A FUZZY EFFECTIVE CURVIC ANALYSIS APPROACH FOR BUILDING EXTRACTIONS OVER SATELLITE IMAGES

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Abstract: Satellite images are the critical real-time images captured by radar or the satellite to identify the regions on earth. It is also used to identify some movement area or specific object area. One of the applications includes identifying the buildings in city areas to analyze the city population density or commercial benefits. In this paper, we propose a fuzzy effective curvic analysis approach to extract the buildings from Satellite images. Firstly, we apply Gaussian filter to reduce the noise in the image. In the second stage, we extract the features of images. In the third stage, we preform the object extraction using fuzzy adaptive radial approach.

Keywords: Fuzzy; Satellite images; Segmentation; Entropy.

1. INTRODUCTION

Image Processing is one of the most explored research areas that is been defined under the specification of various associated processes. Image processing is having its importance and requirements in many application areas. These application areas include medical image processing, agricultural image processing, Satellite images classification etc. The associated fields to the image processing further divided into several sub-areas, so that the information processing is defined as the framework. Image processing is defined under the specification of image level analysis applied on the information process also described with associated process stages and each process stage itself defines an application area. The process stage includes the recognition system, feature generation, segmentation, classification etc. In recent years, image processing comes up with better functionality and with its integration to many other sub-domains such as video system processing, animated image processing is done in the effective and relative way. This kind of information systems is described in the specification of relative image processing issues such as outlier identification, image noise reduction, image feature enhancement etc. This kind of information process is here described with the specification of cost adaptive computation so that the information objects will be processed.

The image processing is itself devised as the hybrid mechanism defined under application specification with associated processes. This broad process area is defined along with the specification of various sub stages or the sub processes. Some of these sub-processes associated to the system are described under

- Image Information Classification
- Object Identification
- Object Detection
- Signal Feature Analysis
- Image Encoding
- Information Hiding with Image
- Feature Extraction
- Image Enhancement

In this paper, we present a model to detect the building objects from Satellite images. We are comparing the [29] with our proposed approach.

2.   LITERATURE SURVEY

Sporea and Andre [1] proposed a spiking neuron based learning approach under neural network to perform the classification. The author analyzed the image under machine learning approach under the impact of spikes over the image. Based on the spiking feature generation model, the linear predictive modeling is applied. Based on this, the image feature is defined as the benchmark and the recognition process is performed on it. The author analyzed the work on many real-time image set including iris dataset. Riano et. al., [2] has defined a work on spiking neuron based pattern recognition using the neural network. In this paper, Author identified the pattern level analysis under pattern description and recovery to obtain the unsupervised learning results. The author defined a layered model to identify the image features and later on perform the recognition on the basis of real-time feature modeling. The author presented the work as the relative information architecture based on the firing neuron.

Oster et. al., [3] defined a work on Saccadic Recognition system based on the spike-based analysis. The author applied the temporal information analysis under specification of information derivation from a biometric retinal image. The derivation is here performed under moment level analysis defined for output encoding scheme. In this paper, the proposed model is used to control the object movement and provide the relative information generation so that the information classification based on the spiking values will be obtained effectively.

Wu et. al., [4] has presented a spiking neuron based work on knowledge representation and learning mechanism. Author presented an intelligent system to perform knowledge discovery and data mining. The work was presented as an intelligent system based on the neuron identification so that the intelligent information processing so that the computational phenomenon based information derivation will be obtained. Author defined a work on logic rule based derivation so that the model specific recognition process modeling will be obtained so that the computational analysis will be obtained under effective data extraction. Once the

feature points are obtained, the mapping to the result dataset is performed to identify the relative mapping over the database system.

In [5], the authors has defined a work to improve the performance vector for pattern sequencing. Author defined the work as the pattern learning process so that the sequence generation based neuron selection process is defined underweight learning approach.

Yan Meng[6] defined a work on human activity detection under spiking neuron to regulate the gene defined network. Author defined a reliable classifier to identify the temporal feature over the image and perform the weight effective analysis to generate the gene regulatory network so that the neural specific development will be obtained from the work. Seo et. al., [7] has presented a model based on the CMOS features and specification of architectural constraints to the environmental constraints so that the learning method over the network will be obtained under scalability vector. Author defined a learning effective approach to generate the image features so that the information transmission will be obtained. Based on these neuron features, the recognition process is performed and improved.

Yu et. al., [8] has defined a work on pattern recognition using spiking neuron based model to achieve time effective information model with machine learning process. Author presented the performance network based derivation applied on real time characters to that the relative pattern recognition will be obtained over the pattern image.

Dhoble et. al., [9] has presented a work on temporal pattern based recognition system under spiking neuron based recognition. This vector includes the event representation, rank ordering and neuron learning. Author provided dynamism to the feature environment so that the information spikes will be obtained and the real information encoding will be done. The machine learning mechanism is here defined under accurate information transition.

Nimish Kale [10] has presented the sensor replacement based human activity recognition under distance analysis so that the daily activity monitoring

will be done effectively. A feature vector based work is defined to perform the monitoring and to configure the server at low level. Author applied the real time object activity recognition on image set based on the configurationally analysis applied on rotated images. Author achieved the practical formation of motion analysis so that the sensor effective recognition will be obtained from the work. Author derived the body orientation based recognition to improve the recognition model so that the sensor data improvement will be done.

Soumitra Samanta [11] has presented detection and description based space time defined activity classification approach for detection of movement over the video data. Author defined a three dimensional model to generate the space time based analysis so that the interest analysis can be obtained. This kind of information derivation can be obtained under interest point analysis so that the video data processing based classification will be obtained from the work.

Kyungseo Park [12] has defined a behavior analysis based recognition system in real environment to identify the abnormal human activity. Author presented the behavior analysis so that eventual analysis over the image will be obtained. Author map the scoring values under information aspect anlaysis so that the temporal aspects based analysis will be obtained and determine the threhsolding under episode value derivation and information classification the relative aspects.

GeorgiosGoudelis[13] has presented a facial poses based video sequence analysis approach to obtain the facial pose estimation in video sequences. The proposed a work based on the pose level estimation the algorithm under mutual information anlaysis under pose invariant analysis so that the view angle based recognition will be obtained from the work.

M. Mahmoud [14] has defined a behavior identification based dissimilarity analysis approach to analyze the abnormal behavior. Author observed the activity recognition based on the abnormal behavior analysis defined in an intelligent environment. Author applied the distance level similarity analysis so that the derivation to the stable values to the environment is

obtained. Author mapped different distance method including hamming method, fuzzy effective method and the abnormal pattern analysis to generate the information behavior so that the relative image recognition will be obtained.

Yingying Zhu [15] has presented the activity recognition based spatial context analysis approach for activity recognition. In this paper, Author presented an intelligent mathematical model to analyze the information context based on observation analysis and provided the information activity based derivation so that the information object will be recognized in more accurate form. The object derivation and the learning process under attribute value analysis are here defined based on the testing distance analysis. Author also provided the model constraint specification for parametric evaluation so that the prediction over multiple dataset will be improved. Author also provided the optimization the information extraction process under weight adjustment so that the relative information gain will be obtained from the work.

Nikolaos Doulamis [16] has defined a motion estimation based work under time and space analysis to identify the person fall. Author defined an integrated system to consider the camera specification so that the information tracking will be done under visualization effective properties adjustment with situation aspect specification. Author provided the combined framework based estimation to extract the object image by background elimination. Author also increased the accuracy rate in scene level identification.

Toshiaki Miyazaki [17] has defined a work on human motion estimation and path identification under human movement path in a room. In this paper, Author defined the algorithmic model to identify the moment of multiple persons under visual sensing and relative hardware level adjustment.

Medhat H.A. Awadalla [18] has defined a work on neural network based spike generation to obtain the pattern chart estimation and recognition. In this paper, spiking neural network architecture is proposed to be used for control charts pattern recognition (CCPR). Furthermore, enhancements to the Spike Prop

learning algorithm are proposed. Author also defined the multiple vectors based learning rules with some constant parameters includes the neuron thresholds. These parameters can be adaptive to improve the work in generalized environment. Here the environment specification is based on the neuron modeling.

Jie Yang[19] has defined an effective sign and translation recognition system. Author provided the sign level recognition so that the information object will be translated over the system. Author defined the detection and recognition mechanism under specification of the relative language. The sign language specification and relative object identification is here been performed under user centric evaluation so that the capability specific object identification will be done. To explore these capabilities, the feature extraction is applied over the image.

Eunju Kim [20] has defined an assurance specific activity recognition system. In this work, Author defined a work on differentiate analysis so that the activity over the object will be identified under significant object generation and the relative information object exploration. Author also provided the experimental analysis so that the recognition ratio will be improved.

Derek HaoHu[21] presented a work on activity recognition to achieve multiple goals. In this article, Author identified the fundamental issues and relative solution so that the accurate object identification will be done. Author analyzes the complexities under different levels so that the recognition accuracy over the complexities will be improved for the associated system specification.

Yi Li [22] has presented a work on human pose estimation and pervasive computing analysis. Author defined a motion sensor based analytical model to identify the pose relative features so that the shape level context will be obtained format he image. Author provided the context improvement based analysis to generate the relative image under view point analysis. Author observed the pose under kernel adjustment and gains the effective recognition rate over the image.

Michael Buettner [23] has defined a work on activity recognition using RFID sensors. Author also provided the analysis on RIFD tags so that the reader level identification to the tags will be obtained so that the indoor activity monitoring and processing will be obtained. Author also provided the information gain analysis to achieve the effective information transmission and provide the activity monitoring.

Wolfgang Maass [24] has presented a complexity analysis based learning method using spiking neuron. Author defined a work on delay insensitive model so that the mapping to the input and output values will be done under relative complexity based investigation. Author presented the learning model so that the framework adaptability under learnability will be achieved.

Stylianos Asteriadis [25] has defined a head pose estimation approach under camera position analysis in uncalibrated environment. Author defined a facial analysis based monitoring and facial tracking on the sequence feature analysis so that the pose parameters will be obtained without knowledge description under environmental parameters. Elden Yu [26] generated the view to the motion analysis sunder relative contact analysis so that the image sequence monitoring and activity analysis will be obtained. Author presented the framework to analyze the activity and provide the skeleton based information derivation so that the extreme point based identification will be performed under primitive point analysis.

S.F. Worgan [27] has defined a work on activity classification and user instruction analysis under industrial settings. Author analyzed the structural behavior of the image under work flow modeling and provided the expert level derivation to the system so that the temporal derivation of the information object will be obtained. Author also provided the transition to the activity recognition under task specification and synchronization. Author identifies the objects under development process so that the monitoring under generalized model will be obtained.

Pengfei Zhou [28] has defined a work on movement detection in indoor and outdoor environments. A work on IO based environment analysis is also defined by the author for discriminative feature identification. Author

defined work under specification of relative sensor devices to generate the signal values and checking under localization and availability vectors so that the accurate recognition and classification for the object models will be obtained. Author also provided a work on the feature generation over the object modeling so that the improvement to the recognition process modeling will be obtained.

Dahiya Susheela et. al., [29] proposed an object oriented approach to extract building from high resolution satellite images. The proposed technique worked well on high resolution image. This proposed technique is not giving the expecting performance on the images having same reflectance intensity for building as of other objects in the given image.

3. PRPOSED WORK

Object Segmentation is one of the major image processing activities used to improve the object recognition and classification. This processing stage is defined as the intermediate stage of various image processing applications. Object segmentation can be defined as a sub stage to identify the objects over the component images and to count the region objects. The proposed work is defined to identify the building objects in Satellite images. In this work, a noise robust mathematical filter approach is defined to perform the building extraction. We have considered multiple parameters to extract the buildings over the object images. In this section, we first define the problem, followed by the objectives and methodology of this paper.

A. Problem Definition

Today Satellite Images are having its significance in many commercial as well as social applications. Image processing applications in this area includes the Google map based GPS system, location trackers, region identification and classification etc. One of such innovative field included in this area is to identify the commercial and residential areas from satellite images. This region identification becomes more critical when the object count or building extraction is performed. The presented work is defined in the same

area. The work is here defined as the combination of mathematical filters and curvic analysis. In this work, a layered approach is defined to perform the building extraction. At the early stage, the preprocessing is defined to remove the noise over the image. This stage will also include mathematical filters to explore the image features. In second stage, a segmented mathematical approach will be defined to identify the key points under multiple parameters. The parameters will include the intensity analysis and visibility analysis. These all parameters are applied under fuzzy logic for region point extraction. Based on these points, the corner points over the image will be identified. In final stage, the radial analysis over each point will be performed to generate the boundaries on these points so that clear object identification will be done. The work will be implemented in matlab environment. The work is about to perform the clear extraction of buildings on high resolution satellite images.

B. Objectives

- The objective of work is to define a mathematical operator based fuzzy adaptive approach for extraction of buildings over the satellite images.
- The objective of work is to provide the effective solution for noisy images
- The objective of work is to improve the building extraction accuracy for satellite images.
- The objective of work is to implement the work in matlab environment.

C. Significance of Work

The presented work is about to detect the buildings in satellite images. The work will be performed on high density and high quality images so that the efficiency and the accuracy are the major requirement. The work is here defined to perform the extraction for noisy images also.

D. Source of Data

To provide the effective extraction of buildings over the Satellite images, the first requirement is to obtain

the real time images. These images can be taken from any web source. In this work, the high resolution building images are extracted from web source. The properties of collected dataset are given here under

E.   Research Methodology

The work is here defined as a three stage model performs the mathematical analysis over the Satellite images under fuzzy logic and to provide the effective extraction of buildings. The model defined in this work is shown in Figure 1.

Table 1
Dataset Properties

Properties	Values
Image Type	Building Images
URL	http://dsp.whu.edu.cn/cn/staff/yw/HRSscene.html
Type	Color
Size	600x600
Format	JPG
Number of Images	50

The work is here defined as the noise robust, fuzzy adaptive model to perform the component extraction or building extraction from the Satellite images. As shown in the Figure 1, in first stage of this model the improvement to the image features is done against noise. To reduce the noise, Gaussian filter approach is defined. In second stage, the feature extraction over the image is done using window adaptive method. The features taken in this work are frequency analysis, visibility analysis and entropy value analysis. After obtaining the statistical block features, the fuzzy logic will be applied. Based on this fuzzy adaptive filter, the extraction of the building bounds over the image

Figure 1:   Proposed Model

will be done. The work is here defined to provide the effective and accurate extraction of buildings from Satellite images.

1. *Gaussian Filter:* Gaussian Filter is here taken as the preprocessing function to remove the noise over the image. The basic model of this method is similar to mean filter but having different kernel value. Kernel in this method is defined in the form of Gaussian (bell shaped). The equational representation of this method is shown here under:

$$G(x) = \frac{1}{\sqrt{2\pi}\sigma}\, e^{-\frac{x^2}{2\sigma^2}}$$

The Gaussian smoothing is here defined using 2D distribution method applied with point spread function. The convolution function is defined under discrete pixel specification and discrete approximation to the Gaussian function.

2. *Fuzzy Adaptive model:* In this present work, a fuzzy adaptive parameter based model is defined for selection of building object points. The statistical parameters are collected from the image using block adaptive approach. After generating the relative block features, the selection of the key points around the buildings is done. The parameters considered for the object selection are visibility analysis, entropy analysis and frequency analysis. These parameters are applied under fuzzy rules to effective election of effective key points. The fuzzy adaptive model for key point extraction is shown in Figure 2.

3. *Fuzzy Logic:* Fuzzy logic is one the most effective control system derivation defined with rule specification. It can be used as the range driven application used in all application areas including the network processing, data processing and control system specification. The specification of integrated rules is here defined along with the specification of relative decision derivation so that the problem
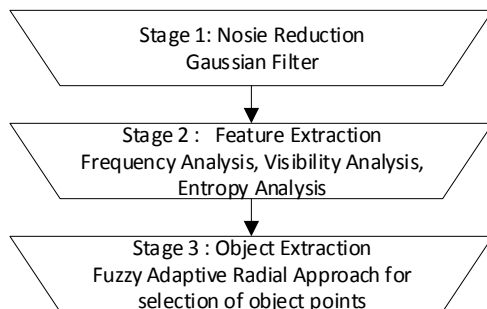
```
┌─────────────────────────────────────┐
│  Accept Filtered SAR image as Input │
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│   Divide the image in smaller blocks│
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│   Scan the image under block window │
│             tracking                │
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│  Obtain the block adaptive features │
│     from the window formed          │
│       Frequency analysis            │
│        Entropy analysis             │
│       Visibility analysis           │
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│ Fuzzify each value to under high,   │
│      medium, and low rates          │
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│ Combine the fuzzy values under fuzzy│
│        AND and OR operators         │
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│ Perform the effective selection of  │
│ pixel points based on the fuzzy     │
│        adaptive analysis            │
└─────────────────────────────────────┘
                 ↓
┌─────────────────────────────────────┐
│ Generate the effective building     │
│          boundaries                 │
└─────────────────────────────────────┘
```
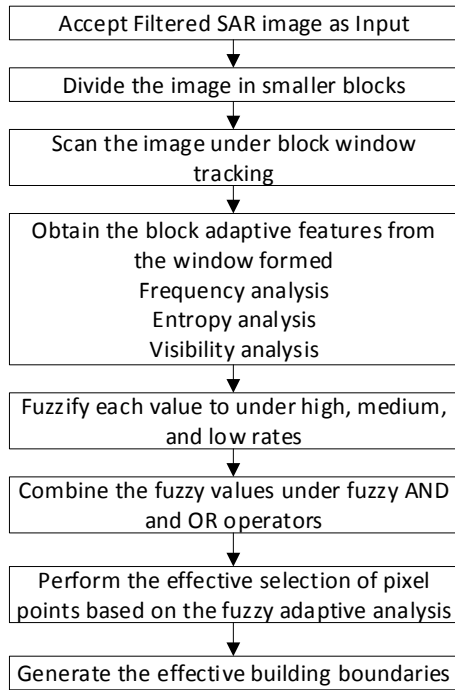
Figure 2: Fuzzy Adaptive Models

identification will be done in an effective and accurate way. The control problem specification is here done under the rule generation so that the effective and accurate decision mapping will be done.

The fuzzy is defined as the set theory approach based on the mapping to the element set to obtain the association for the acceptability to the range value (0, 1). This acceptability value is given as the set value

$$U : S \rightarrow (0, 1)$$

The statement is accepted as the truth or the value as the element exists in the set or not. The statement is true if the second statement is defined as the ordered pair of 1 and false if it is defined as value 0.

Fuzzy logic is used as the degree of truth instead of specifying the definite 0 or 1. The simplest way for the specification of non precise input processing under fuzzy rule. The fuzzy is here applied as the definite membership function. The membership function is here defined with universal membership function

$$F : X \rightarrow [0, 1]$$

The fuzzy associated rule is defined as

$$A = \{(x, f(x)) \,|\, x \in X\}$$

The fuzzy logic is here applied to process the input in the relational form so that the reason processing will be done. The information extraction based approach is here applied with fuzzy constraints to process the elastic elements. In this work, the fuzzy is applied on multiple parameters including the visibility analysis, entropy analysis and frequency analysis.

4. RESULT

The method described above, improved the results of [29]. The method takes images same as [29].

(a)　　　　　(b)　　　　　(c)

Figure 3: Input Images [29]

Here Figure 4 is showing the improved featured image. To improve the image features histogram equalization is applied in this work. The Figure 4 is showing the results of improved image.

(a)　　　　　(b)　　　　　(c)

Figure 4: Histogram of improved images

Here Figure 5 is showing the results of building extraction. Here figure 5 is showing the building areas bounded by green color.
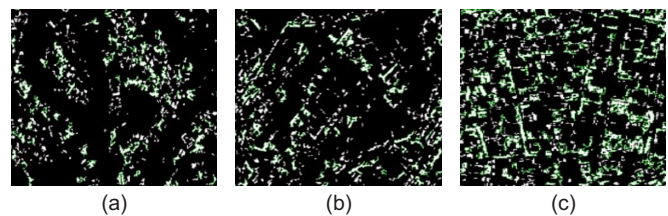

(a)　　　　　(b)　　　　　(c)

Figure 5: Building Extraction Result

A. Comparative Analysis

The presented work is here compared with existing approach to extract the building objects from Satellite

images. The existing approach has used the imagine tool to perform the object extraction. The analysis is here done in terms of number of actual objects in Satellite images and the extracted building from the image. The recognition rate based analysis is obtained from the work. The analytical statistics obtained from the algorithmic approach is shown in Table 2.

Table 2
Building Extraction Analysis

Satellite image	Total objects	Detected objects (existing approach [29])	Accuracy (Existing)	Detected objects (proposed approach)	Accuracy (Proposed)
a	66	67	98.507462	69	95.65
b	111	179	62.011173	71	63.963964
c	122	120	98.360655	121	99.180327

B. Detected Object Analysis

Here figure 6 is showing the detected object analysis in case of existing and proposed approach. Higher the difference between the total objects and extracted objects, more recognition rate will be obtained. The results show that the proposed work has provided better results.
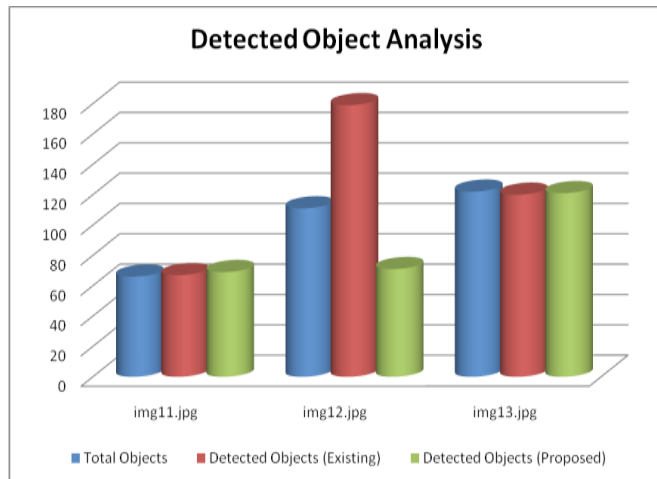

Figure 6:   Detected Object Analysis

C. Recognition Rate Analysis

Figure 7 is showing the comparative analysis with existing approach in terms of recognition rate. The results show that the work has provided effective object extraction.
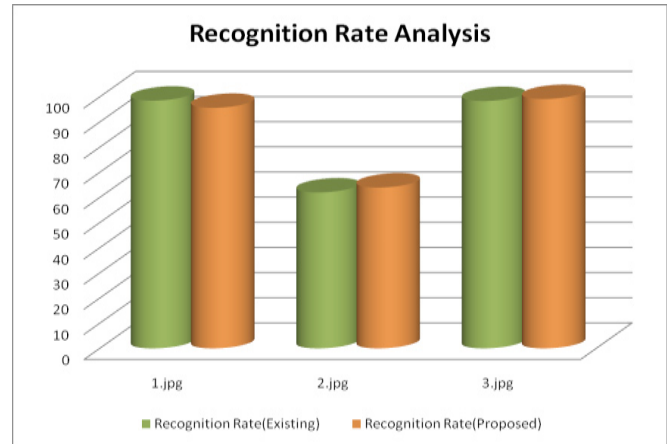

Figure 7:   Recognition Rate Analysis

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