



FACE DETECTION AND OBJECT DETECTION USING IMAGE PROCESSING

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Abstract:

An Unmanned Ariel vehicle (UAV) has greater importance in the army for border security. The main objective of this project is to develop a MATLAB code using Viola-jones algorithm for object detection. Currently UAVs are used for detecting and attacking the infiltrated ground targets. The main drawback for this type of UAVs is that sometimes the object are not properly detected, which thereby causes the object to hit the UAV. This project aims to avoid such unwanted collisions and damages of UAV. UAV is also used for surveillance that uses Viola-jones algorithm to detect and track humans. This algorithm uses cascade object detector function and vision. train function to train the algorithm. The main advantage of this code is the reduced processing time. The MATLAB code was tested with the help of available database of video and image, the output was verified.

Keywords: Object Detection, Face Detection, Unmanned Aerial Vehicle, Image Processing & Computer Vision

1. Introduction:

The Unmanned Aerial Vehicle, which is an aircraft with no pilot on board. UAVs can be remote controlled aircraft (e.g. flown by a pilot at a ground control station) or can fly autonomously based on pre-programmed flight plans or more complex dynamic automation systems. UAVs are currently used for a number of missions, including reconnaissance and attack roles. For the purposes of this article, and to distinguish UAVs from missiles, a UAV is defined as being capable of controlled, sustained level flight and powered by a jet or reciprocating engine. In addition, a cruise missile can be considered to be a UAV, but is treated separately on the basis that the vehicle is the weapon. The acronym UAV has been expanded in some cases to UAVS (Unmanned Aircraft Vehicle System). The FAA has adopted the acronym UAS (Unmanned Aircraft System) to reflect the fact that these complex systems include ground stations and other elements besides the actual air vehicles.

Officially, the term 'Unmanned Aerial Vehicle' was changed to 'Unmanned Aircraft System' to reflect the fact that these complex systems include ground stations and other elements besides the actual air vehicles. The term UAS, however, is not widely used as the term UAV has become part of the modern lexicon.

The military role of UAV is growing at unprecedented rates. In 2005, tactical and theater level unmanned aircraft (UA) alone, had flown over 100,000 flight hours in support of Operation ENDURING FREEDOM (OEF) and Operation IRAQI FREEDOM (OIF). Rapid advances in technology are enabling more and more capability to be placed on smaller airframes which is spurring a large increase in the number of SUAS being deployed on the battlefield. The use of SUAS in combat is so new that no formal DoD wide reporting procedures have been established to track SUAS flight hours. As the capabilities grow for all

types of UAV, nations continue to subsidize their research and development leading to further advances enabling them to perform a multitude of missions. UAV no longer only perform intelligence, surveillance, and reconnaissance (ISR) missions, although this still remains their predominant type. Their roles have expanded to areas including electronic attack (EA), strike missions, suppression and/or destruction of enemy air defense (SEAD/DEAD), network node or communications relay, combat search and rescue (CSAR), and derivations of these themes. These UAV range in cost from a few thousand dollars to tens of millions of dollars, and the aircraft used in these systems range in size from a Micro Air Vehicle (MAV) weighing less than one pound to large aircraft weighing over 40,000 pounds.

2. Literature Survey:

Venkatalakshmi. B et al. presented a method for automatic red blood cell counting using houghtransform [1]. The algorithm for estimating the red blood cells consists of five major steps: input image acquisition, pre-processing, segmentation, feature extraction and counting. In pre-processing step, original blood smear is converted into HSV image. As Saturation image clearly shows the bright components, it is further used for analysis. First step of segmentation is to find out lower and upper threshold from histogram information. Saturation image is then divided into two binary images based on this information. Morphological area closing is applied to lower pixel value image and morphological dilation and area closing is applied to higher pixel value image. Morphological XOR operation is applied to two binary images and circular Hough transform is applied to extract RBCs. Vision-based Autonomous Landing of an Unmanned Aerial Vehicle by Srikanth Saripalli, James F. Montgomery and Gaurav S. Sukhatme [2]. Fitzgerald, Daniel L. and Walker, Rodney A. and Campbell, Duncan A. A Vision Based Emergency Forced Landing System for an Autonomous UAV [3]. This paper introduces the forced landing problem for UAVs and presents the machine vision based approach taken for this research.

Vision-based automatic landing of a quad rotor UAV on a floating platform A new approach using incremental back stepping by A.S. Mendes on March 7, 2012.[4]The goal of this thesis is to design a fully automated system for vision-based landing of a quad rotor UAV on a floating platform. Since this project includes a real-time implementation component, it is also a secondary goal to analyze the feasibility of real-time implementation using cheap and light sensors.

3D Vision Based Landing Control of a Small Scale Autonomous Helicopter Zhenyu Yu, Kenzo Nonami, Jinok Shin and Demian Celestino Unmanned Aerial Vehicle Lab., Electronics and Mechanical Engineering, Chiba University[5]. Autonomous landing is a challenging but important task for Unmanned Aerial Vehicles (UAV) to achieve high level of autonomy. The fundamental requirement for landing is the knowledge of the height above the ground, and a properly designed controller to govern the process. This paper presents our research results in the study of landing an autonomous helicopter. The above-the-ground height sensing is based on a 3D vision system. We have designed a simple plane-fitting method for estimating the height over the ground. The method enables vibration free measurement with the camera rigidly attached on the helicopter without using complicated gimbal or active vision mechanism. The estimated height is used by the landing control loop. Considering the ground effect during landing, we have proposed a two-stage landing procedure. Two controllers are designed for the two landing stages

respectively. The sensing approach and control strategy has been verified in field flight test and has demonstrated satisfactory performance. Autonomous environmental mapping in multi agent UAV systems by Linus Jan Luotsinen B.S. University of Dalarna, 2002. To simulate the agent behaviours, and to gather quantitative measurements, a simulation environment was created. The simulation environment was described in detail [6]

3. Scope of research:

Image processing based UAV is not completely operational as it is there is a manual intervention of a camera and joy stick. It will reduce the man work time and complexity of the work. In some cases UAVs use very costly laser sensors and multiple sensor integrated systems to detect the objects and people. This project will be useful in replacing the laser sensor and servile the location using cheaper systems. UAV is a very expensive vehicle which cannot be lost under blunders of non-detected objects and unprocessed faces so this project aims in compensating such situations.

4. Image Processing:

Image processing is a method to convert an image into digital form and perform some operations on it, in order to get an enhanced image or to extract some useful information from it. It is a type of signal dispensation in which input is image, like video frame or photograph and output may be image or characteristics associated with that image. Usually Image Processingsystem includes treating images as two dimensional signals while applying already set signal processing methods to them.

Image processing basically includes the following three steps.

- Importing the image with optical scanner or by digital photography.
- Analyzing and manipulating the image which includes data compression and image enhancement and spotting patterns that are not to human eyes like satellite photographs.
- Output is the last stage in which result can be altered image or report that is basedon image analysis.

5. Block Diagram

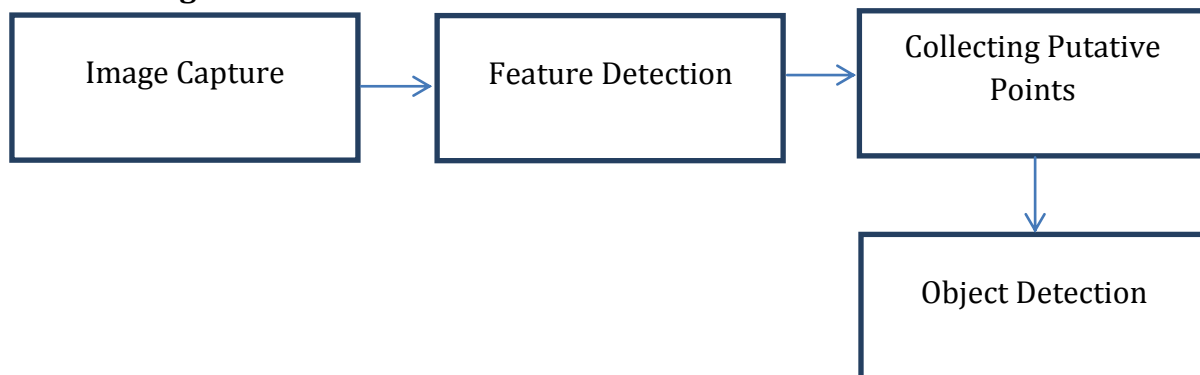


Figure (1): Block Diagram for Object Detection

The image is captured by a camera. From the image, features are determined by the algorithm. Form that putative points are collected. By using the putative points the object to be concreted can be determined from the image.

6. Results.

6.1 Face Detection:

A simple face tracking system by dividing the tracking problem into three separate problems:

- ✓ Detect a face to track
- ✓ Identify facial features to track
- ✓ Track the face

Step 1: Detect a Face to Track

Before you begin tracking a face, you need to first detect it. Use the vision. Cascade Object Detector to detect the location of a face in a video frame. The cascade object detector uses the Viola-Jones detection algorithm and a trained classification model for detection. By default, the detector is configured to detect faces, but it can be configured for other object types. The detected face output is shown in figure 2.

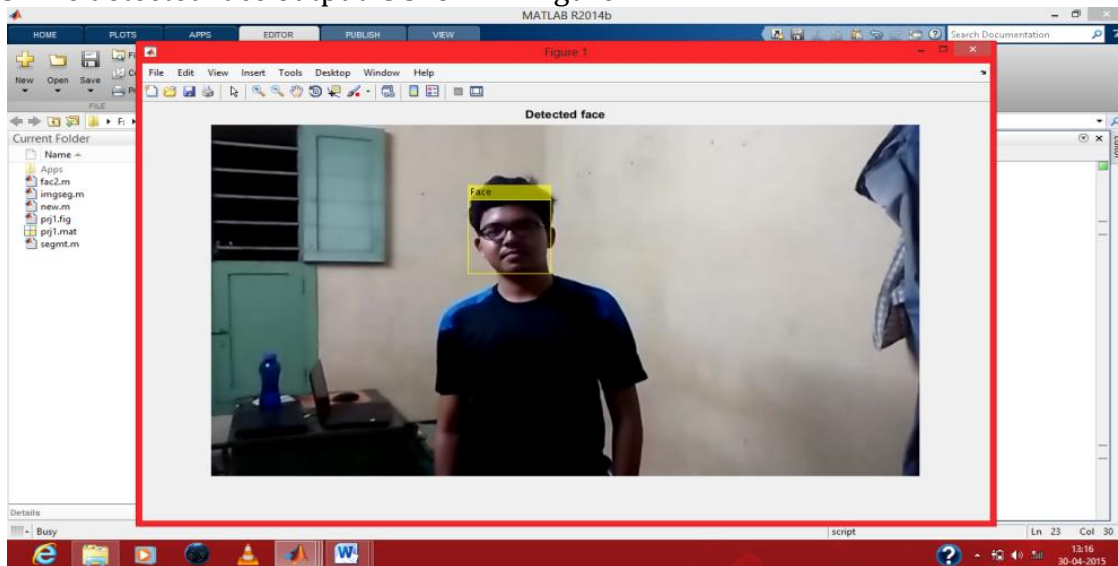


Figure (2): Detected Face

You can use the cascade object detector to track a face across successive video frames. However, when the face tilts or the person turns their head, you may lose tracking. This limitation is due to the type of trained classification model used for detection. To avoid this issue, and because performing face detection for every video frame is computationally intensive, this example uses a simple facial feature for tracking.

Step 2: Identify Facial Features to Track

Once the face is located in the video, the next step is to identify a feature that will help you track the face. For example, you can use the shape, texture, or color. Choose a feature that is unique to the object and remains invariant even when the object moves. In this example, you use skin tone as the feature to track. The skin tone provides a good deal of contrast between the face and the background and does not change as the face rotates or moves. The HSV color space output is shown in figure 3.

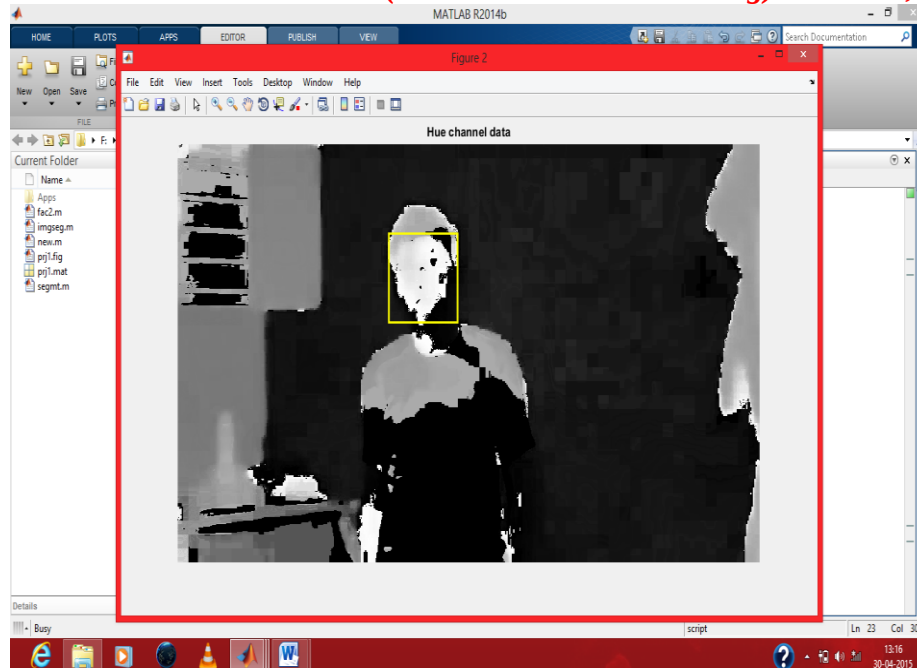


Figure (3): HSC color space hue selection

Step 3: Track the Face

With the skin tone selected as the feature to track, you can now use the vision. Histogram Based Tracker for tracking. The histogram based tracker uses the CAM Shift algorithm, which provides the capability to track an object using a histogram of pixel values. In this example, the Hue channel pixels are extracted from the nose region of the detected face. These pixels are used to initialize the histogram for the tracker. The example tracks the object over successive video frames using this histogram. Final detected face in the video segment is shown in figure 4

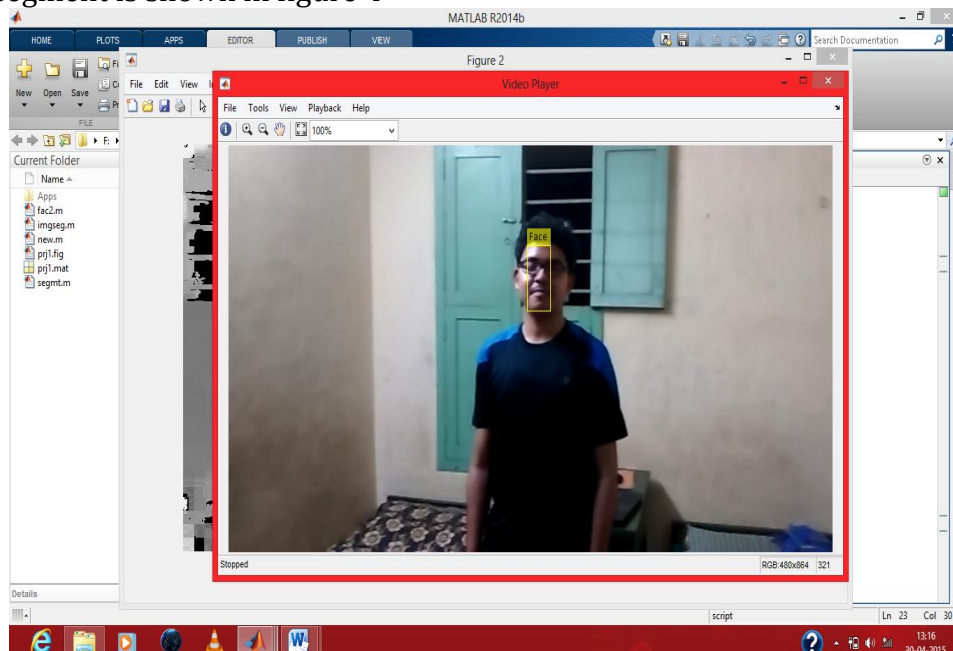


Figure (4): Detected face in the video frame

6.2 Object Detection

An algorithm for detecting a specific object based on finding point correspondences between the reference and the target image. It can detect objects despite a scale change or in-plane rotation. It is also robust to small amount of out-of-plane rotation and occlusion. This method of object detection works best for objects that exhibit non-repeating texture patterns, which give rise to unique feature matches. This technique is not likely to work well for uniformly-colored objects, or for objects containing repeating patterns. Note that this algorithm is designed for detecting a specific object, for example, the elephant in the reference image, rather than any elephant. For detecting objects of a particular category, such as people or faces, see vision. People Detector and vision. Cascade Object Detector.

6.2.2 Stepwise Procedure:

Step 1: Read Images

- Read the reference image containing the object of interest.



Figure (5): Image of Object

- Read the target image containing a cluttered scene.



Figure (6): The Whole Scene

Step 2: Detect Feature Points

- Detect feature points in both images.

- Visualize the strongest feature points found in the reference image.

100 Strongest Feature Points from Box Image



Figure (7): Object Features Detection

- Visualize the strongest feature points found in the target image.

Step 3: Extract Feature Descriptors

Extract feature descriptors at the interest points in both images.

300 Strongest Feature Points from Scene Image



Figure (8): Features of the Scene

Step 4: Find Putative Point Matches

- Match the features using their descriptors.
- Display putatively matched features.

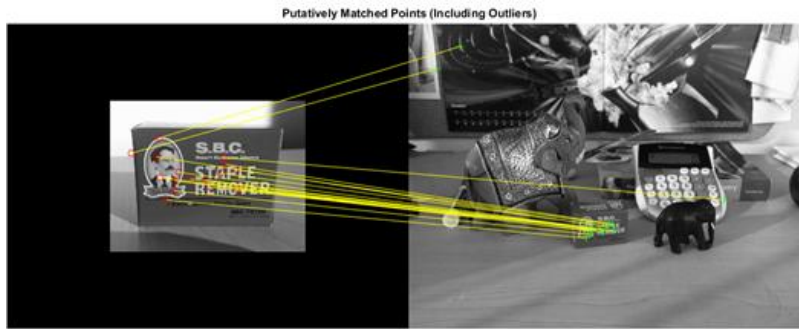


Figure 99): Matched Points

Step 5: Locate the Object in the Scene Using Putative Matches

- Estimate Geometric Transform calculates the transformation relating the matched points, while eliminating outliers. This transformation allows us to localize the object in the scene.
- Display the matching point pairs with the outliers removed

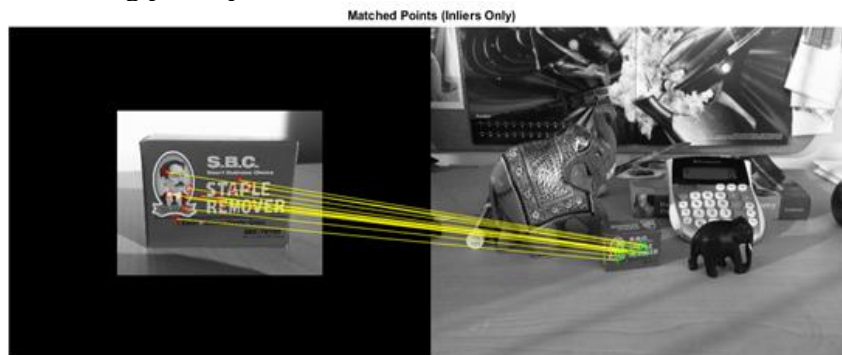


Figure (10): Exact match in scene

- Get the bounding polygon of the reference image.
- Transform the polygon into the coordinate system of the target image. The transformed polygon indicates the location of the object in the scene.
- Display the detected object.



Fig.11 object detected

7. Conclusion:

This work is done in Matlab and can be performed with Open CV also but we prefer Matlab because we can include Open CV programs in Matlab and the execution time in Matlab is lesser. The main aim was to detect the objects and the output objects were detected from the scene. The face detection program can be implemented to detect and follow people in case of surveillance. I conclude my project report by pointing its use in surveillance and obstacle detection process. In future this program can be used to control the cameras in a UAV and navigate through obstacles effectively. This program can be upgraded to reduce the process time of the controller so a different methodology can be tried and implemented.

8. References:

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