ISSN 2394-3777 (Print)
ISSN 2394-3785 (Online)
Available online at www.ijartet.com
International Journal of Advanced Research Trends in Engineering and Technology (IJARTET)
Vol. 3, Special Issue 3, April 2016

Satellite Remote Sensing Image Based Aircraft Recognition And Detect Fuzzy Clustering

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Abstract—**This paper presents the Recognition of object (Aircraft) in an image for better recognition based on the combination of wavelet features and correlation on shape analysis. An object can also be recognized with help of texture or appearance features through Scale invariant feature transform (Wavelet Transform). These correlation measurement and SIFT for appearance feature extraction are effectively utilized for accurate object recognition .Aircraft on the wavelet based method, we propose a new hybrid recognition method that combines Wavelet features and Correlation changes. Gaussian noise removal purpose will use filter process and feature extraction purpose we use wavelet transform. The performance of these used algorithms will be differentiated though precision and recall rate metrics. These results show the proposed shape primitives are indeed sufficiently powerful to aircraft recognize in satellite remote sensing images.**

Index Terms—**Aircraft, Fuzzy Clustering, Wavelet Transform.**

I. INTRODUCTION

REMOTE sensing that has driven the entire technology since the early days of the entry of satellites into space. Second World War, as for example the follow-ups to a bombing raid to assess damage to the target. With the advent of rockets and then satellites, observations of both military and political activities on the ground became possible, ushering in the so-called Age of Spy Satellites.

Manipulating data in the form of an image through several possible techniques. An image is usually interpreted as a two-dimensional array of brightness values, and is most familiarly represented by such patterns as those of a photographic print, slide, television screen, or movie screen. An image can be process adoptically or digitally with a computer.To digitally process an image, it is first necessary to reduce the image to a series of numbers that can be manipulated by the computer. Each number representing the brightness value of the image at a particular location is called a picture element, or pixel.

There are also a few recognition methods that estimate the direction first after binarization and then recognize the types of aircraft. These methods estimate the direction of aircraft before representing targets that actually takes more aircraft shape characteristics, such as symmetry and fuselage characteristics, into account. These methods also require the binary image of each aircraft for direction estimation and the silhouette or contour with less fracture for target representation, which reduces the practicability of the above methods.

As aircraft recognition is still a challenging problem, we want to further investigate how we can resolve issues in this field. Aircraft recognition is different from other natural object recognition: 1) the number of aircraft types is limited,2) each type of aircraft has fixed size and shape. Considering the above characteristics, we can build a template for each type and match the test aircraft to the different types of templates. By doing this, we can make more use of the shape characteristics of different types of aircraft. More importantly, we will focus on how to measure the similarity between targets and all types of templates, independent of the overall shape extraction of targets.

Once the image has been digitized, there are three basic operations that can be performed on it in the computer. For a point operation, a pixel value in the output image depends on a single pixel value in the input image. For local operations, several neighboring pixels in the input image determine the value of an output image pixel. In a global operation, all of the input image pixels contribute to an output image pixel value.

II. PROPOSED SYSTEM

In the proposed system, the Wavelet Transform Feature Based Aircraft Recognition can be used.

- Aircraft Multispectral Image
- Pre-processing
- Lifting Wavelet Transform
- Features Extraction
- Similarity Measurement Analysis
- Aircraft detection using Fuzzy Clustering

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ADVANTAGES

The advantages of proposed system are

1)It provides better accuracy of segmenting objects.
2)Correlation is useful to detect desired object with help of templates rather than Euclidean distance.
3)Flexibility and better compatible approaches in recognition.

III. BLOCK DIAGRAM

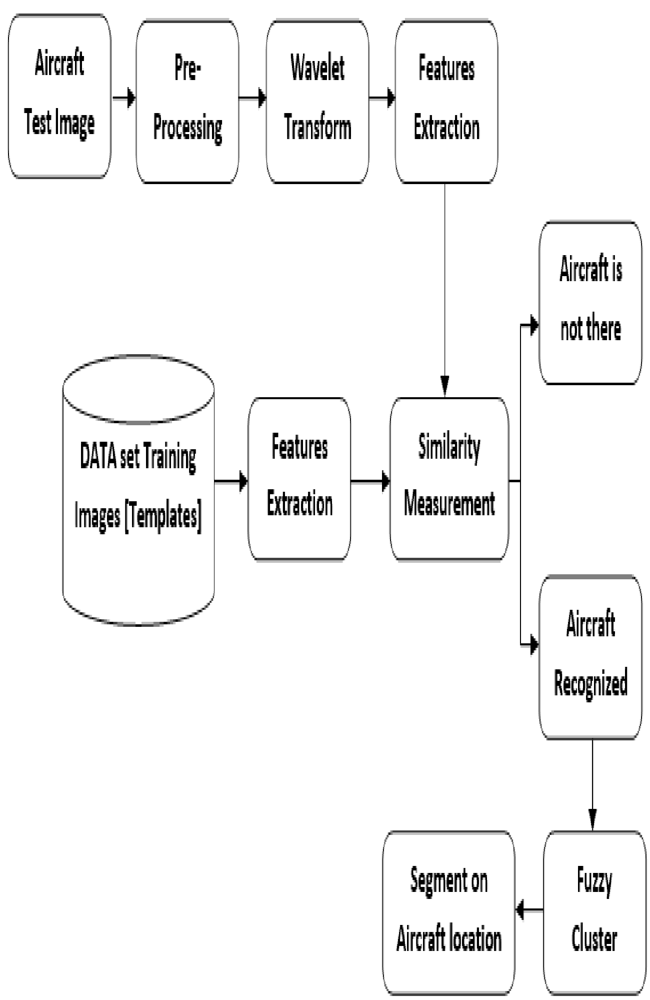

Fig 1 Block Diagram

The aircraft text image is the collection of segments are selected for each aircraft type template is different but the criterion of the selection is same. Preprocessing is used to remove the noise from the given input image by using median filter. Wavelet transform contains both preprocessing and signal segment feature. Feature extraction is based on decision boundaries in machine learning, pattern recognition and image processing start from an initial set. Finally feature extraction is the characteristics of an aircraft recognition.
There are four steps to proceed the process. First, we want to input image (Color or Gray Scale Image). Second, Re-Sizing for input Image.Third, (i)Band reduction using principal component analysis ,(ii)Reshape for 3-plane to Single plane and (iii)Wavelet Transform Features Extraction on LH and HL sub band Analysis on 5 properties with help of these properties we can recognize aircraft is there or not. If Air craft is there means we need to segment and boundaries that object.And finally,(i)Segmentation using Cluster Method (ii)Reshape of Single Plane and (iii)Histogram Calculation and Equalization.

IV. METHODOLOGIES

A. AIRCRAFT MULTISPECTRAL IMAGE

Multispectral images used to obtain a collection of segments. The Multispectral image are selected as basic element to reconstruct the standard template. We represent each segment as a binary image with the same size as the segment image. The segment region of a binary image is foreground and the other region is base ground.

RGB Component Image With Plane Process

An RGB image, sometimes referred to as a "truecolor" image, is stored in MATLAB as an m-by-n-by-3 data array that defines red, green, and blue color components for each individual pixel. RGB images do not use a palette. Christo Ananth et al. [5] proposed a system in which this study presented the implementation of two fully automatic liver and tumors segmentation techniques and their comparative assessment. The described adaptive initialization method enabled fully automatic liver surface segmentation with both GVF active contour and graph-cut techniques, demonstrating the feasibility of two different approaches. The comparative assessment showed that the graph-cut method provided superior results in terms of accuracy and did not present the described main limitations related to the GVF method. The proposed image processing method will improve computerized CT-based 3-D visualizations enabling noninvasive diagnosis of hepatic tumors. The described

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imaging approach might be valuable also for monitoring of postoperative outcomes through CT-volumetric assessments. Processing time is an important feature for any computer-aided diagnosis system, especially in the intra-operative phase.

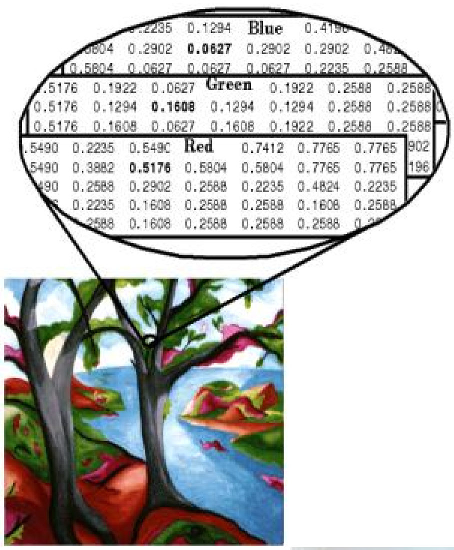

Fig2 Depicts an RGB Image of Class Double.

To further illustrate the concept of the three separate color planes used in an RGB image, the code sample below creates a simple RGB image containing uninterrupted areas of red, green, and blue, and then creates one image for each of its separate color planes (red, green, and blue). It displays each color plane image separately, and also displays the original image.

B. PREPROCESSING

Preprocessing is used to remove the noise from the given input image by using median filter.

Noise Removal (Image Smoothing)

An image may be "dirty" (with dots, speckles, stains) In image processing, to smooth a data set is to create an approximating function that attempts to capture important patterns in the data, while leaving out noise or other fine-scale structures/rapid phenomena. In smoothing, the data points of a signal are modified so individual points (presumably because of noise) are reduced, and points that are lower than the adjacent points are increased leading to a smoother signal.
Smoothing may be used in two important ways that can aid in data analysis

(1) by being able to extract more information from the data as long as the assumption of smoothing is reasonable and
(2) by being able to provide analyses that are both flexible and robust. Many different algorithms are used in smoothing.

C. WAVELET TRANSFORM

The wavelet transform is similar to the Fourier transform (or much more to the windowed Fourier transform) with a completely different merit function. The main difference is this: Fourier transform decomposes the signal into sines and cosines, i.e. the functions localized in Fourier space; in contrary the wavelet transform uses functions that are localized in both the real and Fourier space. Generally, the wavelet transform can be expressed by the following equation:

$$F(a,b) = \int_{-\infty}^{\infty} f(x)\, \psi^{*}_{(a,b)}(x)\, \mathrm{d}x$$

where * is complex conjugate symbol and function ψ is some function. This function can be chosen arbitrarily provided that it obeys certain rules.
As it is seen, the Wavelet transform is in fact an infinite set of various transforms, depending on the merit function used for its computation. This is the main reason, why we can hear the term "wavelet transforms" in very different situations and applications. There are also many ways how to sort the types of the wavelet transforms. Here we show only the division based on the wavelet orthogonality.

D. FEATURES EXTRACTION

In machine learning, pattern recognition and in image processing, feature extraction starts from an initial set of measured data and builds derived values (features) intended to be informative, non redundant, facilitating the subsequent learning and generalization steps, in some cases leading to better human interpretations. Feature extraction is related to dimensionality reduction.
When the input data to an algorithm is too large to be processed and it is suspected to be redundant (e.g. the same measurement in both feet and meters, or the repetitiveness of images presented as pixels), then it can be transformed into a reduced set of features (also named a "features vector"). This process is called feature extraction.

Geometry Feature

Geometry arose independently in a number of early cultures as a body of practical knowledge concerning lengths, areas, and volumes, with elements of formal mathematical science emerging in the West as early as Thales. By the 3rd century BC, geometry was put into an axiomatic form by Euclid, whose treatment—Euclidean geometry—set a standard for many centuries to follow. Archimedes developed

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ingenious techniques for calculating areas and volumes, in many ways anticipating modern integral calculus.

E. TEMPLATE MATCHING

Template Matching is a high-level machine vision technique that allows to identify the parts of an image (or multiple images) that match the given image pattern. It can be used in manufacturing as a part of quality control, a way to navigate a mobile robot, or as a way to detect edges in images.Template Matching is a technique for finding areas of an image that match are similar to a template image (patch). We need two primary components are source image and template image. Source image (I): The image in which we expect to find a match to the template image. Template image (T): The patch image which will be compared to the template image. Our goal is to detect best technique for the highest matching area.
Template matching provides a new dimension into the image-processing capabilities, although there have been many attempts to resolve different issues in this field. Advanced template matching algorithms allow finding the pattern occurrences regardless of their orientation and local brightness.

F. SIMILARITY MEASURE

After estimating the direction of aircraft and alignment, we consider the problem how to measure the similarity between real target and all types of target. We propose a new reconstruction-based similarity measure. First, we segment the test image into homogeneous segments and choose a subset of all segments that minimizes the reconstructive error with the template of each type. Having done this operation, we identify the test target as the type whose template achieves the minimal reconstructive error. For each type, we use a binary image with a target of this type in the center upright as the template of this type.

G. PERFORMANCE ANALYSIS

Accuracy

A perfect diagnostic procedure has the potential to completely discriminate subjects with and without template matching. Values of a perfect test which are above the cut-off are always indicating the unauthenticated, while the values below the cut-off are always excluding the authenticated. Unfortunately, such perfect test does not exist in real life and therefore diagnostic procedures can make only partial distinction between subjects with and without matching.Values above the cut-off are not always indicative of a aircraft since subjects without matching can also sometimes have elevated values. Such elevated values of certain parameter of interest are called false positive values (FP). On the other hand, values below the cut-off are mainly found in subjects without disease. However, some subjects with the disease can have them too. Those values are false negative values (FN).

Sensitivity

Sensitivity is expressed in percentage and defines the proportion of true positive subjects with the template matching in a total group of subjects with the disease (TP/TP+FN). Actually, sensitivity is defined as the probability of getting a positive test result in subjects with the template matching (T+|B+). Hence, it relates to the potential of a test to recognize subjects with the matching. Specificity is a measure of a diagnostic test accuracy, complementary to sensitivity.

V. TRANSFORM AND FUZZY CLUSTERING

A. WAVELET TRANSFORM

A wavelet series is a representation of a square-integrable (realor complex-valued) function by a certain orthonormal series generated by a wavelet. Nowadays, wavelet transformation is one of the most popular of the time-frequency-transformations. This article provides a formal, mathematical definition of an orthonormal wavelet and of the integral wavelet transform.The integral wavelet transform is the integral transform defined as

$$[W_\psi f](a,b) = \frac{1}{\sqrt{|a|}} \int_{-\infty}^{\infty} \psi\left(\frac{x-b}{a}\right) f(x)dx$$

The wavelet coefficients c_{jk} are then given by

$$c_{jk} = [W_\psi f]\left(2^{-j}, k2^{-j}\right)$$

Where$a=2^{-j}$ is called the binary dilation or dyadic dilation, $b=k2^{-j}$ is the binary or dyadic position.
The fundamental idea of wavelet transforms is that the transformation should allow only changes in time extension, but not shape. This is effected by choosing suitable basis functions that allow for this. Changes in the time extension are expected to conform to the corresponding analysis frequency of the basis function. Based on the uncertainty principle of signal processing,

$$\Delta t \Delta \omega \geq \frac{1}{2}$$

wheret represents time and ω represents angular frequency ($\omega = 2\pi f$, where f is temporal frequency).

In other words, the basis function Ψ can be regarded as an impulse response of a system with which the function x(t) has

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been filtered. The transformed signal provides information about the time and the frequency. Therefore, wavelet-transformation contains information similar to the short-time-Fourier-transformation, but with additional special properties of the wavelets, which show up at the resolution in time at higher analysis frequencies of the basis function. The difference in time resolution at ascending frequencies for the Fourier transform and the wavelet transform

B. FUZZY CLUSTERING ALGORITHMS

Fuzzy clustering plays an important role in solving problems in the areas of pattern recognition and fuzzy model identification. A variety of fuzzy clustering methods have been proposed and most of them are based upon distance criteria. One widely used algorithm is the fuzzy c-means (FCM) algorithm. It uses reciprocal distance to compute fuzzy weights. A more efficient algorithm is the new FCFM. It computes the cluster center using Gaussian weights, uses large initial prototypes, and adds processes of eliminating, clustering and merging. In the following sections we discuss and compare the FCM algorithm and FCFM algorithm.

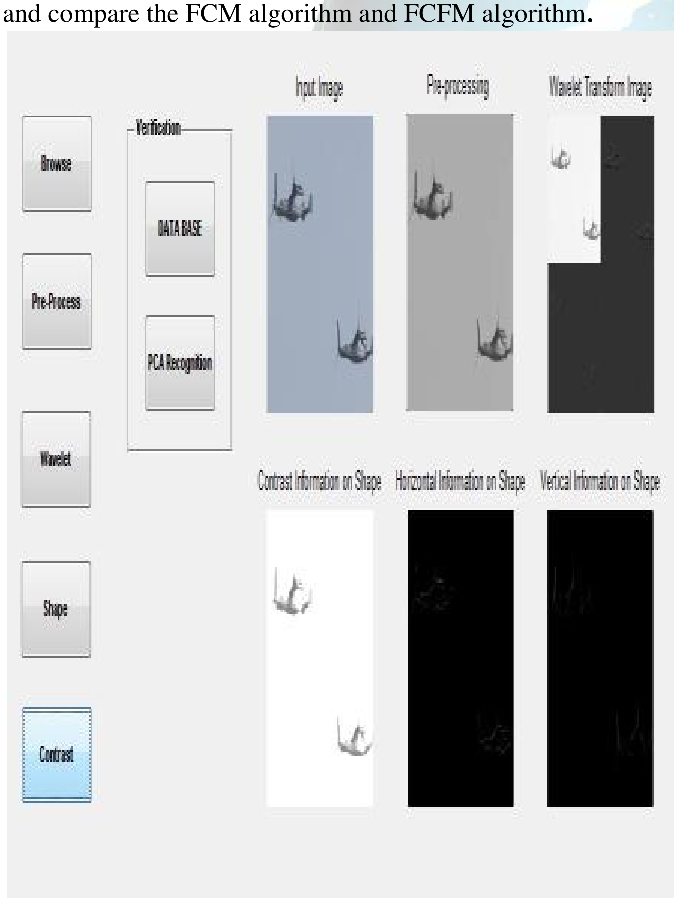

Fig 3 Aircraft Recognition

VI. CONCLUSION

In this paper,we have presented as object tracking algorithm applied to a sequence of multispectral satellite image.This unique algorithm is developed for an optical multi angular dataset and designed based on moving object estimation,target models,target matching three step processing. The main advantage of the method lies in that the method can recognize aircraft robustly and excludes the target overall shape extraction phase, which is usually included in the traditional recognition methods and is not practical due to disturbing background. Potential moving object are first identified on the time series images in frame based object tracking. The method can recognize aircraft robustly and excludes the target overall shape extraction phase, which is usually include in the traditional recognition methods and is not practical due to disturbing background. Therefore the output show that our recognition method yields a good performance.

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