Extracting Tawaf parameters using video analysis techniques

Hajer Aljehani, Mohamed Dahab, Gibrael Abosamra,
hhaljohani@kau.edu.com, mdahab@kau.edu.sa ,gabosamra@kau.edu.sa
King AbdulAziz University
Jeddah, Saudi Arabia

Abstract— Hajj and Umrah is important for every Muslim, every year people from around the word visits makkah to perform the hajj, and due to large number of people the place which is limited is always full. To manage this huge number of pilgrims is a huge challenge for the management team, to resolve the issue related to the crowd, management team always conveys the specific information about the number of people and their density. It is a challenging task to get this information from this huge crowd. It is not always easy to count the people who visit makkah and make arrangement according it, to make safe and secure arrangements, management team always look into videos. There are lot of technical devices present there that can help in extracting this valuable information without counting it manually. Those devices count the people on the basis of their movement in makkah, devices do not only count the people who can move but those who are staying at a place and not moving. The devices that are being used are high pixel with additional features that capture the movement and count the people according to it. Garbor filter is being used to find the empty spaces. As per the arrangement it can be said that these devices are working properly to get a correct count.

Index Terms— computer vision, image processing, Video Analysis, features extraction.

————————————— ◆ —————————————

1 INTRODUCTION

People from around the world visit makkah every year to perform Hajj and Umrah, which is known as a Islamic Pilgrimage, the Tawf is the important part of Hajj and Umrah where people move with different frequencies and velocity around the holy Kabbah, this is the only place where large amount of people gather for a specific time to perform the hajj. When it comes to managing and providing safety to the large crowd it is always a big challenge for the management team, from the futuristic perspective Saudi Arabia is trying their best to enhance the capacity of pilgrims from 8 million to 30 million. Nowadays it is more concerned area that management team has to make the strategies to provide wide space and safety to perform the hajj so that people can perform the hajj without facing any overcrowding situation and mixing up.

To manage the huge crowd, one should take these three steps, 1. Crowd modeling 2. Crowd monitoring 3. Crowd management. Crowd modeling has specific characteristics such as it analyzes why, when, how and where the crowd is moving and taking their steps from entrance point to the exits point. Crowd monitoring also perform specific functions such as it monitors the flow rate of people, it monitor how people are making the queues, where people are gathering for a long time, which it is the highest density area. To manage the huge crowd crowd modeling and monitoring both are the important factors to provide safer safe to pilgrims.

When people are gathering for Tawaf then it is beneficial to get the information, there is a room inside the grand mosque where people watch the movement and people and ensure everything is safe, their main function is to provide the security. The people who are at the duty in the operation room al-

ways watch the screen to provide security to the crowd, once any unwanted or threatening situation arise the take immediate action by watching in the screen. To perform this duty the management team has hired people with high man power because they need someone who has good monitoring skills and can watch into screen very carefully.

In Section 2, the related work. In section 3, the proposed system will be described in detailed finally the evaluation will be presented in section 4.

2 RELARED WORK

Videos play a very important role in taking any vital decision and managing the crowd, when it comes to getting the information about any event or specific action by anyone then video always plays vital role because they have features that can help in capturing every moment so one need not to do it manually.

After the analysis, different techniques have come into mind to help in making the security better and managing the crowd. From the different techniques one technique was suggested by Muhammad Sultan and Sleh[1] by using Deferent and Blob Counting support in counting the movement of people with around 96% accuracy and it has also experienced as well. Another proposal [2]was given to count the people by using CNN act as a detector, where images and video help in counting the crowd and density, this act given 90% accuracy.

Third proposal [3]was taken in which microscopic devices are used in tracking the individuals, where they suggested that they would install virtual camera with rotation and high focal

length above the Al Haram Piazza top view. Result showed the limited flow of people.

Fourth proposal[4] was taken to count the movement of people near the gates of Masjid Al Haram, where different counter was installed to count the movement, then ground segmentation is used for counting, to test the sample the open Cv 2.0 was used.

As per the Lopez and idrees[5] proposal to count the number of people in huge crowd the 3D Conditional Random field and static crowd count was used, where it must have same pixel with trajectories to get the clear result.

Fifth proposal [6]states that Crowd Density Estimation System must be used to count the number of people at Masjid Al haram, where foreground blob was used to extract the background and density and edge detection was ranked from high to low level with the help of neural network.

Sixth proposal [7]states that crowding level while performing Hajj and umrah, in this proposal floor mask is used to find stationary and moving floor space of plagiarism, to find out the motion of plagiarism the Hybrid method with the optical technique and block matching technique is used, where it shows the accuracy of 90.58%.

Seventh proposal [8]states that using 3D visual sensor and novel objection detector within the super pixel device help in counting; these devices function as segmentation of pictures taken, analysis of those images and much more with the help of Simple Linear Iterative Clustering method. By using the speed up robotic feature one can easily find the key point. Key point help in detecting every individual in super pixel. Probability map support in describing the accuracy.

From the previous technique it is concluded that these techniques can help in not only managing the crowd but providing super safety as well, these techniques analyze the movement of moving and nonmoving objects and people by placing the cameras of high pixel with different trajectories.

FIGURE 1: A FLOWCHART OF THE PROPOSED SYSTEM

3   THE PROPOSED SYSTEM

our goal is to estimate a count of the number of people across a crowd video frame. Figure 1 shows a flow chart of our method.

3.1   Datasets

One of challenges in my research is getting datasets for Mataf with view that show most or all area of Mataf in height not more than 10 m to be able counting .The Dataset we used take from Institute of the Custodian of the Two Holy Mosques for Hajj and Umrah Research are video recorded by camera frame by frame are used to test on our method with frame rate of the video is 30 frames per second and frame resolution is 1920 × 1080. The video contains more than 5,000 frames.

We annotated a dot on head manually in the frame of video to evaluate results.
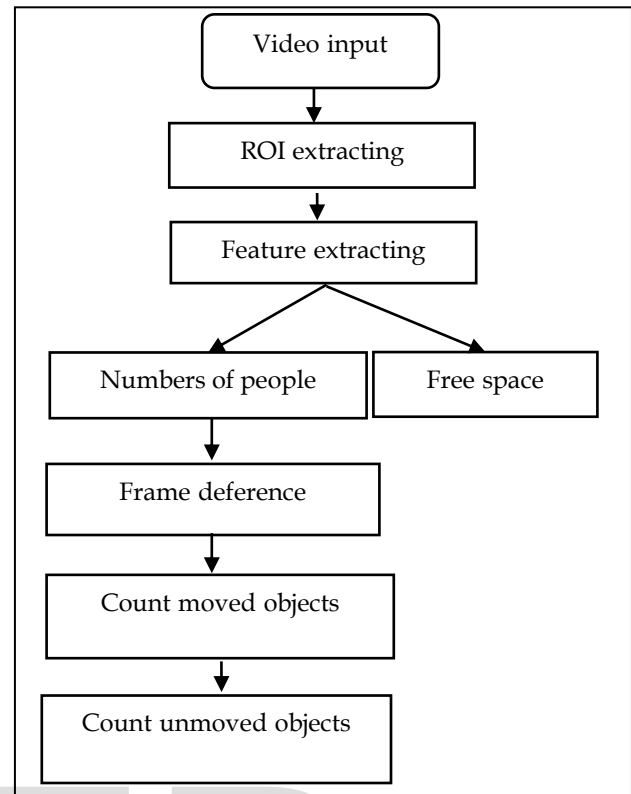
Example frames of the dataset are shown in Figure 2.

FIGURE 2: EXAMPLE FRAME

In the sample frame, many people are entering the tawaf area and leaving this area from different sides. Some people are standing. In the tawaf area (middle area) many people are moving at different speed. At the outer circle they are moving fast whereas in the inner circle the motion is slow.

3.2   ROI

Most of crowd researches take the whole ground area captured in the image as the region of interest (ROI) without allowing the users to flexibly select only certain target regions but some allow [6].

3.3 Find Empty space

Identify regions based on their texture is our method to find empty space in Mataf area. Gabor filter is a good model of how humans distinguish texture. And segmentation is visually obvious because of the difference in texture between the floor and people. The set of frequencies and orientations is designed to localize different, roughly orthogonal, subsets of frequency and orientation information in the input image. Regularly sample orientations between [0,150] degrees in steps of 30 degrees. Sample wavelength in increasing powers of two starting from 4/sqrt (2) up to the hypotenuse length of the input image.

3.4 Superpixels

Superpixels separate regions with different textures and shapes. We specified 2000 the number of superpixels in frame and used the simple linear iterative clustering (SLIC) algorithm. This algorithm groups pixels into regions with similar values. then we extract features of each superpixels.

3.5 Feature Extraction and count

To estimate the number of people across frames in a video in our case the crowd density does not change a lot across frames

so, our method can be used more effective to calculate counts every other *p* frames.

SURF and MSER local feature vectors are detected and extracted from reference images of the target and merged[9].

For detect number of move and non-move people we find move people by using frame subtraction to find the deferent between frames then we use MATLAB commands that use in the method in [10] to get number of moved people then by using subtract it from the total number of people to get the un-move people

4 OVERALL SYSTEM EVALUATION

The proposed method results as shown in Figure 3 it performs good results for count compared with ground truth.
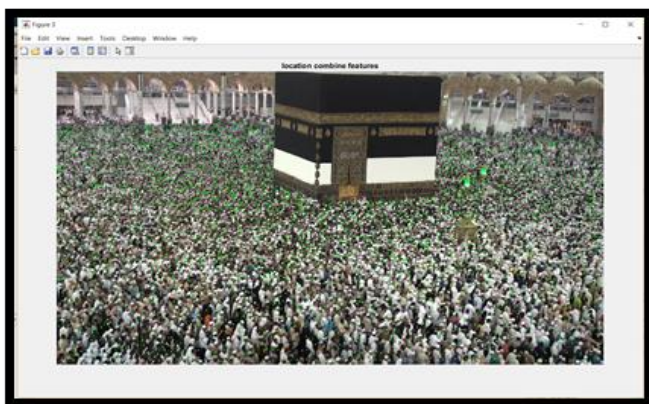

Figure 3: Result of counting

We use the equations that use in [5] to evaluate the results. For the absolute difference we use equation (2).

$$AD = mean(|GTC - PC|) \text{ (2)}$$

GTC being the ground truth count from the annotated frames, and PC the predicted count. For the normalize absolute difference metric we use equation (3).

$$NAD = mean(|GTC - PC|GTC) * 100 \text{ (3)}$$

The proposed method gave good results in count compared with GT and with method in [5].

Table 1: Results for our proposed method

Method	NAD	AD
Proposed	1.09%	35
[5]	67.3	984

4 CONCLUSION

This thesis studded the issues of counting in extremely crowd density this is done by combining the features SURF, MERS that extraction from farm to find number of people then subtract farm to find move people then n move people. Also find empty space at Mataf sing Gabor filter. Good results we found comparing with ground truth.

This research shows several conclusions crowd at Mataf, but there are some directions for future research:

- Build datasets of video a picture for Mataf area with new expansion and represent all the area in deferent times and crowd levels.

- Study crowd in deferent time during the day.

- Build a real-life counting system that give alive results with CCTV cameras.

REFERENCES

[1]   S. D. Muhammad Arif, SalehBasalamah. (2013) Counting of People in the Extremely Dense Crowd. *IAES International Journal*.

[2]   M. T. Sultan Daud Khan, Muhammad Khurram Amin, Akram Nour. (2017, Sep 14) Towards a Crowd Analytic Framework For Crowd Management in Majid-al-Haram. *arXiv*.

[3]   M. H. Dridi, "Tracking individual targets in high density crowd scenes analysis of a video recording in hajj 2009," *arXiv preprint*

arXiv:1407.2044, 2014.

[4]   H. S. M. Al-Khaffaf, F. Haron, S. Sarmady, A. Z. Talib, and I. M. Abu-Sulyman, "Crowd Parameter Extraction from Video at the Main Gates of Masjid al-Haram," in *Frontiers in Computer Education*, S. Sambath and E. Zhu Eds. Berlin, Heidelberg: Springer Berlin Heidelberg, 2012, pp. 727-736.

[5]   E. G. López and H. Idrees, " Counting in High Density Crowd Videos

", 2016.

[6]   S. M. Y. Norhaida Hussain Halimatul, Nor Liza Hussain ,Jasy Liew Suet Yan, "CDES: A pixel-based crowd density estimation system for Masjid al-Haram," *Elsevier,* 2011.

[7]   S. A. K. a. M. U. A. Sumaiyya Farooq. (2017) Congestion analysis of pilgrims in Hajj and Umrah congregation using block matching and optical flow. *Journal of Physics*.

[8]   T. N. Miriam Lopez-de-la-Calleja, Muhammad Attamimi, Mariko Nakano-Miyatake, Hector Perez-Meana, "Object Detection Using SURF and Superpixels," *Journal of Software Engineering and Applications,* vol. Vol. 6 No. 9, 2013.