Enhancement of Context by Image Fusion and Surrealist Video
Jaspreet Kaur & Amandeep Singh
Department of Electronics and Communication Engineering, GNDU Amritsar
Department of Electronics and Communication Engineering, SLIET Longowal

Abstract- This paper presents the algorithm for enhancing the low quality images and videos. As during the night, the traffic is not clear from which any information can be gain. So to make these images and videos more informative the high quality background is provided to the night time video. The new technique called Frame Subtraction Based fusion (FSB) is described in detail. The proper video result is also achieved.

Keywords: Image Fusion, Background Extraction, Foreground Extraction, Binarization, Filtration.

I. INTRODUCTION
As in the traffic surveillance, the night time images are not so informative due to poor illumination. So the purpose of fusion technique is to extract and synthesize the good illuminated video from the sequence of frames of same target, so that it becomes more interpretable for the human vision. The main challenge in fusion is to extract the background and foreground fusion because of the hazards like halting, ghosting and aliasing [1, 2]. So the need is to develop such an algorithm which provide proper context to the video along with taking into consideration the artifacts that may arise. This paper explains the new fusion algorithm called Frame Subtraction Based fusion (FSB) technique. In this prototype, the camera capture the video of the traffic during the day time for extracting the background for fusion and finally the night time video need to be enhanced is fused with this highly illuminated background to get fused final video. In the next section, the previous related work is discussed. In the section 3, the basic algorithm for extraction and fusion is detailed and after that the final results and conclusion is presented.

II. RELATED WORK
Marey and Murbridge are the two personalities who invented the idea of image fusion in 19th century [1]. But, the main work is implemented by the U.K. ministry to guide their pilots in the night. In the first method the fusion is done on the main source image itself resulting in the reduction of contrast.

To improve the contrast of the image, the pyramid based image fusion technique is implemented. In this the pyramid transform in implemented in pyramid form on the image [3]. Even though this method retains the spectral and spatial properties of the image, but due to the implementation in pyramid form the edges of the images are not enhanced properly. Also, this method is quite difficult to implement on the real time videos. After this, the wavelet based and region based image fusion technique is invented. Both these methods give satisfactory results on the image [4]. But, the algorithm is quite complex to implement. As all the pixels are compared and chosen from all the images with good contrast. So, the memory requirements for these two techniques are very large. Because of each pixel processing the time consumption is also very large. When wavelet transform is implemented alone the results are not good enough on some of the images. By collaboration of this method with intensity hue saturation (IHS) the results are satisfactory [5]. Some other techniques like HIS, principle component analysis (PCA), filter fusion are also time consuming as they work on each pixel [6]. Another technique is the segment based image fusion in which each image is segmented into blocks and processing is done separately on each. Even though this method is good in remote sensing but in night time image fusion it requires lot of memory to save and process each segment. Also it is not possible to implement on the real time videos. So, the need is to develop such an algorithm which will overcome all the above mention problems faced in other techniques. Along with this, buildings which are important enough for security purposes may use the high quality cameras. These cameras are providing good results during the day time but, during the night the image becomes information less due to the noise significance. On the road sides, applying the good quality cameras is also not a cost effective. The other way out is application of the high intensity light sources on the road sides. This is also not good enough as it may pose problem to the drivers during the night. These light sources may disturb the nearby owners of the buildings. The image taken from the road not only contains the vehicles going on but also the nearby buildings. These buildings are also important as perceptual cues to be preserved in fusion are contained in them. Thus, the main objective of this work is to develop fast, cost effective algorithm which provides reliable results.

III. METHODOLOGY
Image fusion is the technique by which the images which are taken under different illuminations are combined together to get the more informative image or video. In the prototype, the first main step is to extract the background from the sequence of images, captured from the camera, of the same target. This extraction is done for
both the day and night time video. Finally, the video to be enhanced is processed and fused result is acquired.

In the prototype, the two main steps are involved that is background fusion and foreground extraction. First thing to do is to extract the background both for day and night time video and next step is fusion process.

A. Reference image from day and night

The video is captured from all day long and night for extracting the base reference images used for fusion. In the loop, difference of all frames is computed to detect the change. These difference frames are changed to binary form and by filtration the noise is removed. Finally, this frame is multiplied with any frame to get reference image. Following steps are involved in this:

1). Video capturing: The camera is placed on the target and video is captured which is used in the MATLAB environment using image acquisition toolbox. The object is created for video acquisition which is used in the prototype for processing. The captured video is stored in an array in the form of sequence of frames. Then, the frames are taken in the order to compute the difference to detect the change. This change is computed at once between the frames not at the pixel level.

2). Binarization: The difference image is changed to binary image by the process called binarization. Binary image represents the pixel value in 0 and 1. Some threshold level is defined in the command and if the pixel value is above the threshold defined then the pixel value becomes 1 otherwise it is 0. This image helps to distinguish the change occurring among the frames. The threshold level is defined depending on the surrounding conditions. In this algorithm, after proper research the value according to the conditions is determined about 30. Figure 1 shows the example of binary image which represents the change occurring among the frames.

3). Filtration: Next main step involved is to remove extra pixels which may not represent the change but above the threshold level defined. These pixels act as a noise in the image. The image processing toolbox contains some of the command used for filtration [8]. Figure 2 shows the filtered image.

4). Final image: Finally, the filtered image is multiplied with the first frame of video to get the exact background. This background is used in fusion to provide high illumination to the night time video. The all frames are passed through all these steps and at last the summation of all these frames are done to get the single final reference image. Main thing to take care is the format of the image in which its data is represented. At the end of the summation the mean of the frames is done so as to make the pixel value up to 255.

B. Fusion process: Now, this is the main step of prototype to provide highly illuminated context to the video. In this the video to be enhanced is captured and timer is started so that after some time the base image for night is processed again to get proper context to the video. In the loop, the frames are compared to get the change and same way the binarization and filtration is done. After this, the filtered frame is multiplied with the new frame coming to get the traffic which needs to be used in the fusion as it is. This process is called foreground extraction. Next, the binary frame is multiplied with the base day time reference image to get the highly illuminated background. Then finally, the fusion of these two frames is done to get the fused video. Figure 3 gives detail of fusion process.

IV. PROBLEMS FACED

In this algorithm, the main problems faced are the format used to represent the video and thresholding.

A. Threshold level

Thresholding is main step to be done while changing the image to binary form. If proper level is not known then this may lead to the problem as exact change is not detected. After thresholding, this binary image is need to process with the first frame to get the base image. For this, the logical ‘OR’ operation is used as with ‘AND’ operation and simple summation operation the required reference image is not detected.

B. Difference of images

In the end, the image data is needed to be represented in the proper format to get the required video. When the binary image is multiplied with the first frame the data of the image get changed, means the image becomes black and white without removing the change but required image is colored. To remove this problem the backward
difference is also calculated to remove all the changes occurring in adjacent frames.

C. Pixel approximation

While extracting the reference image, the summation of all frames is done that make the pixel values above 255. This problem makes the video most of white in color. To remove this problem, all the frames after summation are averaged.

V. RESULTS

The results given below are accepted in the World Congress on Engineering (WCE - 2011) held in London, U.K [11]. The image evaluation is done mostly on the basis of mean, standard deviation and entropy. But these parameters don’t reflect any good information about the image quality. The entropy is the measure of information in the image, means higher the entropy more will be the information content [9]. But from this, it is not clear whether the information added is the image content or the noise. Table I shows the various evaluated parameters of the resultant image.

<table>
<thead>
<tr>
<th>Image</th>
<th>Band</th>
<th>Mean</th>
<th>Standard Deviation</th>
<th>Entropy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Frame subtraction based fused image</td>
<td>R</td>
<td>100.727</td>
<td>10.938</td>
<td>6.94</td>
</tr>
<tr>
<td></td>
<td>G</td>
<td>94.038</td>
<td>12.328</td>
<td>6.85</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>90.536</td>
<td>16.305</td>
<td>6.95</td>
</tr>
</tbody>
</table>

But from these parameters, it is not clear about actual quality of the image. Higher the entropy means more information but it is not known whether this information added is actually the image content or the noise. To get the clear picture about this criterion the INI about the image is calculated [10]. Table II shows the INI values of the fused image. If the INI value is positive then the information added is required image content and if it goes negative then the added information is noise.

From the table given below it is cleared that the results are having proper image content as image content is positive.

<table>
<thead>
<tr>
<th>Image</th>
<th>Entropy of fused image</th>
<th>Entropy of restored image</th>
<th>Enhanced image content</th>
<th>Noise</th>
<th>Signal</th>
<th>INI</th>
</tr>
</thead>
<tbody>
<tr>
<td>FSB-R</td>
<td>6.94</td>
<td>4.31</td>
<td>2.63</td>
<td>1.84</td>
<td>.79</td>
<td>.429</td>
</tr>
<tr>
<td>FSB-G</td>
<td>6.85</td>
<td>2.90</td>
<td>3.95</td>
<td>1.44</td>
<td>2.51</td>
<td>1.74</td>
</tr>
<tr>
<td>FSB-B</td>
<td>6.95</td>
<td>2.51</td>
<td>4.44</td>
<td>1.32</td>
<td>3.12</td>
<td>2.36</td>
</tr>
</tbody>
</table>

The images given below explain output of all the step of the algorithm. Figure 4 is the image need to be enhanced. Figure 5 and 6 are the reference images which are extracted first before the fusion process. Figure 7 gives the extracted foreground which is the night time traffic needed as such. Figure 8 is the enhanced background without the change. And last but not the least is the final fused image shown in figure 9.

Fig. 3: Flow chart of fusion process
VI. CONCLUSION

The technique explained above called Frame Subtraction Based Fusion (FSB) is giving highly reliable results on video also. This technique is also cost effective and simple to implement and requiring less memory as compared to other techniques.

VII. FUTURE SCOPE

The investigation into the field of image fusion presented in this work was thorough, however, it was not exhaustive and some natural extensions to the research presented in it are recommended in this section.

The adaptive thresholding of the image according to the illumination can be included. Further this algorithm may be collaborated with the Intelligent Transport System (ITS) which represents a major initiative to improve current roadway and travel conditions through the use of advanced techniques such as GPS, cellular communication, and automated vehicles without having to construct new roads.

Also, construction of hardware platforms for real time image fusion implementation, where fusion algorithms can be tested in real life conditions, is highly recommended.
REFERENCES


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AUTHOR PROFILE

Jaspreet Kaur:

B.Tech: From LLRIET, Moga
(Affiliated to Punjabi Technical University, Jalandhar)

M.Tech: From SLIET, Longowal

Publications:


