**Digital Image Processing**

**Reading Assignment#1**

**Name : Mehmood Amjad**

**Roll No: 19I-0472**

**Improved Target Tracking Algorithm Based on Camshift**

**Purpose:**

The purpose of this research paper was to introduce a new and improved version of the original target-tracking algorithm based on camshift. In the original target-tracking algorithm, the accuracy was greatly reduced if there were any similarity between target color and the background color or if the target was ambiguous or dark.

This research paper used Kalman filtering algorithm and contour features of the target to improvise the original target-tracking algorithm.

**Pseudocode:**

Video capture (path)

Loop:

Read video Frame by frame

Camshift (Frame)

Threshold (frame, value)

if Window size > threshold then

dilate(frame)

erode(frame)

ConvertToBinary(frame)

CannyEdgeDetect(frame)

drawContours(frame)

else if Bhattacharyya coefficient < threshold then

use Kalman’s algorithm

else if frame == last

break

End Loop

**Applications:**

The key point of Camshift algorithm combined with Kalman filtering is tracking target position. Therefore, this algorithm finds its applications in tracking targets with background similarities or tracking a ambiguous or dark target.

* Face detection/Person detection in CCTV.
* Finding an object in an image/video with a lot of background noise.

**Weaknesses:**

Compared with other algorithms, the improved target-tracking algorithm has the lowest average detection speed. This is because, it is using a lot of time consuming functions on every frame. Therefore, in complex situations, this algorithm, despite the fact that its more accurate, will prove less beneficial because of the time it takes.

**Datasets:**

* Video of a player playing football in a stadium.

In this experiment, they used the algorithm such that the player was the target. As the video continues, the background noise keeps on increasing but the player was locked on using contours and hence was easy to differentiate regardless of all the background noise.

* Video of a person walking past a pillar

In this experiment, the person is first locked on however, as soon as he gets behind the pillar, he gets undetected. But, by applying the prediction of Kalman’s algorithm, we are able to accurately locate the target.

**Mean Shift: A Robust Approach toward Feature Space**

**Analysis**

**Purpose:**

The purpose of this paper is the analysis of a complex multimodal feature space using mean shift. This process determines the modes of different clusters using mean shift which can be used for better image segmentation and image smoothing than K-mean.

**Applications:**

* Discontinuity preserving images.
* Image Segmentation.

**Weaknesses:**

* Computationally expensive.

**Datasets:**

* Discontinuity preserving smoothing:

For the discontinuity preserving and smoothing, a cameraman’s image is shown which was smoothed after applying the mean shift filter.

* Image Segmentation:

For image segmentation, there is first an image of MIT building, whose regional boundaries are drawn and the objects are segmented after applying the mean shift. Similarly, there is an image of a room where the regional boundaries drawn using mean shift separate each object.

**How mean shift works?**

In mean shift, we take a pixel and take its initial location as mean. After this we take its surrounding (define a kernel) and calculate the mean. Then, we shift the pixel to the new mean. We keep on doing this until we get to the mode (peak of cluster), where further computation won’t change the mean.