

Object based Classification of Satellite images by Combining the HDP, IBP and k-mean on multiple scenes

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Abstract: The goal of this system to analyze remote sensing images and classify objects into land cover or use classes. In this project classify the object based unsupervised classification of remotely sensed very high resolution (VHR) panchromatic and multispectral satellite images in which the hierarchical dirichlet process (HDP) and Indian buffet process (IBP) and k-means clustering algorithm on multiple scenes. In this framework, a VHR satellite image is first over segmented into basic processing units and divided into a set of subimages. The hierarchical structure of our model transmit the spatial information from the original image to the scene layer implicitly and provide useful cues of classification by using k-means clustering algorithm. Clustering is a popular tool for exploratory data analysis such as k-means clustering technique. K-means clustering algorithm is used to partition and analyzes the data which used the required cluster. After dividing the cluster which deciding the color of frequency by using HDP and IBP technique and then applying the color frequency by using the support vector machine algorithm (SVM). Support vector machine algorithm is used for classification of an image. After performing the classification algorithm display the spatial information with the help of deciding color frequency also it shows the percentage of every spatial information.

Keyword: Unsupervised classification, Very high resolution (VHR), Hierarchical dirichlet process (HDP), Indian buffet process (IBP), support vector machine (SVM)

1. INTRODUCTION

The classification of images is becoming more and more important in many applications, the applications of images are divided into two approaches that is first one is the supervised method and unsupervised method. The supervised method requires the availability of a training set for learning the classifier. The supervised methods offer higher classification accuracy compared to the unsupervised ones, but in some applications, it is necessary to resort to unsupervised techniques because training information is not available and the unsupervised

method known also as clustering methods, perform classification just by exploiting information conveyed by the data, without requiring any training sample set. So the unsupervised method is better than the supervised method. In the paper we used the unsupervised method, to classify very high resolution panchromatic as well as multispectral satellite images in an unsupervised way, in which the hierarchical Dirichlet process (HDP) and Indian buffet process (IBP) are combined on multiple scenes. Object-based image analysis (OBIA) often consists of two steps: 1) image segmentation and 2) the classification of image objects using a classifier. The advantages of object based image analysis for analyzing high spatial resolution satellite images. And the object based has been applied successfully in land use and land cover classification. Object based images analysis of high resolution multispectral images however the classification accuracy highly depends on the quality of the image segmentation while both segmentation and classification are designed independently. The main contribution of the paper is a novel application framework to solve the problems of traditional probabilistic topic models and achieve the effective unsupervised classification of very high resolution (VHR) panchromatic and multispectral satellite images. The hierarchical structure of our model transmits the spatial information from the original image to the scene layer implicitly and provides useful cues of classification by using clustering technique, clustering is a popular tool for exploratory data analysis, such as K-means clustering technique. The k-mean clustering technique is used to apply for the segmentation. K-mean clustering algorithm is used to partition and analyze the data which used the required cluster. Initially this number of clusters is taken as starting values. Sometime images which are captures are blur or unclear so they do not return proper return but now with the help of multiple satellite it captures the multiple satellite images and splits them separately. The images are splitting or partitioning because of the avoiding the exceptions, exceptions that means large number of images is uploaded at a time then efficiency are less and time consuming is more to find actual areas. The HDP and IBP technique are used to

decide the color for the different areas after dividing the color performing the classifications by using support vector machine algorithm. Hierarchical dirichlet process very high resolution satellite image are divided into sub images. HDP is transmitting the spatial information from original image and provide the useful cues of classification. Indian buffet process specially defined the sparse binary metric with finite number of rows and unbounded number of columns. It is used to select subset of geo-object class to provide special regularizations. It receives geo-object and scene classification from VHR panchromatic image.

2. LITERATURE SURVEY

1. Object-Based Unsupervised Classification of VHR Panchromatic Satellite Images by Combining the HDP and IBP on Multiple Scenes [1]

In this paper, author proposed, a nonparametric Bayesian classification algorithm by combining the HDP and IBP technique. It is used to classify the panchromatic image automatically without the knowledge of the number of classes in an unsupervised way. The main contribution of this paper is a novel application framework to solve the problems of traditional probabilistic topic models and achieve the effective unsupervised classification of very high resolution (VHR) panchromatic satellite images.

2. Change detection model based on neighborhood correlation image analysis [2]

In This paper, it implements the change detection based on object correlation image and neighborhood correlation image. The object correlation images used multispectral and panchromatic images but neighborhood correlation image is used only multispectral images. This correlation images are based on brightness values from the same geographic area. It is used two classification algorithm i.e. machine learning decision tree and nearest neighbor classifier.

3. Classification of satellite images using new fuzzy cluster centroid for unsupervised classification algorithm [3]

In this paper, it included the several satellite image classification methods and technique. Satellite image classification methods are divided into three categories: automatic, manual and hybrid. In this paper is used to automated satellite image classification technique, it is divided into two categories: supervised and unsupervised.

4. Multi-scale latent Dirichlet allocation model for object oriented clustering [4]

In This paper, author proposed, the high resolution satellite images are divided into accurate segmentation. It is used the latent dirichlet allocation method but by using method does not give the accurate images. So it proposed the Markov Random field method. This method is used to add the spatial information for accurate segmentation.

5. Automatic detection of geospatial objects using multiple hierarchical segmentations [5].

In this paper, author proposed nova method for automatic object detection in high resolution images by combing spectral information. It use the morphological operations applied to individual spectral bands. This paper proposed object detection algorithm that formulated the detection process as an unsupervised grouping problem

6. Object based image analysis for remote sensing [6]

In this paper, author proposed; present a new method for segmenting remote sensing images based on spectral and texture feature. It uses the local spectral histogram representation which consists of histogram of filter responses in a local window. It provides an effective feature to capture both spectral and texture information. Disadvantages of this paper it does not make use of spatial information and the number of cluster cannot usually be obtained directly and automatically.

7. Stick-breaking construction for the Indian buffet process [14]

In this paper, author proposed to derive the stick-breaking representations for the IBP. It develops slice samplers for the IBP that are efficient, easy to implement. It develops the analogous to sethuramans seminal stick breaking representation for CPRs.

8. Entropy rate superpixel segmentation [15]

In this paper, author proposed, unsupervised image segmentations based on Bayesian network. Bayesian network is more used in many areas of decision support and image processing. There are two approaches operate in two phases: the first phase is to make an over

segmentation which gives super pixels cards. And the second phase the super pixels by Bayesian network.

9. Object-oriented image analysis and scale space [7]

In this paper, author proposed, study of image descriptors for the classification and recognition of RSI. It included the 7 descriptors that encode texture information and 12 color descriptors that can be used to encode spectral information. It also proposed the methodology to evaluate image descriptor in classification problem by using KNN classifier.

10. Multiagent object-based classifier for high spatial resolution imagery [8]

In this paper, author proposed, the detail of preserving smoothing classifier random field. To apply the object oriented strategy in CRF classification framework. There are two main approaches are used to take the spatial contextual information Object oriented classification method which integrates the classification and segmentation algorithm and Random field method which is used the another useful classification on that can incorporate the spatial contextual information.

11. An object-oriented clustering algorithm for VHR panchromatic images using nonparametric latent Dirichlet allocation [10]

In this paper, author proposed LLDA model. The LLDA model handles the document clustering with labeled instance. The document labels are obtained by the user's judgment or authentic resources.

12. Probabilistic data association methods for tracking complex visual objects [9]

In this paper, author proposed, a multi-target tracking algorithm under dynamic background based on TLD and multithreading .Multithreading mechanism to expand the number of tracking target. By proposed algorithm not only the rigid object but also non rigid object can be tracked. Single target tracking as well as multiple moving targets is kept at the same time.

13. A Bayesian hierarchical model for learning natural scene categories [12]

In this paper, author proposed, compares the various techniques which retrieve the high resolution remote sensing images from large remote sensing. There are described two texture descriptor such as circular covariance histogram (CCH) and rotation invariant point triplets by using the mathematical morphological tool (RIPT).

14. Latent Dirichlet allocation with topic-inset knowledge [13]

In this paper, author proposed, an unsupervised model hrLDA for automatic terminological ontology learning. hrLDA is a domain independent self-learning model that means it is very promising for learning ontologies in new domain and thus can save significant time and effort in ontology.

3. COMPARATIVE STUDY OF LITERATURE SURVEY

Title	Author	Description
Object-Based Unsupervised Classification of VHR Panchromatic Satellite Images by Combining the HDP and IBP on Multiple Scenes	Yang Shu, Hong Tang, Jing Li, Ting Mao, Shi He, Adu Gong, Yunhao Chen, and Hongyue Du, November 2015	To solve the problems of traditional probabilistic topic models and achieve the effective unsupervised classification of very high resolution (VHR) panchromatic satellite images.
Change detection model based on neighborhood correlation image analysis	J. Im and J. R. Jensen Nov. 2005.	It implements the change detection based on object correlation image and neighborhood correlation image.
Classification of satellite images using new fuzzy cluster centroid for unsupervised classification algorithm	C. H. Genitha and K. Vani Jun. 30-Jul. 4, 2013	It included the several satellite image classification methods and technique.

Multi-scale latent Dirichlet allocation model for object oriented clustering of VHR panchromatic satellite images	H. Tang et al Mar. 2013.,	It proposed the Markov Random field method. This method is used to add the spatial information for accurate segmentation.
Automatic detection of geospatial objects using multiple hierarchical segmentations	H. G. Akcay and S. Aksoy Jul. 2008.	It proposed nova method for automatic object detection in high resolution images by combing spectral information
Object based image analysis for remote sensing	T. Blaschke, Jan. 2010	present a new method for segmenting remote sensing images based on spectral and texture feature
Stick-breaking construction for the Indian buffet process	Y. W. Teh, D. Görür, and Z. Ghahramani, Mar-2007	It develops the analogous to sethuramans seminal stick breaking representation for CPRs.

An object-oriented clustering algorithm for VHR panchromatic images using nonparametric latent Dirichlet allocation	Y. F. Qi et al, 2012	It proposed LLDA model. The LLDA model handles the document clustering with labeled instance.
Probabilistic data association methods for tracking complex visual objects	C. Rasmussen and G. D. Hager, Jun. 2001.	a multi-target tracking algorithm under dynamic background based on TLD and multithreading
A Bayesian hierarchical model for learning natural scene categories	L. Fei-Fei and P. Perona, Jun. 20-25, 2005,	Compares the various techniques which retrieve the high resolution remote sensing images from large remote sensing.
Latent Dirichlet allocation with topic-inset knowledge	D. Andrzejewski and X. Zhu, Jun. 4, 2009,	In this paper, proposed an unsupervised model hrLDA for automatic terminological ontology learning.

Entropy rate superpixel segmentation	M.-Y. Liu, O. Tuzel, S. Ramalingam, and R. Chellappa Jun. 21-23, 2011,	It proposed unsupervised image segmentations based on Bayesian network
Object-oriented image analysis and scale space	T. Blaschke and G. J. Hay, Oct. 2001.	In this paper study of image descriptors for the classification and recognition of RSI.
Multiagent object-based classifier for high spatial resolution imagery	Y. F. Zhong, B. Zhao, and L. P. Zhang, Feb. 2014.	The detail of preserving smoothing classifier random field. To apply the object oriented strategy in CRF classification framework

4. PROBLEM DEFINITIONS

In existing system object based unsupervised classification of very high resolution panchromatic satellite images by combining the HDP, IBP on multiple scene, this paper used for the purpose of remotely scene satellite images providing the unsupervised classification for collecting spatial structural and information or it use to analyze remote sensing images and classify object into land cover or use classes example of water, soil, building, vegetation, and unknown are. In an existing system it perform the operation only on panchromatic images which return the in an gray scale format but in an proposed system it perform the operation on panchromatic as well as multispectral satellite images and it return the result both images are in gray scale format. Another problem is that lack of HDP (hierarchical dirichlet process) and IBP (Indian buffet process) method it only used to deciding the color frequency of a menus or area. It performs the operation with the help of Chinese restaurant franchise

process But the drawback is that it required more time for processing or deciding the color frequency which is overcome in a proposed system by using a k-mean clustering technique. By using k-mean clustering technique divide the number of five clusters and this cluster divided into a number of 10 by 10 blocks so it easily find the color of frequencies. Third problem of this existing system it does not performed the operation on multiple satellite images at a time. But in proposed system it performs maximum four numbers of images at a time. It also does not show the percentage of an area in an existing system but in proposed system it show the area with the help of graph.

5. OBJECTIVES

The main objectives of the study are listed below:

1. To implement Clustering Ensemble Strategy.
2. To implement Multiple Satellite Images.
3. To implement system which work with panchromatic and multispectral.

6. PROPOSED SYSTEM

The proposed work is planned to be carried out in the following manner:

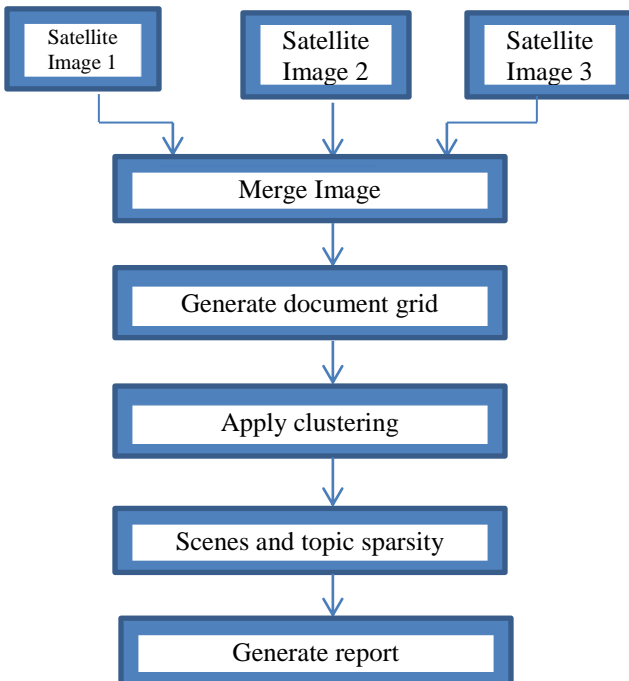


Fig: Basic System Architecture

Fig. shows the basic system architecture of proposed system, In a system architecture need to upload one or maximum four image at a time these images are panchromatic as well as multispectral then all images are merging by using multiple satellite images, with the help of multiple satellite images it captures the multiple number of images those images are sometimes blur or clear so it splits the images into clear images from data set. And then generate document grid, in document grid it store details about the merging images i.e. color, texture and pixels etc. After generation document grid we will apply clustering using k-mean clustering technique.

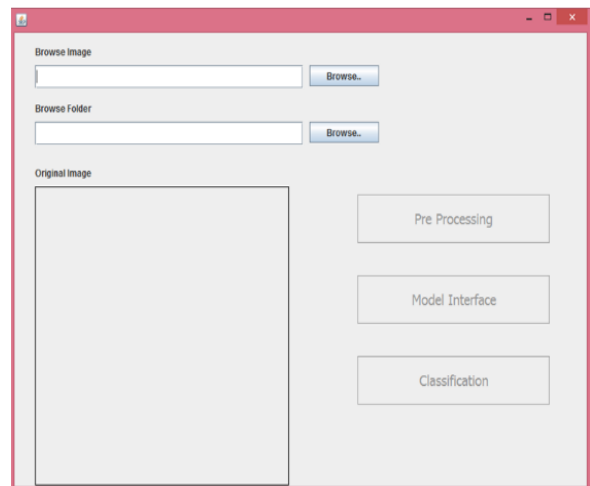
After applying clustering technique to decide the maximum color intensity images with the help of scenes and topic sparsity and then generate the report, in generate report we will store the images as well as calculation document.

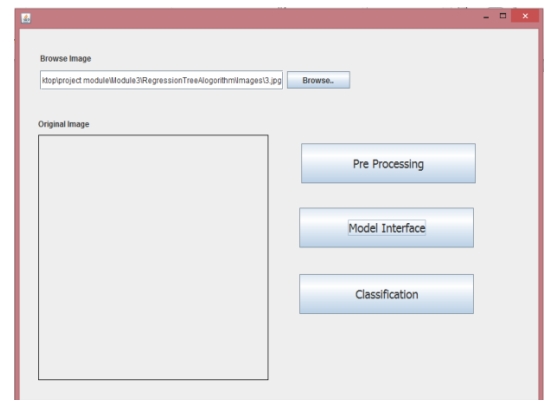
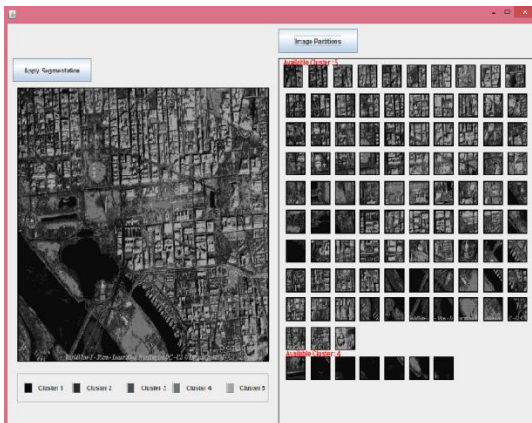
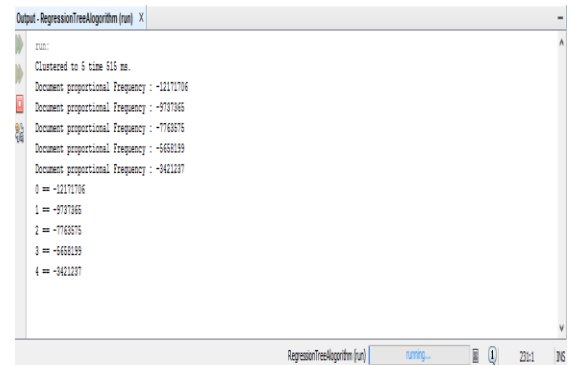
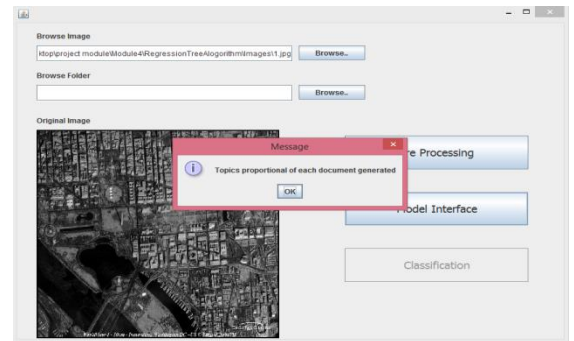
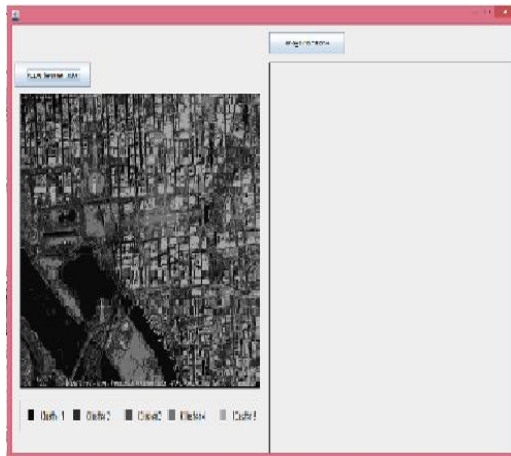
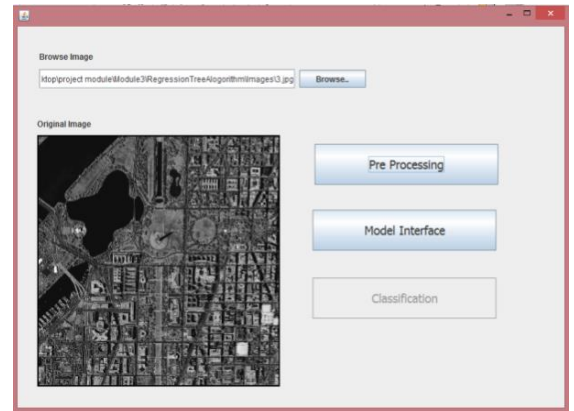
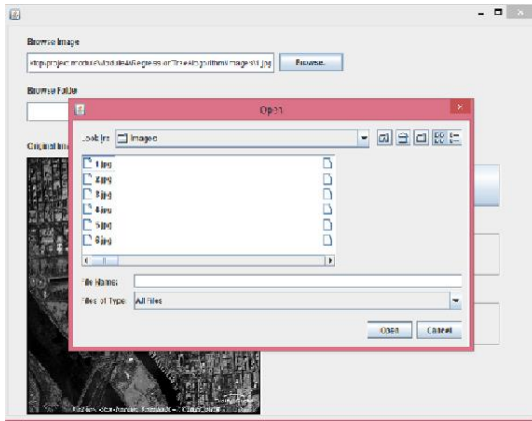
7. MODULE

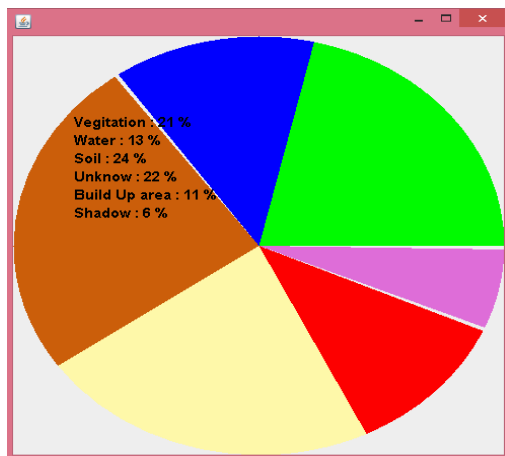
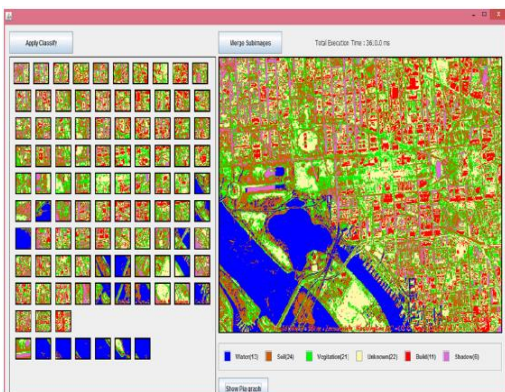
In this project it included the number of three modules:

- Implementation of merge image and preprocessing.
- Implementation of generation of documents grid and clustering.
- Implementation of sence and topic sparsity, generate report.

8. IMPLEMENTATION OF MODULE







9. CONCLUSION

The goal of this system is to analyze remote sensing images and classify objects into land cover or use classes. The classification process is used as crucial step to interpret the land in many different kinds of applications. Today's trend in classification of remote sensing images is to do object oriented or object based classification rather than classifying single pixels. This requires segmentation

of objects before assigning their class labels. In this projects implements object based unsupervised classification of remotely sensed panchromatic and multispectral satellite images. Imagery is an important problem in remote sensing applications because the resulting segmentation can provide valuable spatial and structural information that are complementary to object based spectral information in classifications. It introduces an unsupervised method that combines both spectral and structural information. This project used k-mean clustering algorithm to reduce color texture pattern to improve speed to the classification for HDP and IBP. These systems were used to cluster the regions by clustering algorithm and the cluster labels assigned to each segment in multiple scales were used to classify the corresponding pixels with a SVM classifier. This project used SVM algorithm by combining the HDP with the IBP to consider the hierarchical spatial information of satellite images and the hierarchical spatial information is show to make surely spatial consistency of the classification result.

REFERENCES

- [1] Yang Shu, Hong Tang, Jing Li, Ting Mao, Shi He, Adu Gong, Chen, and Hongyue Du" Object-Based Unsupervised Classification of VHR Panchromatic Satellite Images by Combining the HDP and IBP on Multiple Scenes" IEEE transactions on geoscience and remote sensing, vol. 53, no. 11, November 2015.[2] J. Im and J. R. Jensen, "A change detection model based on neighborhood correlation image analysis and decision tree classification," Remote Sens. Environ., vol. 99, no. 3, pp. 326–340, Nov. 2005.
- [3] C. H. Genitha and K. Vani, "Classification of satellite images using new fuzzy cluster centroid for unsupervised classification algorithm," in Proc.IEEE Conf. Inf. Commun. Technol., Jeju Island, Korea, Jun. 30–Jul. 4, 2013, pp. 203–207.
- [4] H. Tang et al., "A multi-scale latent Dirichlet allocation model for objectoriented clustering of VHR panchromatic satellite images," IEEE Trans. Geosci. Remote Sens., vol. 51, no. 3, pp. 1680–1692, Mar. 2013.
- [5] T. Blaschke, "Object based image analysis for remote sensing," ISPRS J. Photogramm. Remote Sens., vol. 65, no. 1, pp. 2–16, Jan. 2010
- [6] H. G. Akcay and S. Aksoy, "Automatic detection of geospatial objects using multiple hierarchical segmentations," IEEE Trans. Geosci. Remote Sens., vol. 46, no. 7, pp. 2097–2111, Jul. 2008.
- [7] T. Blaschke and G. J. Hay, "Object-oriented image analysis and scale-space: Theory and methods for modeling and evaluating multiscale landscape structure,"

Int. Arch. Photogramm. Remote Sens., vol. 34, no. 4, pp. 22–29, Oct. 2001.

[8] Y. F. Zhong, B. Zhao, and L.P.Zhang, “Multiagent object-based classifier for high spatial resolution imagery,” *IEEE Trans. Geosci. Remote Sens.*, vol. 52, no. 2, pp. 841–857, Feb. 2014.

[9] C. Rasmussen and G. D. Hager, “Probabilistic data association methods for tracking complex visual objects,” *IEEE Trans. Pattern Anal. Mach. Intell.*, vol. 23, no. 6, pp. 560–576, Jun. 2001.

[10] Y. F. Qi et al., “An object-oriented clustering algorithm for VHR panchromatic images uses nonparametric latent Dirichlet allocation,” in *Proc. IEEE Int. Geosci. Remote Sens. Symp.*, Munich, Germany, 2012, pp. 2328–2331.

[11] S. Williamson, C. Wang, K. Heller, and D. Blei, “The IBP compound Dirichlet process and its application to focused topic modeling,” in *Proc. 27th Int. Conf. Mach. Learn.*, Haifa, Israel, Jun. 21–24, 2010, pp. 1–8.

[12] L. Fei-Fei and P. Perona, “A Bayesian hierarchical model for learning natural scene categories,” in *Proc. IEEE Comput. Vis. Pattern Recog.*, San Diego, CA, USA, Jun. 20–25, 2005, pp. 524–531.

[13] D. Andrzejewski and X. Zhu, “Latent Dirichlet allocation with topic-inset knowledge,” in *Proc. NAACL HLT Workshop Semi-Supervised Learn. Nat. Lang. Process.*, Boulder, CO, USA, Jun. 4, 2009, pp. 43–48.

[14] Y. W. Teh, D. Görür, and Z. Ghahramani, “Stick-breaking construction for the Indian buffet process,” in

Proc. 11th Int. Conf. Artif. Intell. Stat., San Juan, Puerto Rico, Mar. 21–24, 2007, pp. 556–563.

[15] M.-Y. Liu, O. Tuzel, S. Ramalingam, and R. Chellappa, “Entropy rate superpixel segmentation,” in *Proc. IEEE Comput. Vis. Pattern Recognit.*, Colorado Springs, CO, USA, Jun. 21–23, 2011, pp. 2097–2104.

[16] X. Chen, M. Zhou, and L. Carin, “The contextual focused topic model,” in *Proc. 18th ACM SIGKDD Conf. Knowl. Discov. Data Mining*, Beijing, China, Aug. 12–16, 2012, pp. 1–9.

[17] L. Fei-Fei and P. Perona, “A Bayesian hierarchical model for learning natural scene categories,” in *Proc. IEEE Comput. Vis. Pattern Recog.*, San Diego, CA, USA, Jun. 20–25, 2005, pp. 524–531.

[18] Y. J. Tang, D. Xu, G. H. Gu, and S. Y. Liu, “Category constrained learning model for scene classification,” *IEICE Trans. Inf. Syst.*, vol. E92-D, no. 2, pp. 357–360, Feb. 2009.

[19] X. L. Zhang, P. F. Xiao, X. Q. Song, and J. F. She, “Boundary-constrained multi-scale segmentation method for remote sensing images,” *ISPRS J. Photogramm. Remote Sens.*, vol. 78, pp. 15–25, Apr. 2013.

[20] J. A. dos Santos, P. H. Gosselin, S. Philipp-Foliguet, R. D. Torres, and A. X. Falcao, “Interactive multiscale classification of high-resolution remote sensing images,” *IEEE J. Sel. Topics Appl. Earth Observ. Remote Sens.*, vol. 6, no. 4, pp. 2020–2034, Aug. 2013.