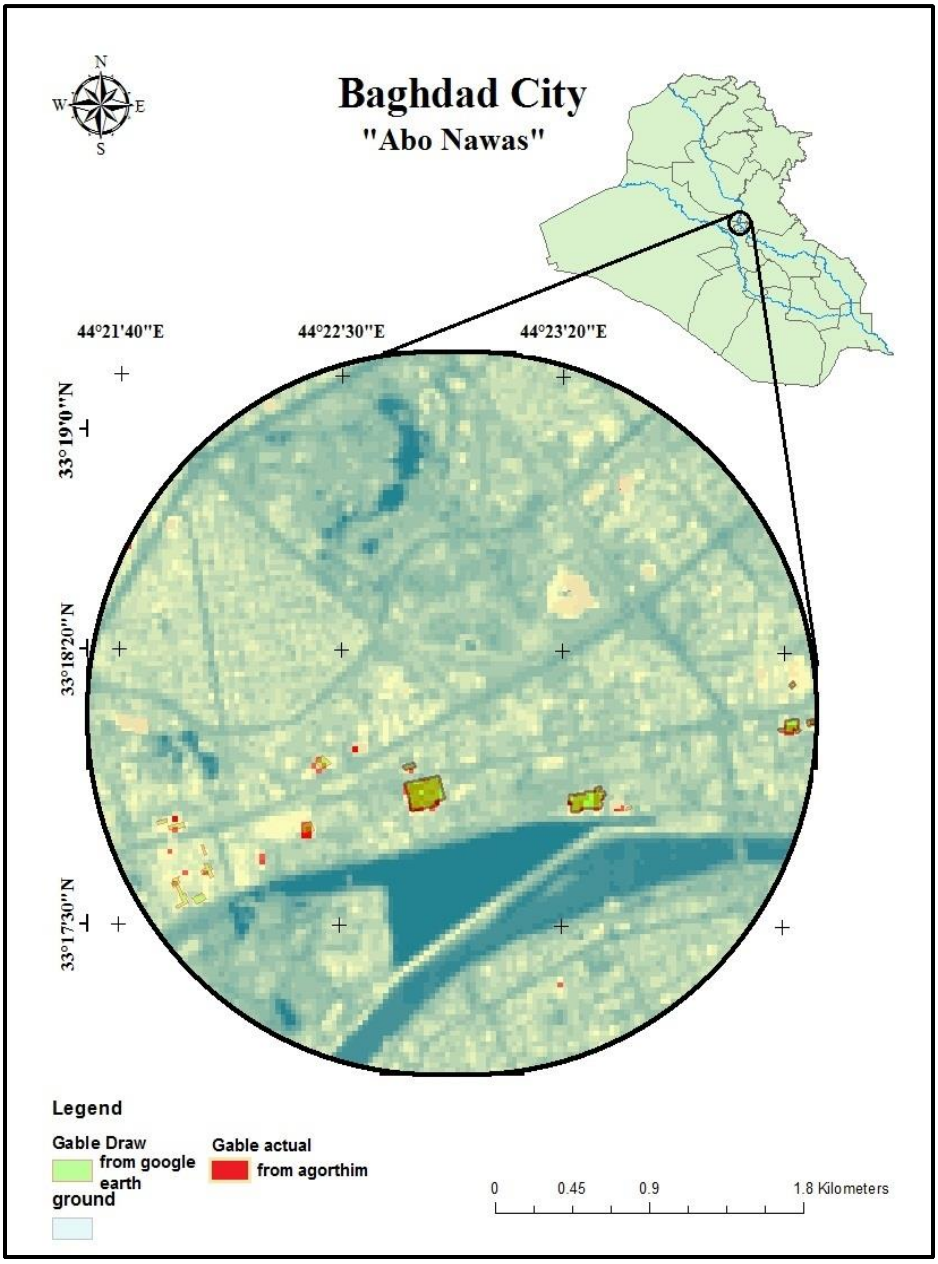


**Fig-3: illustrate Gable actual and Gable draw from the google earth image for for calibration of the proposed models (Abo Nawas)**

## CONCLUSIONS

Brightness is those few significant components generally discussed in the literature. Brightness is related to albedo. The resulted transformation coefficients successfully differentiated gable from bare soil features.

### Drawbacks

Gable extraction from algorithm tricks several major obstacles that any extraction process has to cope. Parts of the gable may be closed from view by shadows and surrounding objects, gable may be unclear (less than the pixel that is 30* 30m) and sun-illumination issues. Gables vary in shapes roof, sizes, and colors.

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