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Bigdata Based Disaster Monitoring of Satellite Image Processing Using Progressive Image Classification Algorithm

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Abstract: The analysis of remote sensing image areas is a need for climate detection and management to monitor flood disasters in key environments and applications. The satellite image is most used to detect the disaster analysis in the earth, and it has advantages to capture an earth image, this earth image has more information to give the control technique. Since the acquisition of satellite and aerial imagery, this system detects the flood disaster, and flood detection has become more desirable in recent years with increasing convenience. In this research work, Progressive Image Classification Algorithm (PICA) is proposed to detect the earth disaster and classify the result more effectively. PICA is most essential to overcome robust shadows, proper access to the characteristics of the disaster, false positives by operators, or false that affect the impact of the disaster. It creates tailoring and adjustments obtained from satellite images before training and post-disaster aerial image data patches. The proposed PICA detects the earth disaster earlier and the accuracy (95.96%).

Keywords*: *Intermittent Image Clustering Segmentation, Progressive Image Classification Algorithm, Satellite Image, Disaster Detection.

1. Introduction

Disaster conservation has become one of the most active areas of remote sensing research, as preserving human life is our top priority after a disaster. This is a swift response operation after catastrophic disasters such as landslides and flood adjustments are essential. Previous studies rely on sensors only focusing on the detected changes, and manually categorize and adjust comparisons based on image processing techniques, disaster-induced change detection methods. To improve the detection accuracy, mounting machine learning, the efficiency of the extraction mechanism can be improved. The machine learning literature, a significant number was detected. Bag Overlays Recommended Appearance-Words were placed to identify mass destruction. Use of artificial neural network cyclone track prediction. In this year's evaluation, the feed-forward multi-layer neural network with the effectiveness of the neural network classification. Then use the three-dimensional view features to detect the corruption. On the other hand, the learning method identified deep geological hazards performed.

One of the most famous deep learning approaches, PICA, is testing for better results during disasters such as avalanches, earthquakes, and landslides. Mainly focused on sensors, they are simple before this disaster detection system. So they ran into some important issues. For example, the range for confirming that a disaster has occurred is insufficient for verbal communication, limited by the number of sensors, and the correct, accurate data is sent. Also, satellite images of disasters involving operators cannot handle large scale and detection quickly. Therefore, this information can lead to misunderstandings and neglect of disasters. Based on this example, based on previous research. Therefore, the purpose of such a system to check for disasters is the depth of disaster detection system established by each assisted automatic disaster learning monitor, where the purpose of such an operation occurs in a wide range of satellite images. The proposed Progressive Image Classification Algorithm (PICA)is used to improve the performance of this system.

2. Literature Survey

It proposed a new framework for the integration of multi-temporal, regional climate zone classification of Open Street Map (OSM) data with satellite images. The most common method of data fusion is included in the stack, but it ignores the heterogeneity of multimodal optical image data and OSM. [1]. It presents frame images that match the shooting modes of China's new Gaofen-4 nominal projection model. At the end of the experiment, numerous, designed to compare a detailed analysis of the difference between the three shows with the nominal grid [2].The detection algorithm systemized image-based analysis, filtering fire pixel, and time analysis are not clear to confirm the actual test. Fire

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detection comparison between predicted and measured values based on the system [3].Remote sensors onboard aircraft and satellites absorb light reflected from the surface of the earth. Various image processing techniques are needed to get the data to the image[4].

This includes a brief introduction to service-based flood monitoring, its technology, and the development of significant hazard information products [5].The main reason for this fact: many related to the predominant spatial data infrastructure-a complicated theoretical explanation of body dynamics is complicated. Theoretical tasks are more difficult than modeling a cycle laser field, especially on a dynamic time-scale spatial database [6].Monitoring changes in urban growth is an essential issue in urban planning and disaster management. Although some change detection methods have been proposed to address urban growth, their performance is often limited due to satellite image time series [7].The image of the Earth is very large and complicated because I have chosen a neural network, dedicated image enhancement, a specific location, no place to detect and improve it [8] automatically.

Currently, due to the accumulation of toxic substances in waste cities and the more dangerous air pollution that is present in the mine of some cities due to their natural resources being present inside the middle and around the contaminated surface. City of Cerro de Pasco to level official [9].The benefits of using SAR satellite imagery to monitor the occurrence of natural disasters have been tried. Microwave oven in the lower part of PALSAR-2emits, receiving backscattered waves on the surface of the earth as observation data [10].A new solution is to introduce a precise three-axis on the stable center of gravity subpixel star to the satellite with a geostationary earth observation focus sensor. A small two-dimensional array is better used to capture star points than a linear array of detectors [11].Polar metric L-band Synthetic Aperture Radar (SAR) by using the possibility of land cover wide area classification [12].

Instead of a continuous need for damage, drought, and regular monitoring and other natural disasters, because it is very slow. Satellite images can be used to modify the overall monitoring of dam reservoirs and water resources of river basins [13].It has extensive coverage of a series of pan-chromatic sensor spectral satellites, from geosynchronous to sun-synchronized optical radar, so that the system has high spatial, high temporal resolution, and high spectral capabilities [14].The purpose of this study was to determine the appropriate spectral characteristics of rice flood development based on remote sensing image data domain scale mapping and detection methods [15].Residential areas are essential places for human habitation and living. Utilize remote detecting innovation to distinguish local locations and is of extraordinary incentive for land asset arranging and use, fiasco anticipation and alleviation, and different regions [16].

Therefore, we analyzed image data from remote sensing satellites to detect changes in forest cover. Since the original data has jobs, serious pollution defects, we will first design a mechanism to restore the image due to the lack of surface reflection information in time and space [17].The aim is to reduce the over-segmentation algorithm with minimal loss of data and transform the image size by splitting the image pixels into supergroups, which provides an easy way to take advantage of the interdependence of adjacent pixels [18]. Land Observing Technology Satellite-2 (LOTS-2) is an agricultural and natural resource, such as forest and sea/land ice as technology development, the Earth observation satellite monitoring land, environmental monitoring introduced for prevention and mitigation [19].The use of Earth observation satellite constellations near real-time surveillance systems expected to be used for disaster management. However, since these satellites are over a few minutes, they may not have enough time to send all of their observations to a Low Earth Orbit (LEO) satellite ground station to the ground station [20].Two thin covers detect the coarse resolution of images acquired at different times with land changes and the excellent spatial and temporal resolution of the figure resolution change identifying new super-resolution methods[21].

3. Materials and Methods

To increase the precision of their results, the Progressive Image Classification Algorithm (PICA) incorporates machine learning techniques for locating disaster areas. One of these scenarios could benefit from this approach. One of the most important technological subfields of performance learning, technology, and machine learning is the detection of "disasters," or areas of change.

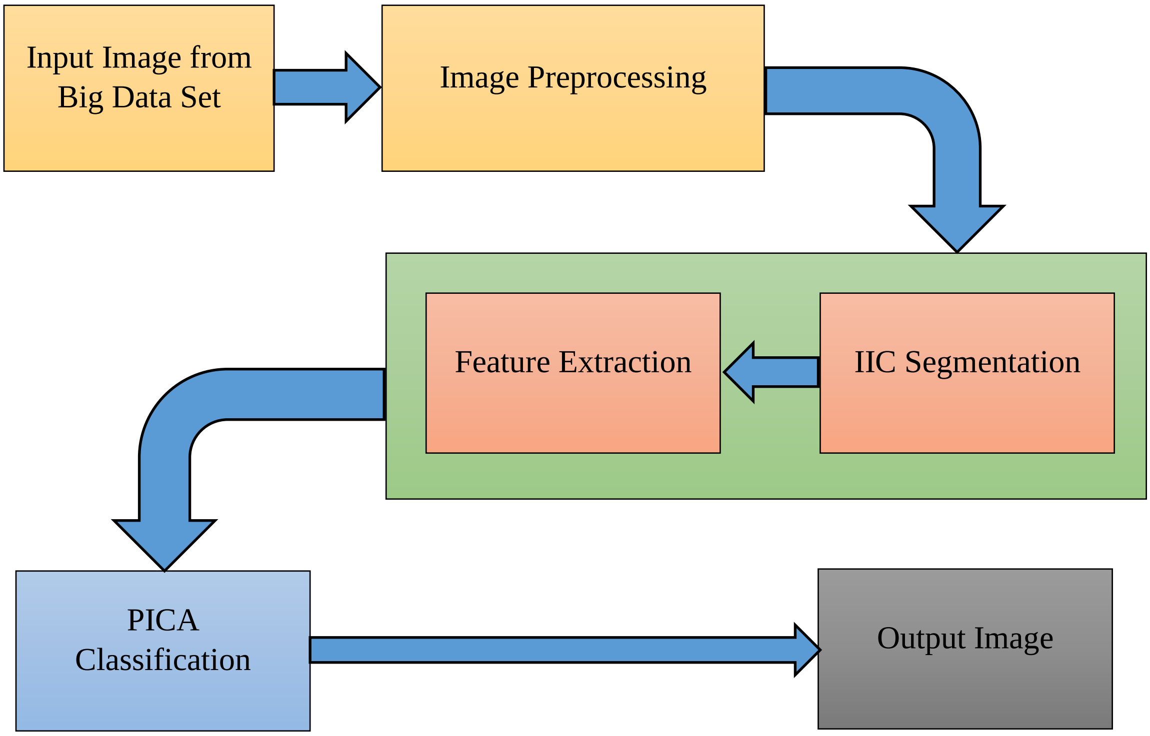


Fig. 1. The Proposed System Block Diagram

The proposed Classification Algorithm system consists of two phases: the training phase and the testing phase. This section presents studies that produce unique high precision results. The origin of our research is learning to change from previous disasters. In other words, the difference in learning image feature change detection obtained from the pre-disaster image (3 RGB channels) and the post-disaster image (3 RGB channels). In most previous studies, the query image is a feature-absorption feature only from disaster disasters, to meet the nature of disasters treated as change detection. Therefore, previous studies can be obtained from the early stages of error results. It focuses on reducing the error from the initial (learning phase) and detecting changes in the image before and after the disaster. Also, the means of change caused a disaster. Most importantly, our method is faster and more than previous studies in disaster detection speed.

3.1 Image Preprocessing Median Filter

Image processing is used to change the images so that we can learn more about how they function in digital form.We need to take at least two digital images of the same area at different times with the same sensor in order to detect any changes.A step-by-step explanation of how to use satellite image change detection is provided by the system.Typically, input images are taken at various times.A noise filter is used to get rid of presence information and image distortion.The image convolution mask is the name given to the process of filtering.The type of image produced by filters is determined by the impact's sound.ambiguous, which can be filtered out of an image.Before extracting large objects, the details of the image are free of blur.Enhancement technology has the potential to improve images.

3.1.1 Median Filter based Image preprocessing technique:

Step 1: Through the satellite, initialize the input image;The pixel value in this input image is examined.

Step 2: Determine the intensity value of each color channel using its pixel intensity and gray level.

$$k = k^i + 1, when\ i = 0 \qquad \text{---- (1)}$$

Step 3: The value of the input earth image is compared to the value of the post image, and the difference is subtracted.

Step 4: The input image's co relative frequency is.

$$I_f[k^1] = I_f[k^1 - 1] + [k^i] \qquad \text{---- (2)}$$

Step 5: The accuracy of the disaster earth image area and the ground truth value must be compared by the filtering method.

Step 6: Stop.

3.2 Image Segmentation

Image segmentation methods are commonly applied to get the data related to digital images or to discover limits with objects. The division is a significant advance in picture examination. A non-transformed context that transforms a grayscale or color image into a binary image has similar gray levels. It divides the pixels into context groups together while calling the binary mapped regions near the spatial position. The threshold uses two disjoint areas with values of the input data and other thresholds greater than those of the most straightforward non-contextual segmentation technique. The image can be segmented by pixel, region, or a combination of two or more texture-based techniques until the blending process is complete.

3.2.1 SEGMENTATION USING INTERMITTENT IMAGE CLUSTERING SEGMENTATION ALGORITHM:

Step 1: Get the preprocessed image and analysis the value and cluster the image.

Step 2: Initialize the bias field to mean-variance of the input image and weight the image is estimated to initial probability.

$$p = x|c \quad \text{---- (3)}$$

Step 3: Estimate the expected value of the hidden intensity value for the current value

$$p_{new}(x_j) = p(x_j|c_j) \quad \text{---- (4)}$$

Step 4: The original p indicators are to be transformed into a linear combination by a brand-new comprehensive index mathematical processing for Intermittent Image Clustering Segmentation.

Step 5: The model parameters by taking the maximum likelihood estimate according to the current valuation of the complete data.

$$p_{old}(x_j) = p_{new}(x_j) \quad \text{---- (5)}$$

Step 6: The best test results for this Intermittent Image Clustering Segmentation (IICS) algorithm can be achieved without using the pattern background image method, but the types of targets that the algorithm can detect are limited.

Step 7: End.

3.3 Image Classification

In remote sensing, image classification is a crucial technology. A supervised learning classifier serves as the foundation for the Progressive Image Classification Algorithm (PICA), and object-based image analysis is one of the three primary types. It is possible to classify using any one of these methods or any one of these techniques. It is able to carry out the method by combining the discriminative image classification algorithms of (DICA).Change Detection The Geospatial Information System, or GIS, measures a region's character and how it has changed between two or more periods.A lot of the time, this involves comparing satellite and aerial images of the same area taken at different times. Change detection can be modified using pixel-based methods to detect, based on detection method object changes, by mixing using change detection methods. An image change may be a change that occurs because of a different shape than the disappearing object or movement of such a purpose. Distinguishing proof of quantitative and subjective change identification has gotten significant in all territories. As of late, it is identifying changes in remote detecting pictures has become a significant research issue because of fast changes in condition, nature, and urban territories.

Proposed Progressive Image Classification Algorithm
Step 1 re-evaluating or initializing the parameters of the model. **Step 2** The image has been preprocessed to improve its quality. **Step 3** vectors with two parameters:a dimensional parameter of the information picture and an S-dimensional parameter of the multinomial conveyance. **Step 4** Three variables are randomly initialized before they are updated, i.e., the scene index of sub-images S; the binary matrix B, which indicates the class selection of each sub-image; and the matrix of the class labels of over segments Z. **Step 5**

Sampling the class selection indicator binary vector.

$$p(b_{m,k}|\pi_{s,k}, \alpha\beta k, s_m = s, n_m^k \qquad \text{---- (6)}$$

where n_m^k is the number of pixels associated with class k insub-image m.

Step 6

Using a class label for each sample throughout the segment.Instead of sampling, label the class as "over segment."

Step 7

In our model, the quantity of class K is not fixed.When only a small number of classes are used to display the image, it may misinterpret the actual number as infinite.

Step 8

Driving the results of the characterization and checking the union.The calculation determines whether intermingling was achieved after the Gibbs examining strategy has been completed.

Step 9

Defining the criterion requires a looping stop.

Step 10

End.

4. Results and Discussion:

The most prevalent manipulation and operation in two-dimensional data is the proposed Progressive Image Classification Algorithm (PICA) analysis in MATLAB 2017b.Upload information inspector and look at confirmation signals from various analog data and data groups, as well as analyze simulations that are currently running.The performance of the proposed PICA technique is analyzed in terms of the following parameters

- Sensitivity
- Specificity
- Accuracy
- Precision
- Recall

In order to define the aforementioned parameters, a basic understanding of True Positive (TP), True Negative (TN), False Negative (FN), and False Positive (FP) is required.

Sensitivity

Table 1 shows the comparative results of the sensitivity of the existing SVM, RVM and the proposed PICA. It is observed from the table that, SVM technique shows a sensitivity measure of 77.46, RVM technique shows a sensitivity measure of 80.28 whereas, the PICA shows a sensitivity measure of 92.95 respectively.

Table 4.1 Sensitivity Measure of SVM, RVM and PICA

Techniques	**Sensitivity**
SVM	77.464
RVM	80.2817
PICA	92.9577

The Table values are pictorially represented via a graph and it is evident from the graph that the sensitivity of the proposed PICA technique is significantly high compared to the existing SVM and RVM techniques. Also, based on mathematical analysis, it is observed that the proposed PICA shows an increase of 13.63% in sensitivity compared to the RVM technique. The results are shown in graph in figures which denotes the sensitivity. The x-axis of the graph denotes the various techniques such as SVM, RVM and PICA for performance analysis and y-axis denotes the performance value ranging from 0 to 100. It is evident from the graph that the proposed PICA technique shows high sensitivity compared to the existing SVM.

Specificity

Table 2 shows the comparative results of the existing SVM, RVM, and proposed PICA techniques. The results are shown in graph in figures which denotes the specificity. The x-axis of the graph denotes the various techniques such as SVM, RVM and PICA for performance analysis and y-axis denotes the performance value ranging from 0 to 120. It is evident from the graph that the proposed PICA technique shows high specificity compared to the existing SVM and RVM techniques.

Table 2 Specificity Measure of SVM, RVM and PICA

Techniques	Specificity
SVM	100
RVM	100
PICA	100

In Specifity comparative results of the existing algorithms are SVM (Support Vector Machine), RVM (Relavant Vector Machine) compared to proposed algorithm PICA and here y-axis denotes the values 0 to 120 ranging. The (SVM) algorithm outputs an optimal hyper-plane. This hyper-plane is a line dividing in two part where in each class lay in either side. The RVM is uses Bayesian inference to obtain parismonious solutions for regresion and probabilistic classification and RVM has an identicial functional from to the Support Vector Machine.

Accuracy

Table 3 describes the comparative results of the accuracy of the existing SVM, RVM, and proposed PICA techniques. It is observed from the table SVM technique has an accuracy of 87.09, RVM technique shows a sensitivity accuracy measure of 88.70 whereas, the PICA shows a sensitivity accuracy measure of 95.96 respectively.

Table 3 Accuracy of SVM, RVM and PICA

Techniques	Accuracy
SVM	87.09
RVM	88.70
PICA	95.96

The table values are pictorially represented via a graph and it is evident from the graph that the accuracy of the proposed PICA technique is significantly high compared to the existing SVM and RVM techniques. Also, based on mathematical analysis, it is observed that the proposed PICA shows an increase of 7.56% of accuracy when compared to the RVM technique. The results are shown in graph in figures which denotes the accuracy.

The x-axis of the graph denotes the various techniques such as SVM, RVM and PICA for performance analysis and y-axis denotes the performance value ranging from 0 to 100. It is evident from the graph that the proposed PICA technique shows high accuracy compared to the existing SVM and RVM techniques.

Precision

Table 4 shows the comparative results of precision of the existing SVM, RVM, and proposed PICA techniques.

Table 4 Precision Rate of SVM, RVM, and PICA

Techniques	Precision
SVM	100

RVM	100
PICA	100

The results are shown in graph in figures which denotes the precision rate. The x-axis of the graph denotes various techniques such as SVM, RVM and PICA for performance analysis and y-axis denotes the performance value ranging from 0 to 100.

Recall

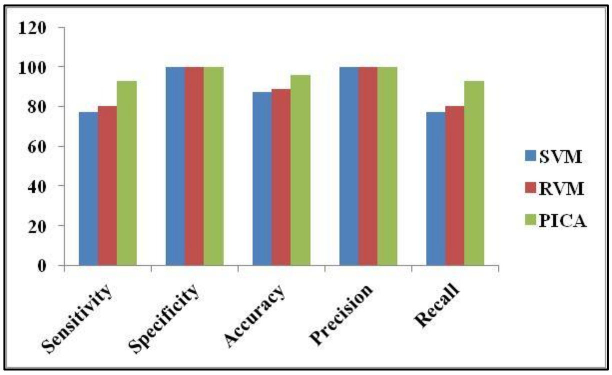
Table 5 describes the comparative results of the recall rate of the existing SVM, RVM, and proposed PICA techniques. It is observed from the table SVM technique has a recall rate of 77.46, RVM technique shows a sensitivity measure of 80.28 whereas, the PICA shows a recall rate of 92.95 respectively.

Table 4.5 Recall Rate of SVM, RVM, and PICA

Techniques	**Recall**
SVM	77.46
RVM	80.28
PICA	92.95

The table values are pictorially represented via a graph and it is evident from the graph that the recall of the proposed PICA technique is significantly high compared to the existing SVM and RVM techniques. Also, based on mathematical analysis, it is observed that the proposed PICA shows an increase of 13.63% in recall rate when compared to the RVM technique.

The results are shown in figure which denotes the recall. The x-axis of the graph denotes various techniques such as SVM, RVM and PICA for performance analysis and y-axis denotes the performance value ranging from 0 to 100. It is evident from the graph that the proposed PICA technique shows high recall rate compared to the existing SVM and RVM techniques.



5. Conclusion

The Precision, recall, and the f-measure parameter all show significant improvements with the proposed PICA method. There is no loss of color information when using the PICA and extract to locate the disaster area. Six RGB channels are combined in advance after the disaster. utilizing a straightforward subtraction technique of various channels, pre-disaster by channel, employing grayscale and grayscale disaster (disaster area or G in extraction by R or B channel) in contrast to the conventional approach, which uses only two channels. As a result, both the new method and the old one for extracting from the affected area produce satisfactory results without compromising the original color information. Every disaster detection system in the world uses the proposed research method as a potential disaster relief center. The development of a rescue route for operators to use in detecting natural disasters in the affected areas and looking for casualties will further enhance our strategy and assist you in narrowing your presentation here. The proposed PICA method is more accurate than the conventional one (95.96 percent).

Reference

[1] Guichen Zhang, Pedram Ghamisi, "Fusion of Heterogeneous Earth Observation Data for the Classification of Local Climate Zones" in IEEE Trans on Geoscience and Remote Sensing, Volume. 57, issue. 10, page. 7623 – 7642, 2019.

[2] Xiaochong Tong, Jing Wang, "Normalized Projection Models for Geostationary Remote Sensing Satellite: A Comprehensive Comparative Analysis" in IEEE Trans on geoscience and remote sensing, Volume. 57, issue. 10, page. 7623 – 7642, 2019.

[3] Zhengyang Lin, Fang Chen, "A Contextual and Multi-temporal Active-Fire Detection Algorithm Based on FengYun-2G S-VISSR Data" in IEEE Trans on geoscience and remote sensing, Volume. 57, issue. 11, page. 8840 – 8852, 2019.

[4] Anusha, Bharathi, "An overview on Change Detection and a Case Study Using Multi-temporal Satellite Imagery" in International Conf on Computational Intelligence in Data Science, 2019.

[5] Franz J Meyer, Olaniyi A Ajadi, "Applications of a SAR-Based Flood Monitoring Service during Disaster Response and Recovery" in International Geoscience and Remote Sensing Symposium, 2019.

[6] Boris Bergues, Matthias Kubel, "Single-Cycle Non-Sequential Double Ionization" in the IEEE Journal of selected topics in quantum electronics, Volume. 21, issue. 5, 2019.

[7] Caglayan Tuna, Merciol, "Monitoring Urban Growth with Spatial Filtering of Satellite Image Time Series" in Joint Urban Remote Sensing Event, 2019.

[8] Lalitha, Shanta Rangaswamy, "Satellite Image Enhancement Using Neural Networks" in International Conf on Inventive Computation Technologies, 2018.

[9] Edgardo Lozano-Cotrina, Erik Berrospi-Elises, "Detection of Minerals Through the Processing of Satellite Images" in International Conf on Electronics, Electrical Engineering, and Computing, 2018.

[10] Risa UMEMURA, Toshikazu SAMURA, "An efficient orthorectification of a satellite SAR image used for monitoring disaster" in International Workshop on Advanced Image Technology, 2018.

[11] Haopeng Zhang, Yi Su, "Star Image Simulation and Subpixel Centroiding for an Earth Observing Sensor" in International Geoscience and Remote Sensing Symposium, 2018.

[12] Masato Ohki, Masanobu Shimada, "Large-Area Land Use and Land Cover Classification with Quad, Compact, and Dual Polarization SAR Data by PALSAR-2" in IEEE Trans on geoscience and remote sensing, Volume. 58, issue. 9, page. 5550 – 5557, 2018.

[13] Dalgeun Lee, Jongpil Kim, "Application of Landsat-8 and Sentinel-1 Images for Drought Monitoring Over the Korean Peninsula" in International Geoscience and Remote Sensing Symposium, 2018.

[14] Li, LU, "Application of the GF satellite data in flood disaster monitoring" in International Geoscience and Remote Sensing Symposium, 2018.

[15] Jianghao Sun, Lin Yuan, "Regional-scale monitoring of rice flood disaster based on multi-temporal remote sensing images" in International Conf on Agro-geo-informatics, 2018.

[16] Wei Wu, Wei Liu, "Remote sensing recognition of residential areas based on GF-4 satellite image" in International Workshop on Earth Observation and Remote Sensing Applications, 2018.

[17] Salman, Xuming, "Forest Change Detection in Incomplete Satellite Images With Deep Neural Networks" in IEEE Trans on Geoscience and Remote Sensing, Volume. 55, issue. 9, page. 5407 – 5423, 2017.

[18] Xuejun Zhai, Xiaonan Niu, "Distance Dependent Chinese Restaurant Process for VHR Satellite Image Over segmentation" in Joint Urban Remote Sensing Event, 2017.

[19] Takeshi Motohka, Yukihiro Kankaku, "Advanced Land Observing Satellite-2 (ALOS 2) and its follow-on L-band SAR mission" in Radar Conference, 2017.

[20] Shigenori Tani, Michiya Hayama, "Multi-carrier Relaying for Successive Data Transfer in Earth Observation Satellite Constellations" in Global Communications Conference, 2017.

[21] Xiaodong Li, Feng Ling, "A Super-resolution Land-Cover Change Detection Method Using Remotely Sensed Images With Different Spatial Resolutions" in IEEE Trans on geoscience and remote sensing, Volume. 54, issue. 7, page. 3822 – 3841, 2016.