Available online at www.jrors.ir

Journal Of Radar and Optical Remote Sensing

JRORS 1 (2020) 46–54

Investigating the Possibility of Feature Extraction in Subpixel Scale from MODIS Images in Homogeneous Backgrounds

Mohammad Hosein Mehrzade Abarghooee[a*]

[a]*Master of Remote Sensing and GIS*

Received 18 April 2019; revised 18 Agust 2019; Accepted 12 March 2020

Abstract

Today, due to the access importance to precise, comprehensive and daily spatial information of the various phenomena and the change over time in terms of location and nature. In order to monitor their behavior and the possibility of planning and deciding in different cases, it have been attempting to improve the imaging performance with increasing spatial accuracy, radiometric spectra of the sensors. But each improvement stage requires time and cost, and taking into account different periods and sometimes long periods of imaging of a point on Ground level (low time resolution), which is due to smaller FOV (increased spatial accuracy). However, daily monitoring of many features is not possible, especially those that are smaller than the sensor's pixel size. Therefore, it is necessary to use, methods for features extraction from low resolution images, in which the feature dimensions and the spatial resolution of sensor is of fundamental situation. In this research, attempt has been made to investigate the possibility of various possible modes, including the location of the barge in the image, the images taken in different bands of emission, radiance, reflection, the presence of two features side by side, the effect of flame on adjacent feature, the study of noisy bands, the presence or absence of flame, non-solid features such as platforms and solid features, such as barge, on different days of the year.

Keywords*:* Detection, MODIS, Reflectance bands, Subpixel

1. Introduction

The detection of floats and features location such as oil and gas platforms in open waters, seas and lakes due to the existence of a homogeneous region in the background, which is basically a large

[*]*Corresponding auth*or. Tel: +98-9132545651.
Email address: hosein_mehrzade@yahoo.com.

surface of water, is easier than detection of same case on land.

One of the sensors that produce ground surface coverage on a daily basis and its images available online is the MODIS detector mounted on the terra and aqua satellites; it takes 3 to 4 images per day from same region on the earth. Therefore, with spatial resolution (SR) of the sensor (250, 500, and 1000 meters) for different bands, can be used to detect and monitor the features.

Considering the importance of the deployment of military vessels and platforms in order to track and economic developmental issues in order to estimate the location of gas and oil pipelines that are carried out principally by pipelay barges and other related fields. In this research based on subject it is possible to design and investigate, the floating dimensions due to the limited SR of the MODIS sensor, which in the case of pipelay barge, it's length is about 40 to 100 meters.

2. Materials and Methods

2.1 Case Study

The study area is in Persian Gulf, South Pars gas region, and Pipe Lay Barge (PLB) C-master barge at position (zone39, WGS84), (596611 @ 2961256) and platforms were examined in the following situations.

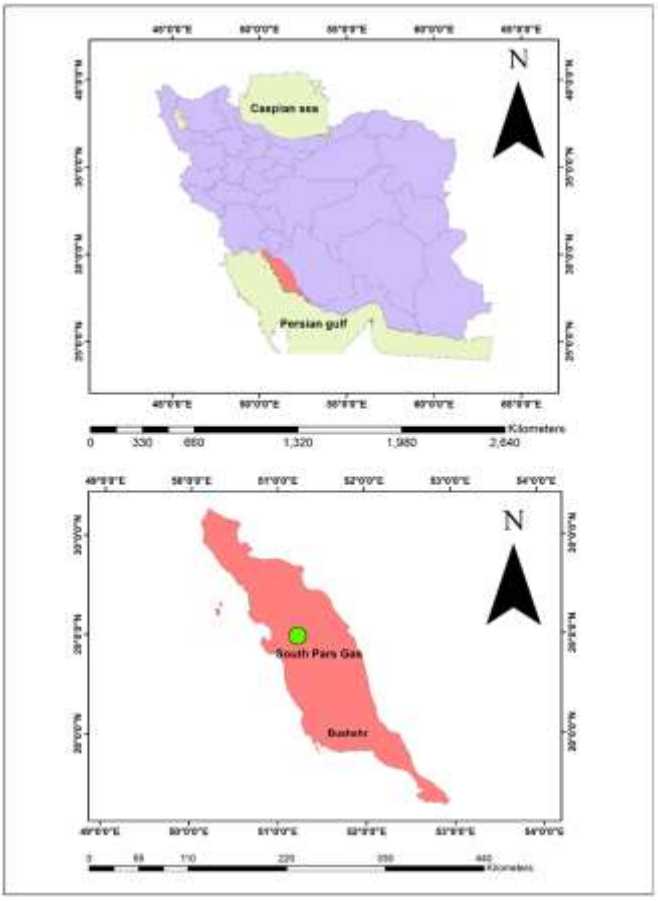

Figure 1. Geographical location of the region

The images used belongs to May13, July16, Jun30, and August 1, 2013, which are geo-referenced using ENVI software.

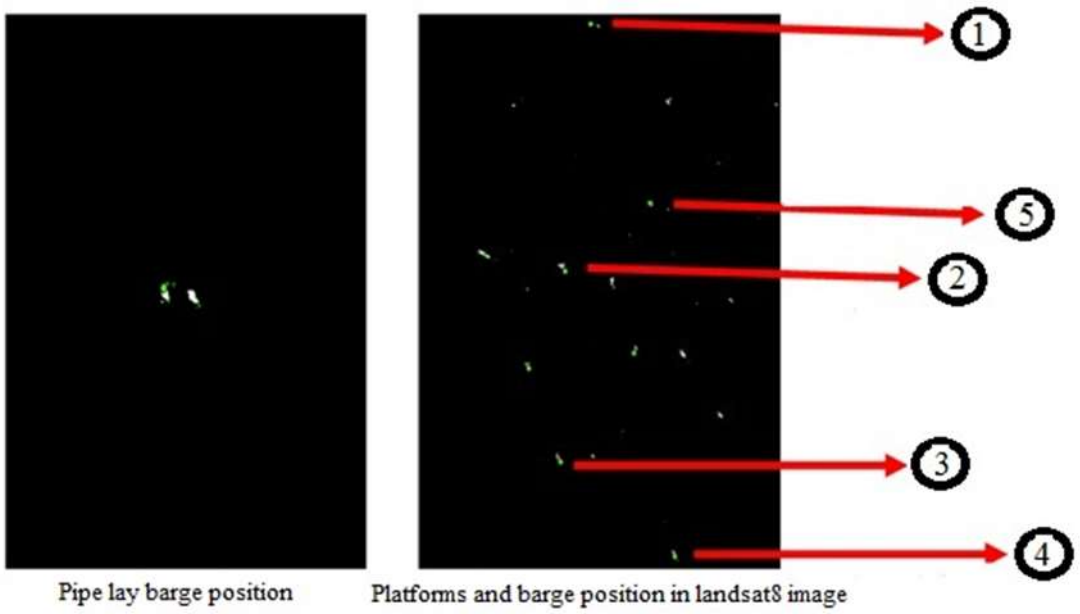

Figure 2. Situation of studied features

As shown in Figure 2, images with a SR of 1 km (emissive, radiance, reflection) for the 5 samples were the first sample, the pipelay barge, the second and third samples, platforms with flame, and the fourth and fifth samples, platforms without flame.

With coding in Matlab software, all images and modes were converted to images of 5 km by 5 km and 10 km by 10 km around the feature, and the investigating of the emission bands for different images represents the signal strength of the flames that flame with The 10-by-10-meter dimension (in reality) creates an effect of several kilometers in several kilometers in the image, which is largely recognizable in the early bands of the emissive set so that the barges around the active platforms in these bands are Unidentifiable, however, the direction and dimensions of the detected platform are deposition from reality about 2 to 3 kilometers, and dimensionally due to it's effect in emissive bands, heat spreading in the atmosphere is much wider than the dimensions of the flame.

In these spectral bands, the presence of a feature in the center of the images or the corners, due to the signal of fire, does not interfere with the detection, and usually the exposure is not a point, but a halo of light.

Figure 3. Platform with flame, detected in the bands of Emissive (bands 1 to 4) a- sample3 band 4 b-sample3 band 3 c-sample 3 band 2 d-sample 3 band 1

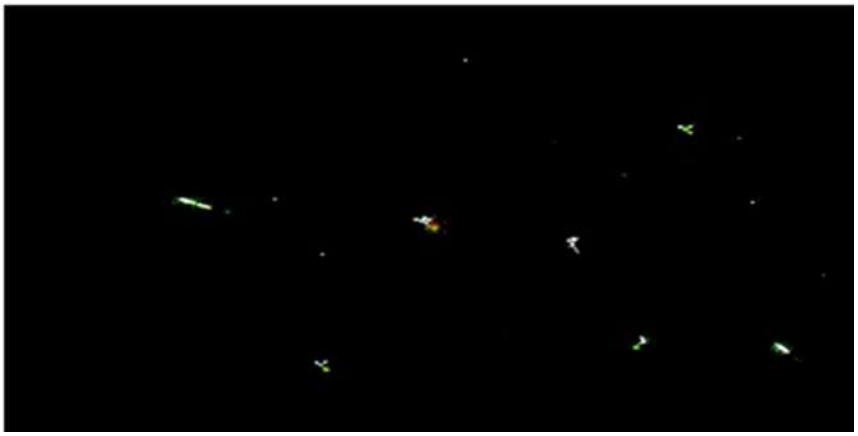

Figure 4. Platform with flame in Landsat8 image

For this type of features, the use of 10 km and 5 km neighborhoods is not very different in detection, and in some cases, if there is smoke from flames, in the short wavelength bands, the smoke effect is visible.

For detecting the feature without fire signal in subpixel scale in MODIS images (1 km); factors such as atmospheric conditions, the location of the feature in the image, the effects of systematic noise, the proximity of the effects to other features, the effect of sunlight reflection, and the state of the sea waves affects are important, but in general, in bands 5 through 11, according to Fig. 5, the effects are not detected due to the high noise of the images.

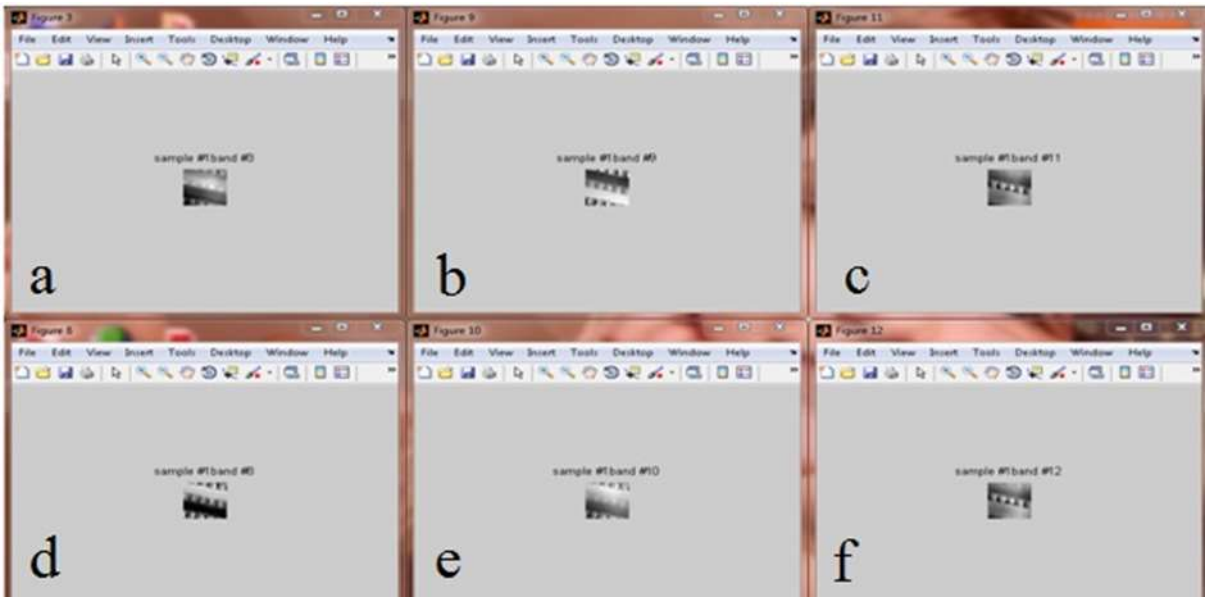

Figure 5. High-noise images, a- sample1band5 b- sample1band9 c- sample1band11 d- sample1band8 e- sample1band10 f- sample1band12

In bands 12 through 16, which are related to biochemical properties and phytoplankton and ocean colors, the images are mostly dark and have no detectability, so checking on bands 1 through 4 (visible and near infrared) and some bands 17 to 19 can be done.

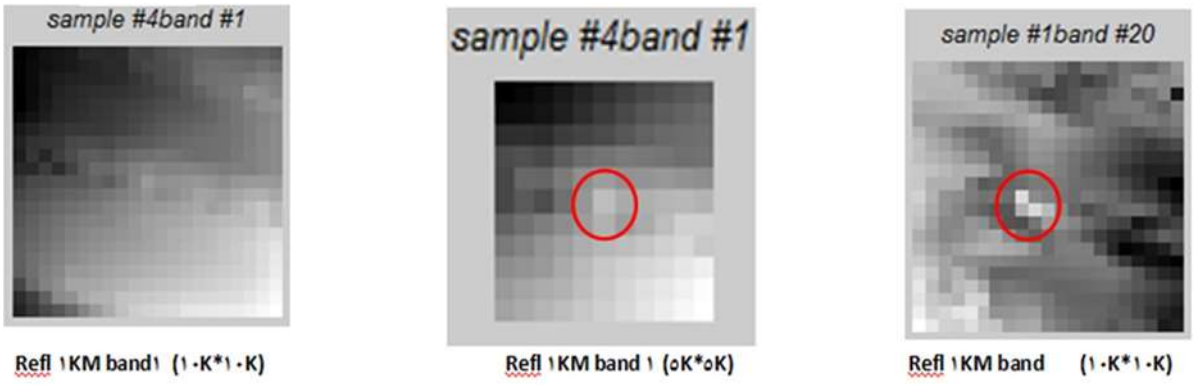

Figure 6. The Impact of Neighborhood Dimensions in Determining features

As shown in Fig. 6, in these cases, the neighboring dimensions are effective, in 5km Neighborhood, DN changes are sharp but the field of view is smaller, resulting in less reliability, the location of the feature in the image It is also important that about same features, one of them undetectable across the image, and the other one can be detected at the center of the image (Fig. 7), so that in MODIS images taken with Terra satellite, affected area is in the corner of the image and in images taken with Aqua

satellite is closer to the center, which in some cases leads to the detection of further features.

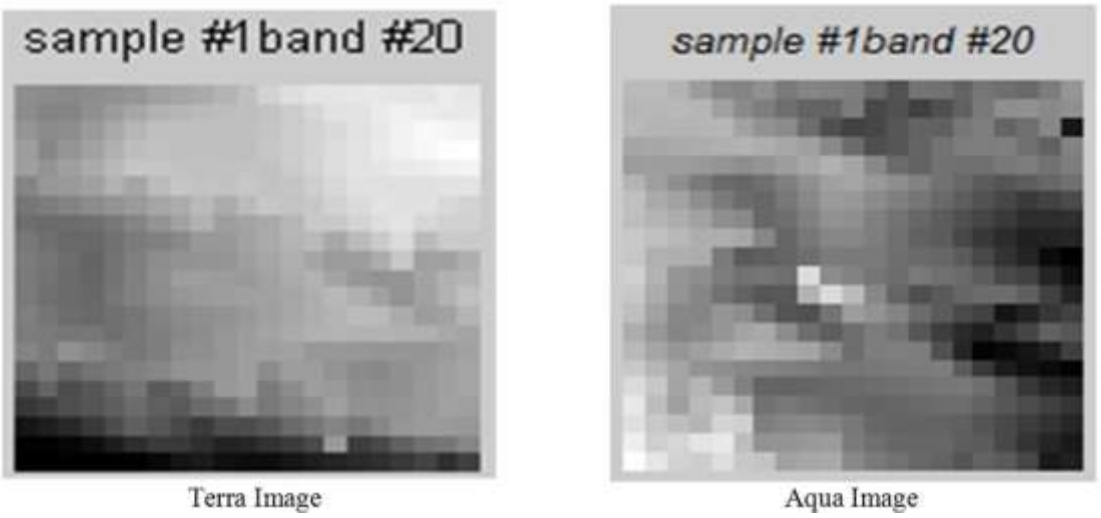

Figure 7. The difference between the images of the Terra and Aqua

In the case of radiance spectral bands, they act much like reflectance bands.

In the case of MODIS images with SR of 500 meters, which consists of 7 bands of 36 bands, high-temperature features in bands 5 to 7, and features without heat characteristic in visible bands and near infrared bands 1 to 4, and in some cases, bands 6 and 7 are investigatable - Figures 8 and 9 - which can be achieved with better SR in the same atmospheric conditions.

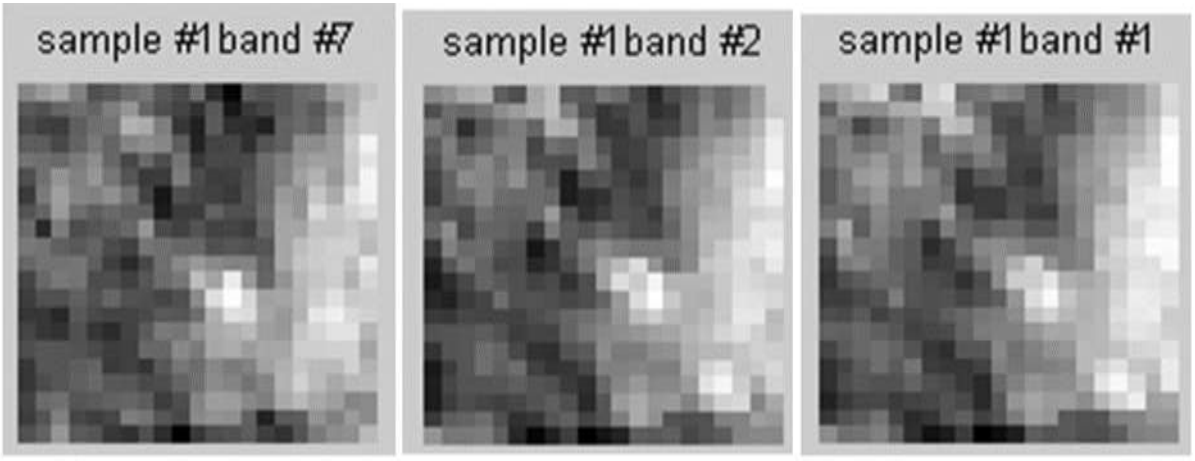

Figure 8. The barge detection in Reflectance images with SR of 500 m (AQUA)

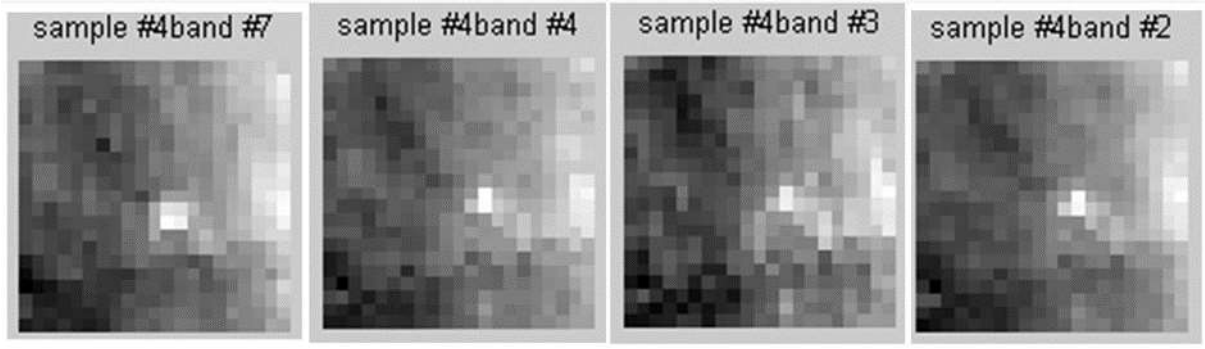

Figure 9. Flameless platform detection in Reflectance band images with SR of 500 m (AQUA)

As shown in Fig. 10, in the case of a 250-m MODIS product, which includes 2 bands 1 and 2, a 40 to 100-meter (floating) feature is detectable, but cannot be commented on the dimensions. And only identifying and detecting is possible.

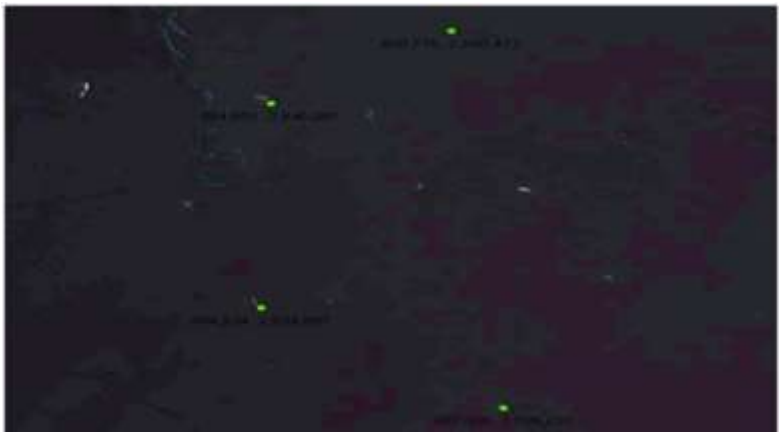

Figure 10. Area and position of the platforms in Landsat8

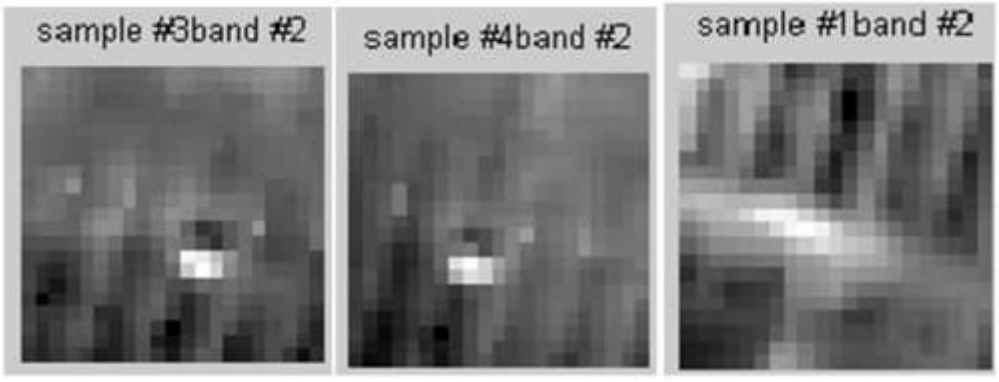

Figure 11. Detection of features in Reflectance images with SR of 250 m

Figure 12. Barge position in Landsat8 image

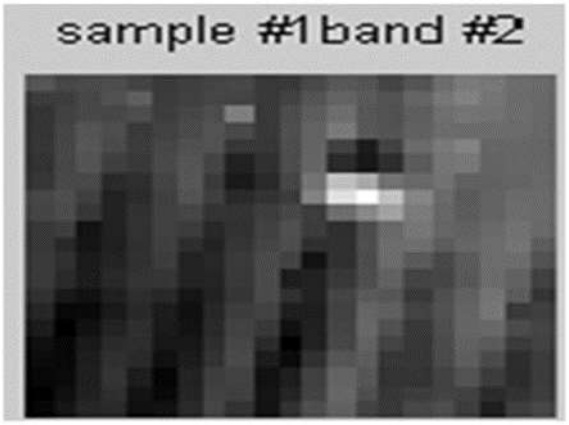

Figure 13. Barge detection in images with SR of 250 m

3. Result and Discussion

In the case of flame pixels due to the strong signal if fire, the feature can easily be detected in bands 20 to 32 emissive and bands 5, 6, 7, and even some other bands, and the important issue in this field is the detection of spatial correction. The exact location of the feature is due to atmospheric conditions.

In MODIS images with SR 500 m, if atmospheric conditions are favorable, in most bands 1 through 7, all samples are detectable, except that bands 5 and 6 that have noise-like effects or severe reflections.

In the case of spectral bands with SR 250-meter, as already mentioned, features DN variations are often visible, so considering the sum of factors and making initial corrections on MODIS images and the use of images that are less affected by atmospheric effects (radiometric and Geometric) or applying atmospheric effects in the form of DN correction, the probability of detecting of features with dimensions of 100 by 50 (platforms and floats) can be done.

In general, the results include:

• The reflectance bands 8, 9, 10, 11, and 12 in most MODIS images have severe noise.

• In reflectance bands 6 and 7and emissive bands 1, 2, 3, and 4, we have anomalous if there is flame, if there is a pixel of fire in the vicinity of the float, about 4-5 km, other features will be affected.

• In most MODIS bands, there is a systematic noise, but because of the signal strength of the fire, feature could be detected.

• In some areas, because of the sunlight reflection, features detection is not possible.

• In images with SR of 500 meters and 250 meters (in case of favorable weather conditions), we can detect anomalies for each of the 5 samples.

4. Conclusions and Suggestions

Considering the importance of detecting features smaller than pixel size in satellite imagery and having MODIS images on a daily basis, the above method or combination of bands, and evaluation and algorithmic evaluation based on the use of various effective bands in detecting It can be useful in navigating and providing maps or even military applications, so it is possible to provide methods for

determining precisely geometric locations (such as super-resolution) or providing a method for selecting optimal bands for these detections.

It is also possible to apply changes in the structure of moving or non-mobile features, for example, the use of very low-emission alloys, such as shiny aluminum, to create synthetic anomaly to identify various features.

References

AlawiPanah, S. K. (2009). Thermal Detection and its Application in Earth Sciences. Tehran: Tehran University Press. ISBN: 9-5363-03-964-978.

Specifications of spectrum bands of the Modus sensor and analysis taken from the link https://modis.gsfc.nasa.gov/about/specifications.php.