

Images and Position Tracking

Mohammad Asim¹, Riya Malik², Shagun Bhatt³

¹Asst. Professor, ^{2,3}B.Tech. Students

^{1,2,3} MGM CoET, Noida, Uttar Pradesh, India

Abstract : In this paper, we describe the problem of position tracking using images and fuzzy logic. The field of image analysis and position tracking has been combined along with fuzzy logic to solve the problem of accessing and monitoring movements of objects from remote place. There are other various approaches to solve the same problem but since fuzzy logic has been proved to be the best among them so in this research we are using the same to solve our problem. Images can be obtained using various methods in the real world scenario. This approach is easy and cost efficient to be implemented.

Keywords: Fuzzy logic, Image Acquisition, fuzzy logic controller

1. INTRODUCTION

Fuzzy logic is a field of Artificial Intelligence in which many valued outputs are obtained over range of inputs. It spreads the output over the function of inputs. Fuzzy logic is being extensively used in the field of position tracking to monitor the movements of the object of interest by occluding noise and other erroneous factors coming in the process. In this paper a stepwise approach has been taken in order to obtain the desired result.

2. LITRATURE SURVEY

In this paper “Fuzzy Logic Path Planner and Motion Controller by Evolutionary Programming for Mobile Robots Byung Cheol Min, Moon-Su Lee, and Donghan Kim” robot soccer system has been taken into consideration and fuzzy logic has been applied. Here robots acquire image of the ball present in front of its wheel and keeps a check on the movement of opponent player. By doing this he avoids the obstruction and hits the ball into goal post. This method uses capturing of the present scene and then concentrating on the object of interest and separating it. After this according to the situation made the robot finds an angle at which it will hit the ball and fetch a goal [1].

The second paper that we studied was “Neural Networks & Fuzzy Logic Elakkiya Prabha TPre-Final B.Tech-IT,M.Kumarasamy College of Engineering, Karur Kiruthika M Pre-Final B.Tech-IT,M.Kumarasamy College of Engineering,Karur” a automatic breaking system has been described based on the fuzzy logic. In this and automatic breaking system has been developed in which if the obstacle subtend an angle which is greater than the threshold value, the speed eventually decreases. The angle is taken as the input and speed is taken as output. Fuzzy rules have been used to define the rules of decrement of the speed. There are various scenarios that have been taken into consideration to demonstrate the need of automatic breaking system such as a speed breaker, flyover, sudden movement of object in front of car. This technique uses sensors for image acquisition. The same technique is used in rear part of car and automatic breaking is done [2]. The third paper that has been taken “Color-Based Object Tracking and Following for Mobile Service Robots Mohamed Abdellatif Dept. of Mechatronics and Robotics., Egypt-Japan University of Science and Technology, Alexandria,Egypt” color based segmentation of object of interest has been separated from the background and then tracking has been performed. The tracking has been performed based on the colour the targeted object and the signals to the controller are sent via wireless network a fuzzy logic controller (FLC) has been designed to control the steering of the vehicle. The drawback of this was that if there are two objects with same colour intensity values of the colour are observed the controller is not able to track the object of interest [3].

The fourth paper which helped our research is “Fuzzy Rule-based Classification of Human Tracking and Segmentation using Colour Space Conversion Sivabalakrishnan.M1 and Dr.D.Manjula2 1Research Scholar, Department of CSE, College of Engineering, Anna University, Chennai, Tamil Nadu, India sbkrishnanm@gmail.com 2 Assistant Professor, Department of CSE, College of Engineering, Anna University, Chennai, Tamil Nadu, India manju@annauniv.edu ”. In this paper the entire process has been performed in steps. The first step is to acquire the image and then object of interest has been separated from the background by the technique of background subtraction. The RGB (Red-Green-Blue) values has been converted into HSV (Hue-Saturation-Values).The noise has been removed by applying median filter. For object identification, blobs analysis has been performed. Then tracking is performed based on colour space conversion [4].

The fifth paper taken into consideration is “Adaptive camera selection based on fuzzy Automaton for object tracking in a multicamera system kazuyuki morioka1, szilvester kovács2, péter korondi3, joo-ho lee4, hideki hashimoto5 1meiji university in tokyo, japan, 2university of miskolc, 3budapest university of technology and economics, Hungary 4ritsumeikan university in kyoto, 5university of Tokyo, japan” . In this paper, multiple cameras have been used to track a single object. The selection of the tracking by the dominant camera (a camera which will track the object) is based on the transfer of control based on the nearest camera selection. Since the object is movable, the distance of it from the nearest camera is calculated and then the control is transferred to the minimum of all. A regular update of control is performed so as to avoid noise and irregularities. A comparison of regular approach from the fuzzy approach has been performed in which fuzzy has been proved a better approach.

3. Object Identification:

In this, the object of interest is secluded from the entire image for the purpose of tracking. Object identification includes various steps:

1. Image Acquisition.
2. Morphological Operations.

3.1 Image Acquisition

It is the first step to the process of object tracking which is performed to get the image for the image analysis purpose.

Various types of sensors are being used for the purpose of image acquisition. After acquiring the image various types of operations are performed on the image to remove noise.

3.2 Morphological Operations

Morphological operations on the image are carried out to remove noise and irregularities from image. A structuring element is used to perform a set of operation which is a combination of Union and Intersection operations. Morphological operations are performed in an image to remove imperfections.

3.3 Erosion

Erosion is a kind of morphological operation which is done on binary as well on grey scale image. It is denoted by:

$$A \ominus B = \{z \in E | B_z \subseteq A\}$$

Where A is a binary image and B is a structuring element. If all the pixels of B are contained in it, then the values of pixels are retained else the image gets deleted or eroded. It is carried out in an image for the purpose of eroding the boundaries a structuring element is used which performs a subtraction operation on the image that is it shrinks the image by removing area of noise from it.

3.4 Dilation

Dilation is other type of morphological operation which is done so as to enlarge the boundary of an image. It extends the boundary of an image. A structuring is needed so as to dilate the image. It is denoted by:

$$A \oplus B = \{z \in E | (B^s)_z \cap A \neq \emptyset\}$$

Where A is the input and B is the structuring element

3.5 Opening

Opening is a kind of morphological operation in which pixels connecting two parts of image are removed. The operation of opening shrinks the image. It is an operation of erosion by the structuring element on an input image followed by the dilation on the internal image. It is denoted by

$$A \circ B = (A \ominus B) \oplus B$$

Where A is an input image and B is a structuring element. Opening is a kind of operation which is used to place the pixel of the foreground at the background. It is an morphology row removal technique.

3.6 Closing

Closing is a technique in which noise is removed in a way that occlusion caused to an image are repaired by placing the foreground place. The operation of closing enlarges the image and aids in removing in morphological noise. Closing is a reverse operation of Opening. Closing is applied by successive application of two operators that is Dilation and Erosion. A Dilation operation is always followed by Erosion. It can be denoted by:

$$A \bullet B = (A \oplus B) \ominus B$$

Where A is an input image and B is an structuring element.

4. Classification

Classification is a technique which is used in the process of selection of the appropriate part of the whole image that is it helps in the identification process of the object to be tracked in the whole image sequence which is referred. This process easily lets us know about the object of interest and helps in tracking the correct path. It also tell about the unnecessary movements and objects with less interest. The process of Classification is carried out with the help of various machine learning techniques where we can make a machine learn and help in automatic classification process. The techniques used in learning are:

1. Supervised Learning.
2. Unsupervised Learning.
3. Reinforced Learning.
4. Object based Classification

4.1 Supervised Learning

Supervised Learning is a technique in which we make the machine learn certain features that are according to our interest. In this technique the inputs are provided in a pair to

the machine that is to a input a corresponding output is also provided to the machine so that the classification n is done according to our requirement. This is the reason that this process is called Supervised learning because as the name suggests a supervisor decides what kind of inputs and outputs the machine should learn so as to fulfil our requirement. In other words we it can also be said that by using supervised learning we can easily get what we want. The diagram below gives the description of Supervised Learning:

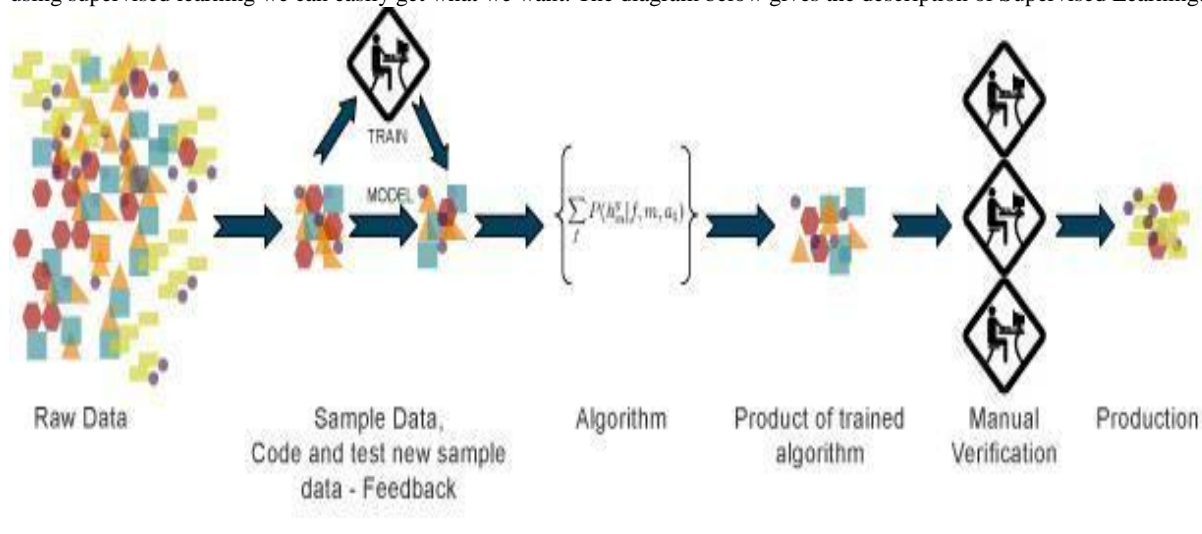


Figure 1. Supervised Learning

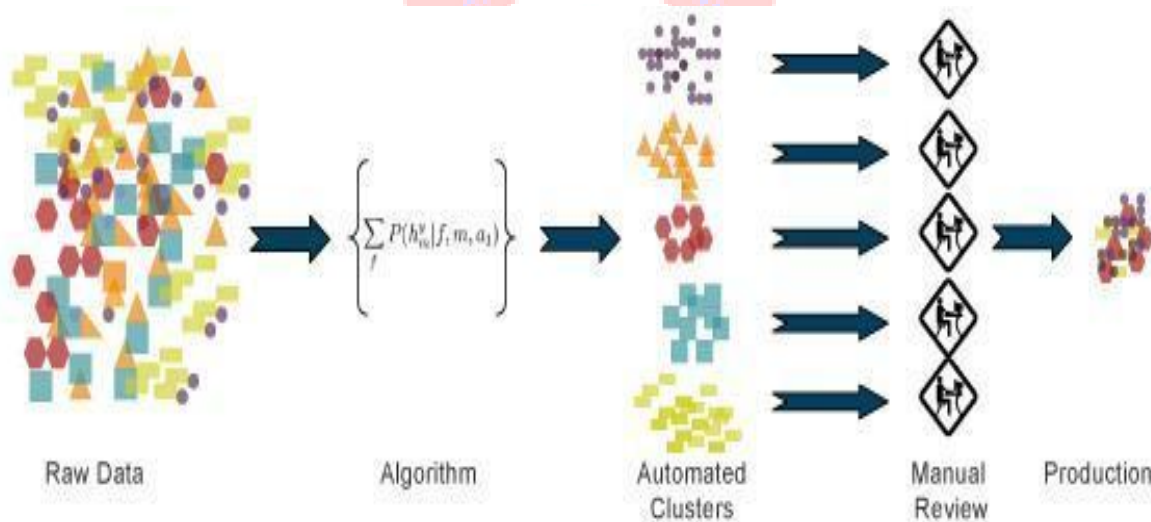


Figure 2. Unsupervised Learning

4.2 Unsupervised Learning

Unlike Supervised learning, Unsupervised Learning takes unlabelled input and gives the outputs according to the matching of the various inputs to the data present with the machine. It does not guarantee the exact output which the user is looking for but surprisingly gives the output according to its convenience which may or may not satisfy the users demand.

This is the only reason why researchers more rely on Supervised learning and try to keep their research confined to the supervised learning.

4.3 Reinforced Learning

Reinforced Learning is a branch of Artificial Intelligence which is a reward based learning technique. In this the training data is taken as input and the output is given on the basis of the behaviour of the training data. The Reward simply means the identification of behaviour of the training set and accordingly giving the output to it. This method also involves the process of learning on the basis of previously generated outputs. If the outputs generated do not satisfy the user then Reinforcement of desired output is done. Reinforced learning is also very effective in giving required results according to the wish of user. The Figure below gives us the description of how exactly Reinforced Learning takes place.

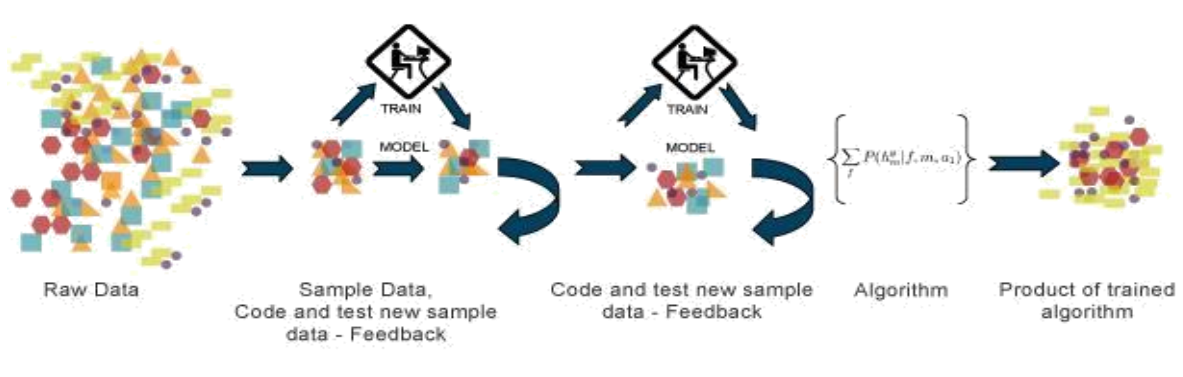


Figure 3. Reinforced Learning

4.4 Object Based Classification

Object Based Classification is a technique in which an image is taken and then according to the requirement its surrounding are classified as shadows and other objects. In this process the image is classified into two major parts one is the required one and other is not required. The object to be searched is taken into consideration and other surrounding objects are removed or occluded.

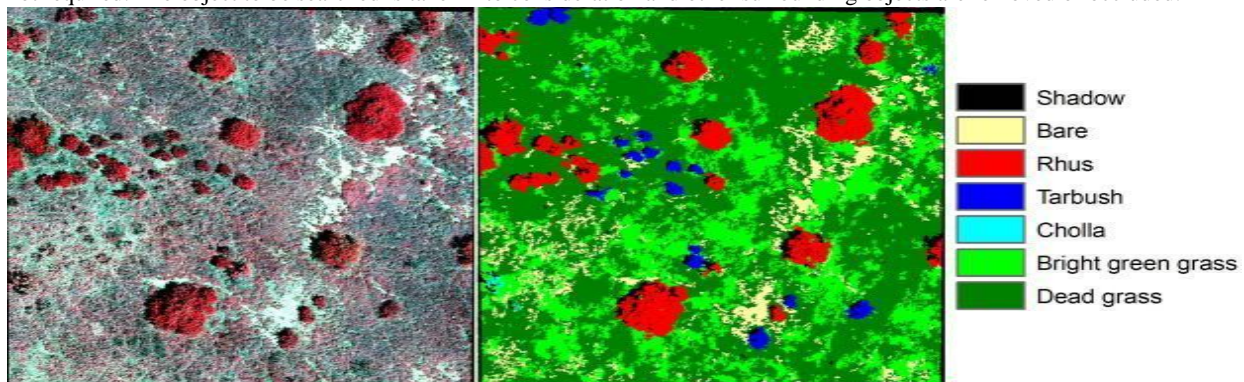


Figure 4. Object Based Classification

5. Tracking

The third and the final step in position tracking using images is the Tracking the movements of the object using images. This is the most important and crucial step as this is the core part of the whole research and work done so far. Thus tracking will also involve various steps but the one which suits our forte can be used as the main method. The various steps are:

1. Colour Based Segmentation.
2. Background Subtraction.
3. Optical Flow.
4. Image Thresholding.

5.1 Colour Based Segmentation

Colour based segmentation is a kind of tracking technique in which a segmentation of the image is done on the colour. The coloured system tracks the movements by picking up a colour and then following it. The problem arises when the intensity of the colour of two different objects are same. In such a situation it first calculates the Red-Green-Blue that is RGB value of the colour and the values of HSV that is Hue-Saturation Value are also derived. The HSV values of the colour give the information about the brightness intensity value of the colour.

5.2 Background Subtraction

Background Subtraction is a technique of tracking in which background is subtracted to as to seclude the objects from its background and then choosing a base frame and subtracting the subsequent frame of video from a base frame so as to track the movement of the object. This technique is also called Frame Differencing. It is easy to implement with less computation of coordinate values. This helps us in giving a clear picture of the movement of the object.

5.3 Optical Flow

frames. So as to track the speed of the movement of the object in the sequence of frames. It is the apparent motion of the object. It is the optimal solution for the tracking of object.

5.4 Image Thresholding

Image Thresholding is a technique in which a threshold pixel is used and the pixels having values less than this threshold pixel are ignored and others are accepted.

6. Conclusion

This research paper gives the complete view about the various methods that are used in the process of position tracking using images. The paper describes the methods and techniques and the use of it in appropriate way at a certain instance of time during the research. This paper uniquely tells about all the available new approaches and in combination the use of these new approaches. It also tells briefly about each approach so that the reader can easily understand the one appropriate for the use.

7. Reference

- [1] Fuzzy Logic Path Planner and Motion Controller by Evolutionary Programming for Mobile Robots Byung Cheol Min, Moon-Su Lee, and Donghan Kim.
- [2] Neural Networks & Fuzzy Logic Elakkiya Prabha T Pre-Final B.Tech-IT, M. Kumarasamy College of Engineering, Karur Kiruthika M Pre-Final B.Tech-IT, M. Kumarasamy College of Engineering, Karur.
- [3] Color-Based Object Tracking and Following for Mobile Service Robots Mohamed Abdellatif Dept. of Mechatronics and Robotics., Egypt-Japan University of Science and Technology, Alexandria, Egypt.
- [4] Fuzzy Rule-based Classification of Human Tracking and Segmentation using Colour Space Conversion Sivabalakrishnan.M1 and Dr.D.Manjula2 1Research Scholar, Department of CSE, College of Engineering, Anna University, Chennai, Tamil Nadu, India sbkrishnanm@gmail.com 2 Assistant Professor, Department of CSE, College of Engineering, Anna University, Chennai, Tamil Nadu, India manju@annauniv.edu.
- [5] Adaptive camera selection based on fuzzy Automaton for object tracking in a multicamera system kazuyuki morioka¹, szilvester kovács², péter korondi³, joo-ho lee⁴, hideki hashimoto⁵ 1meiji university in tokyo, japan, 2university of miskolc, 3budapest university of technology and economics, Hungary 4ritsumeikan university in kyoto, 5university of Tokyo, japan.

