Survey Paper on Aircraft Recognition for Satellite Image

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Abstract - *Aircraft recognition plays an important role in image processing. Recognition processor is used to extract the shape of aircraft. Recognition is done using various algorithms. In this paper eight types of recognition algorithm are discussed.*

Key Words: Aircraft recognition, SNR, similarity measure, segmentation, features extraction.

1.INTRODUCTION

Image recognition is the way of recognition and identifying an item or an element in a digital image or video. This method is used in many applications such as frameworks for production line computerization, toll corner observing and security observation. Regular image recognition algorithms include optical character image recognition, face recognition, license plate matching, and scene change identification. The recognition of objects in an image this stream would probably begin with image processing techniques for example noise removal, processed by (low-level) feature extraction to find lines, regions and possibly areas with specific surfaces. Besides the complex structure, different aircraft vary in size, shape, and shading or color, and even for one kind of aircraft, the texture and intensity are usually dissimilar in various scenarios. Moreover, recognition frequently suffers from various disturbances for example clutter, different contrasts, and anxiety in homogeneity. Subsequently, the robustness and resistance to disturbance are highly required for the technique.

2. LITERATURE SURVEY

2.1 Aircraft Identification using Principal Component Analysis

In this method dimensionality reduction is performed using principal component analysis. Here, some steps are used. Satellite image is processed under preprocessing. Three steps of processing are used. First, the mean value, covariance matrix, Eigen vectors and Eigen values of the covariance matrix are calculated. This image is segmented by OTSU segmentation process. Then this method is used to reduce the features (shape, size, color and dimension) then image segmentation is used to split the satellite image into multiple segments. After that both segmented image and types of template are compared to measure the similarity between these images. Then aircraft is identified. In aircraft identification area, equivalent diameter, width and height, orientation, perimeter, eccentricities are measured [8].

2.2 Aircraft Recognition using transform features and Detect Fuzzy Clustering

In this paper, hybrid recognition method is used that combines wavelet features and correction changes. The input image is satellite image then preprocessing step is used to remove the Gaussian noise. Wavelet transform is used for feature extraction and segmentation. This image is compared to data base image. Then similarity is measured for both images. If the image not similar then aircraft is not recognized. If it is similar then aircraft is recognized. These images are processed with fuzzy clustering to find the location of aircraft [3].

2.3 Aircraft detection by Deep Convolutional Neural Networks

In this paper deep convolutional neural network (DNN) and deep belief net (DBN) techniques are used. These methods extract stable and large scale features from image. DNN perform better than DBN. DNN is used to improve the performance.DNN is divided into two parts feature extractor and Multi –Layer perception (MLP) classifier. MLP consist of two layers they are hidden layer and output layer. Then the output value is transformed to output image .In that output image bright spot represent the candidates of aircraft. DBN consist of three layer visible input layer, hidden layer and output layer [9].

2.4 Aircraft Recognition using wavelet and fast discrete curvelet transform

Wavelet and fast discrete curvelet transform is mathematical tool for aircraft recognition. Satellite sensing image as input. Preprocessing is used to remove the noise from the input image and improve the parameters such as size and shape. Principal component analysis is used in preprocessing stage then it is processed with segmentation stage. Then segmentation process is performed using discrete wavelet and fast discrete curvelet transform. In

discrete wavelet transform, the image is segmented into four subbands. Then it produced lower subband image which is processed with fast discrete curvelet transform. Then the lower subband images are segmented into eight angles. Then the color, shape and texture of image features are extracted. This image is compared to data base image. Then similarity is measured using probabilistic neural network (PNN) which produced the highest probability value. If the probability value is high then aircraft was recognized [1].

2.5 Automatic aircraft recognition using DSmT and HMM

Aircraft sequence as input it processed with feature extraction. This feature extraction is used to extract moment feature and contour feature. In moment feature, Hu's moment invariants are used. In contour feature, singular values decomposition are used. SVD is used to calculate Eigen value and Eigen vectors. From moment feature and contour feature two Bayesian BBA are compute from PNN 1 and PNN 2 respectively. Two BBA's are combined using dempster rule. The BBA fusion and decision is applied to observed. Then the sequences are feed to HMM classifier. HMM parameters are obtained from observed sequence [10].

2.6 Aircraft Recognition using SVM

In this method, aircraft recognition is done using support vector machines (SVM) classification method. Input is satellite image this image is processed with Gabor filter. It is used for feature extraction (shape, size, texture). Then feature vector is calculated from the magnitude response of filter outputs and reduce the numerical difficulties. After that SVM algorithm is used to find the hyper plane between classes. Finally aircraft is recognized. If it is not recognized then it is rotated and translated, which output is given to filter. Then the above process is repeated until the aircraft is recognized [2].

2.7 Aircraft Recognition using jigsaw matching pursuit algorithm

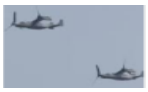
In this paper, jigsaw matching pursuit algorithm is used for aircraft recognition. Input image is satellite image then it processed with direction estimation. First gradient of image is calculated to get contour and texture of the image then to get the histogram of image. From that the direction of aircraft is calculated which are aligned to the satellite image. After that this image is segmented into homogeneous segments then the segmented image and different types of templates are compared using jigsaw matching pursuit algorithm then highest similarities are measured. This algorithm is used to reduce the mean square error [7].

3. EXPERIMENTAL RESULTS

3.1 Aircraft Identification using Principal Component Analysis

In this method, image is detected through correlation coefficient using principal component analysis. The recognition system consists of dimension reduction, threshold value, correlation coefficient. This technique is applied to segmented image then every pixel value is compared to threshold value. After that correlation coefficient is used to identify the aircraft [8].

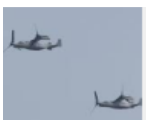
Table -1: Precision Calculation for Different Images

Paper	Input image	Precision (%)
Aircraft Identification in High Resolution Remote Sensing Images using Principal Component Analysis		56.9584
		87.1034
		64.4407

3.2 Aircraft Recognition using transform features and Detect Fuzzy Clustering

In this method, the noise is removed using filtering process. Then features of image are extracted. This image is compared to many types of template then aircraft is recognized [3].

Table -2: Precision Calculation for Different Images

Paper	Input image	Precision (%)
Satellite Remote Sensing Image based Aircraft Recognition Using Transform Features and Detect Fuzzy Clustering		86.9594
		87.1034

3.3 Aircraft detection by Deep Convolutional Neural Networks

In this paper deep learning method is used. It includes feature extraction and multilayer perception. Satellite image features are extracted using feature extraction. This feature extracted image is applied to multilayer perception classifier. Then multiple preprocessing is done to improve the performance. After that aircraft is recognized [9].

Table -3: Precision Calculation

Paper	Input image	Precision (%)
Aircraft Detection by Deep Convolutional Neural Networks		93.15

3.4 Aircraft Recognition using wavelet and fast discrete curvelet transform

In this paper, the satellite image is segmented into four levels to obtain the different angles. Then features of image are extracted. OTSU multiple thresholding techniques are used to extract the foreground and background of the input image. From the recognized image the performance parameters such as accuracy, precision, PSNR, MSE are measured [1].

Table -4: Precision and Accuracy Calculation

Paper	Accuracy (%)	Precision (%)
Satellite remote sensing image based aircraft recognition using wavelet and curvelet transform	96.15	90.60

3.5 Aircraft Recognition using DSmT and HMM

In this paper extracted features from binary image feed PNNs for building primary perception assignments which might be combined with DSmT PCR rule to make a local decision on target type. The set of local decisions obtained after some time for the image sequence feeds HMMs to make the last recognition of the target [10].

Table -5: Precision Calculation

Paper	Input image	Precision (%)
Automatic Aircraft Recognition using DSmT and HMM		95.7

3.6 Aircraft Recognition using support vector machines (SVM) classification method

The features that accentuate the geometric structure of an airplane are obtained using 2D Gabor filter. The recognition is performed by using Support Vector Machines (SVM) characterization technique. A SVM training algorithm builds a numerical model from a set of training examples (aircraft image gathered from airports using Google Earth program) each set apart as having a place with one of two classes aircraft or non aircraft [2].

Table -6: Precision Calculation

Paper	Input image	Precision (%)
Stationary Aircraft Detection From Satellite Images		95.7

3.7 Aircraft Recognition using jigsaw matching pursuit algorithm

In this method, the image is processed with direction estimation in that gradient of image is calculated. Then it is segmented. This algorithm is used to compare the segmented image and the type of aircraft. From the recognized image the performance parameters such as accuracy, precision, PSNR, MSE are measured [7].

Table -7: Precision and Accuracy Calculation

Paper	Accuracy (%)	Precision (%)
Aircraft Recognition in High-Resolution Optical Satellite Remote Sensing Images	92.3	79.41

4. CONCLUSIONS

Bayesian pursuit algorithm is new proposed method for image recognition. From literature survey observed that low signal to noise ratio, high bit error rate and accuracy. These problems are overcome by proposed method.

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