Industrial Engineering Journal
ISSN: 0970-2555
Volume : 52, Issue 6, No. 3, June : 2023

# SMART AND FAST MILITARY AND CIVILIAN AIRCRAFT CLASSIFICATION AND IDENTIFICATION USING CNN

**Gawade Roshani, Deokar kiran, Dhumal Sagar, SonawanePriti.** PG student, Department of Computer Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati, Maharashtra, India.
**Dr. C. S. Kulkarni,** professor, Department of Computer Vidya Pratishthan's Kamalnayan Bajaj Institute of Engineering and Technology, Baramati, Maharashtra, India.

**Abstract**
This paper presents the YOLOv5 based object detection system, this algorithm network is trained using dataset of number of instances of aircraft and make system able to detect and recognize new aircraft testimage . Machine should take its own decision when new aircraft is detect which is not save in database but based on previously trained data system is able to identify and classify aircraft. This will allow the user to knowthe type of aircraft that is military or civilian aircraft. This system can not only detect object but also can identify and classify it. Remote image sensing capability is good feature of YOLO which we used here to identify the real time images of aircraft. Due to which this system can be used in real time object detection.

**Keywords**: YOLOv5, Aircraft, object detection

## Introduction

New technology and automation are used in everyfield. After inventing object detection algorithms remote object detection becomes the interest of area to the scientist. Flight plans are created manually from radar controller's position and data processing manually inputted from submitted flight plan for each aircraft. This manual system tends errors and time consuming. So there is need to have automated and reliable system for fast identification and detection of Aircraft.
Due to rapid improvement in the image resolution is increased so acquiring information also increased. The airport areas become a popular in computer vision to detect civilian andmilitary aircraft become main focus in object detection.
By using this technology flight traffic can be monitor and emergency flight landing decision can be taken furthermore in case of any missing airplane we can found. So by identifying different aircraft we are able to do numerous task fully automatically within less time and with high accuracy. Early detection in fight can monitor flight control and avoid crash of flights.

## Related Work

The airport areas become a popular in computer vision to detect civilian and military aircraft become main focus in object detection. . In civilian applications, YOLOv5 has been used for aircraft type classification and recognition in aerial images [1].Before YOLO, many scientist used artificially combined multiple methods like RCNN and Faster RCNN to detect objects in an image [11]. In military applications, YOLOv5 has been used for military aircraft identification in satellite images and UAV detection and recognition. These suggest that YOLOv5 can be an effective tool for aircraft identification in various domains [2]. aircraft identification is a critical task for defence and security purposes. YOLOv5 has been used in several studies for military aircraft identification. In one study, YOLOv5 was used to detect and recognize military aircraft in satellite images. The authors collected a large dataset of satellite images of military bases and used YOLOv5 to detect and classify military aircraft based on their shape and size. The results showed that YOLOv5 achieved an accuracy of over 90% inmilitary aircraft identification [3]. In this YOLOv5was used for unmanned aerial vehicle (UAV) detection and recognition. The authors collected alarge dataset of UAV images and used YOLOv5 todetect and recognize UAVs based on their size, shape, and flight pattern. The results

showed that YOLOv5 achieved an accuracy of over 95% in UAV detection and recognition [5].

**Methodology**

To recognize object in given image give test image to the system and proposed algorithm which have already trained by using number of images and instances. Neural networks understandonly numbers so the image in vector form applied to train the neural network. By comparing train dataset images with test image, model can identifythe type of aircraft civilian or military.

In this coco dataset is use to train convolutional neural network and by using bounding box and highest bounding box probability where non max suppressing which means discarded other low probability class rectangle and keep only highest class probability rectangle. In this way object is detected within image. Is also uses IOU (insertion of unit ) to detect different classes within image and system gives classified object and identified object aircraft. This all happens by using YOLOv5 algorithm.

**System Block Diagram**

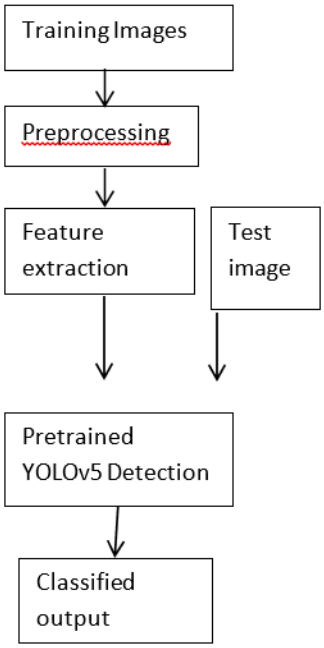


Fig. 1 System block diagram Working of system block diagram

Training phase of system consist following blocks:

1) Training Images 2)Preprocessing 3)FeatureExtraction 4)Pretrained YOLOv5 Detection

Training images : These images are used to trainthe YOLOv5 algorithm to detect required objectin image. Here we use different civilian and military aircraft images to detect real time aircraftobject.

Training of different aircraft image is done in this stage using vector table and mathematical calculations because neural network only understands the numbers.

Preprocessing and feature extraction is done here to extract object from that particular images. These pertained data is store in trained network.

The input image is preprocessed by resizing it toa standard size and applying any necessary image transformations or color corrections.

Testing phase of system consist of following blocks:

1)Test Image 2) Pretrained YOLOv5 Detection 3) Classified output

YOLOv5 Detection: The preprocessed image is passed through a YOLOv5 deep learning model, which detects and identifies the aircraft in the image. When test image is applied to it all these feature

extraction and classification comparing test image with database image is done here and we get final aircraft identified output.
Test Image : An image which has aircraft is given to the system to check wheather model give required output or not.
Output: The system produces an output image provides information about the type of aircraft andits unique identification number.

**Aircraft DetectionFlowchart**
Training images are used to train YOLOv5detection model. Different class training images are used to train that model
Obtained predicted model using bounding box in test image.
If reach at predefined epochs then end otherwise go to step one that is training image.

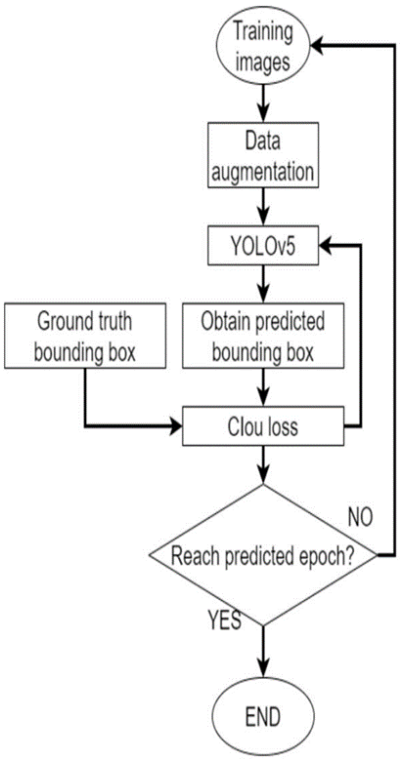


Fig. 2 Aircraft detection flowchart

**Comparison To Other Algorithms**
There are numerous algorithms used for aircraft and different object detection previously. Histogram of gradients algorithm is timeconsuming for complex pixel detection. RCNNalgorithm has very slow rate of training and high prediction time. Single shot detector algorithm is not suitable for little objects. But YOLOv5overcomes all the limitations of these algorithms.

**Result Analysis**
1. Object detection is used to detect the aircraft inimges which are captured by camera in real time this given as test image to system.
2. Compare this test image with pre-trainednetwork .
3. It can detect object in images and identify theaircraft is military or civilian.
4. It is also able to detect the image in case of noany object present in image.


Fig. 3 of Tornado Military aircraft detection

**Conclusion**

In this way introduced the efficient and fast working YOLOv5 algorithm in aircraft object detection. YOLOv5 has shown promising results in aircraft identification in both civilian and military domains. In this search whichsimultaneously guarantees the correctly and fast detection of civilian and military aircraft detectionis done. YOLOv5 is suitable for real time object detection which are remotely can be recognized. There are considerable differences between YOLOv5 and previously used versions of object detection algorithm occurs in terms of speed, accuracy, and specificity of classes. However, some more additional research is required to explore its abilities and utilities in other applications and to improve its perfection, precision and efficiency.

**References**

1. J. Yao and Z. Zhang. (2005, Jun.). Semi-supervised learning based object detection in aerial imagery. presented at CVPR. [Online]. Available:https://ieeexplore.ieee.org/document/1467 377.
2. D. Zhao, Y. Ma, Z. Jiang and Z. Shi, "Multiresolution Airport Detection via Hierarchical Reinforcement Learning Saliency Model," IEEE J- STARS, vol. 10, no. 6, pp. 2855-2866, Jun. 2017,
3. DOI: 10.1109/JSTARS.2017.2669335
4. Y. Xu, M. Zhu, S. Li, et al, "End-to-End Airport Detection in Remote Sensing Images Combining Cascade Region Proposal Networks and MultiThreshold Detection Networks," REMOTE SENSBASEL, 2018, vol. 10, no. 10, p. 1516, Nov. 2018. DOI: 10.3390/rs10101516.C. Szegedy, S. Ioffe, V. Vanhoucke, and A. A. Alemi, “Inception-v4, inception-resnet and the impact of residual connections on learning.” in AAAI, vol. 4, 2017, p. 12.
5. Wei Fang, Soufience Djahel “A Novel YOLO- Based Real-Time People Counting Approach” in Conference Paper · September 2017 DOI: 10.1109/ISC2.2017.8090864.
6. C. Cao, Q. Hou, and K. Zhou. Displaced dynamic expression regression for real-time facial tracking and animation. ACM Trans. on Graphics, 33(4):43, 2014.
7. X. Cao, Y. Wei, F. Wen, and J. Sun. Face alignment by explicit shape regression. Int. J. Comput. Vision, 107(2):177–190, 2014 .
8. Zhang, Fan, et al. "Weakly supervised learning based on coupled convolutional neural networks for
9. Cheng, Gong, Peicheng Zhou, and Junwei Han. "Learning rotation-invariant convolutional neural networks for object detection in VHR optical remote