CHAPTER 7
RESULTS AND DISCUSSIONS

7.1 INTRODUCTION

In this work, the acquired video has been separated into frames and segmented by using contextual clustering. The segmented image is given as input to HMM. Features are generated using HMM. The segmented image contains the human being distinctly visible. As the frame covers certain area, the position of the human in the frame is given with respect to the left hand side of the frame. In our calculation, the number of columns are away from the left position of the frame is suitably scaled based on the area of the space and the position of the human is recorded based on coordinates. The coordinates of the first two frames are given to the estimator. The estimator estimates the next position of the same person. This estimation may not be exact as the position of the person in the third video frame. When, more than one person is present, then separate procedure has to be followed. The segmented frame has to be coordinated with the input frame and corresponding color information of the person is noted. In case, both the persons are wearing the dress in same color then there should be some difference in the height or width of the persons in the image. The features of the segmented image are further processed by the imfeature properties of the matlab. The imfeature provides 19 properties. In this work, two important properties are used to process the features of the segmented image for highlighting the presence of person.
7.2 RECEIVER OPERATING CHARACTERISTIC (ROC) CURVES

Receiver Operating Characteristic (ROC) curve provides information on the tradeoff between the hit rate (true positives) and the false alarm rates (false positives). In order to draw the ROC curve both positive and negative examples are needed.

ROC is the plot between false positive rate and true positive rate. The points plotted here represent the performance of an algorithm in meeting the expected criteria, it is 90% or above.

ROC is plotted for each of the algorithms viz., segmentation by CC, and identification by HMM + RBF, HMM + CPN. A diagonal of the ROC is represented by drawing a line connecting x=0, y=0; x=1, y=1. If the ROC plot is above the diagonal, that is in the region x=0, y=0; x=1, y=1; x=0, y=1 then the implemented algorithm is accepted. The equation (7.1) for TPR and equation (7.2) FPR are given as follows:

\[
\text{True positive rate (TPR)} = \frac{TP}{TP+FN} \quad (7.1)
\]
\[
\text{False positive rate (FPR)} = \frac{FP}{TN+FP} \quad (7.2)
\]

Where FP—False Positive, FN—False Negative, TP—True Positive, and TN—True Negative, the term TP refers to the boundary pixel correctly segmented; TN refers to pixels inside the objects not segmented; FN refers to boundary pixel not segmented and FP refers to pixels segmented adjacent to the boundary.
7.2.1 ROC for segmentation algorithms

Figure 7.1 presents ROC for the performance of CC in segmenting 10 videos. The ROC plot shows the points above the diagonal. This is an indication that CC algorithm can be used for segmentation of objects in frames.
7.2.2 ROC for Person identification

Figure 7.2 presents ROC for the performance of HMM+RBF in identifying person. The plot shows estimation capability for 10 different videos. Each point shows performance of HMM+RBF considering starting and ending frame for each person. The ROC plot shows the points above the diagonal. The TPR is more and the FPR is less. This is an indication that, HMM+RBF can be used for identification of persons using gait.
Figure 7.3 presents ROC for the performance of HMM+CPN in identifying person. The plot shows estimation capability for 10 different videos. Each point shows performance of HMM+CPN considering starting and ending frame for each person. The ROC plot shows the points above the diagonal. The TPR is more and the FPR is less. This is an indication that, HMM+CPN can be used for identification of persons using gait.
7.3 ACCURACY OF SEGMENTATION

The accuracy refers to how correctly the implemented algorithms segment the different objects in different frames. Different measures like precision and recall can be used to evaluate segmentation accuracy. However, in this work the segmentation accuracy is expressed by equation (7.3):

\[
\text{Accuracy} = \frac{TP + TN}{TP + TN + FP + FN}
\]  

(7.3)

Figure 7.4 presents accuracy obtained for the implemented CC algorithm in segmenting frames of images. The segmentation accuracy of CC is minimum 88%.
7.4 ACCURACY OF PERSON IDENTIFICATION

The person walking style identification accuracy is expressed by equation (7.3). The definition of TP / TN / FP / FN changes. The term TP refers to identifying the correct person corresponding his/her gait.

TN refers to not identifying a person for a given gait in the database.

FP – Wrongly identifying a person given a gait, which is not in the database.

FN – Wrongly rejecting the person from the database when the gait is part of the database.

![Fig. 7.5 Accuracy for implemented person identification algorithms using gait](image)

FN refers to coordinates in the background instead of giving coordinates of the specific person\(_x\) (where \(x\) is the person 1 / 2 / 3 or...)
n). FP refers to estimating the coordinates where specific person$_x$ is identified who is not same as the specific person$_x$ in previous frame. Figure 7.5 presents accuracy obtained for the implemented HMM+RBF, HMM+CPN algorithms for 10 videos. The accuracy of identification is better when HMM+CPN is used for person identification using gait.

### 7.5 SUMMARY

This chapter has presented the segmentation accuracy of CC algorithm. The person walking styles identification accuracy of HMM+RBF, HMM+CPN are presented. Chapter 8 presents comparisons of Performance of the proposed method.