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Design and Implementation of Exemplar Based Video Inpainting

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ABSTRACT

Video Inpainting is a vital video improvement technique used to repair or editing of digital videos. Video Inpainting is used to remove unwanted object and texture is reconstructed in the entire video while maintaining Consistent flow of video. The proposed method involves the step preprocessing, motion inpainting and exemplar based inpainting.The step of preprocessing involves segmenting each frame of a video into foreground and background, detecting the foreground objects and then tracking those detected objects. The motion inpainting step will fill the holes created by the occluding object by copying information from object templates generated in preprocessing step. The last step of exemplar based inpaining will fill the remaining holes. The main aim of this research is to look for improving accuracy of inter frame transition and Time efficient.

Keywords

Occlusion, Exempler, kalman filter,

1. INTRODUCTION

Videos are an electronic medium for the broadcasting, recording and display of moving objects. Videos are combining the sequence of images. In spite of this, most of the video editing is done manually at the expense of a large amount of time and money. So the main problem of researchers is that automatic unwanted or undesired object removal, automatic restoration of movies and video editing. At a glance, human can easily determine the subject of interest in a video, even though that subject is presented in an unknown or cluttered background or even has never been seen before. With the complex cognitive capabilities exhibited by human brains, this process can be interpreted as simultaneous extraction of both foreground and background information from a video. Many researchers have been working toward closing the gap between human and computer vision. However, without any prior knowledge on the subject of interest or training data, it is still very challenging for computer vision algorithms to automatically extract the foreground object of interest in a video.

Video inpainting or completion is a vital video improvement technique used to repair or editing of digital videos. In Existing Video inpainting method use the Background subtraction method for object detection from background model. There are different techniques for object detecting and tracking technique kalman filter, mean shift, adaptive mean shift method etc. The kalman filter is the best technique for object detecting and tracking so we have used this technique. Background filling is also replaced with exemplar based method. As increasing need of video inpainting one of the best method is to use exemplar based that gives better result on various video inpainting. Hence these works focus on improving time and maintaining the accuracy for video inpainting.

Video inpainting is one of the very challenging problems in computer vision. This approach may be used for removing an undesired object from an input video. There are many existing techniques like PDE based technique, texture synthesis technique, semi automatic technique, Hybrid technique, object based technique and all this technique has own advantages and disadvantages.

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Weakness of Existing System

Only works with static background.

- Inter frame transitions do not appear smooth.
- The Connected component method is not accurate when noise is present in the video frame.

Strength of Proposed System

- Improve accuracy of inter frame transitions.
- Improve Time.

The Existing method use the connected component method for object tracking and background filling algorithm for inpainting the background. But in connected component method doesn't give the accurate result when noise present in input video. So in proposed method use the kalman filter for object tracking and Exemplar based inpainting method is better than background filling algorithm because exemplar based method is inpaint the large region when large region is missing in input video. In proposed method improve the time and accuracy. In proposed method takes different patch size and compare the result. And also handle the partially occluded object and fully occluded object.

2. OVERVIEW OF VIDEO INPAINTING

Video inpainting is field of digital image processing that the main aims to restore missing regions in a video sequence or remove undesired object from input video. Video inpainting have many challenges like occlusion detection, moving object inpainting, dynamic background lighting variation, different background in the video. The main purpose of video inpainting is to generate an inpainted region. The main application of video inpainting is in video restoration because whenever the video is transmitted through the unreliable network some important information missing or some frame damaged so if we want to see the video again, it is necessary to reconstruct the video again. Second is that unwanted object removal because some dynamic or static object may not want in the video. Third is video modification because change behavior of an object or extend the behavior of objects in the video. It is used in video error concealment, removing logos, video stabilization.

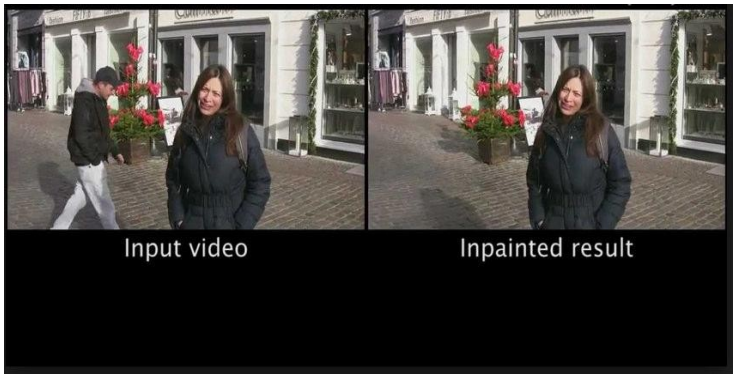

Fig. 1.1 Input video and Inpainted video

The difference between video inpainting and image inpainting: In video inpainting is more complex than image inpainting because in video inpainting inpaint the large number of pixels rather than image inpainting. In video inpainting areas many researchers worked and all are try to maintain the spatial and temporal continuity between frames.None of the researchers trying to maintain spatial and temporal continuity with a good quality. Image inpainting is not directly extended from image inpainting to video inpainting. In video inpainting handle the static, dynamic object' occluding object and occluded object whereas image inpainting handle only static object. Video inpainting takes long time compare to image inpainting.

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3. PROPOSED METHOD

The flow of proposed work involves the step is that first input video is passed from foreground extraction or background subtraction step, then the output of the previous step is set of foreground object or blobs then detect the foreground object then track the object each and every frame. After tracking specified the target object which is to be removed and user manually select the target region which is to be removed. After that occlusion is present in video frame then apply the runtime object inpainting and if occlusion is not present in video frame then apply the exemplar based inpainting. And finally combine the output of the previous two steps and display output as a video.

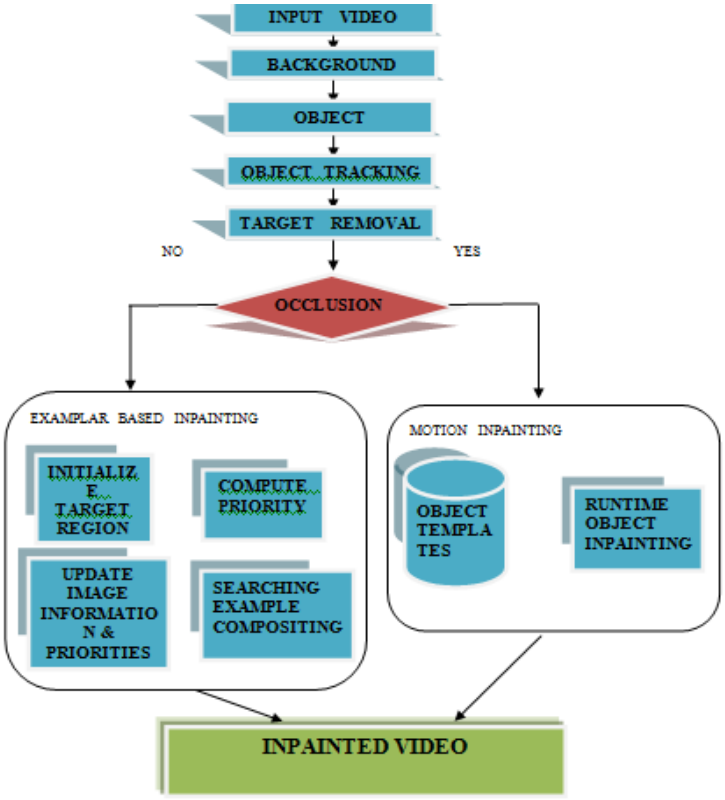

Figure- 2.2 Flow chart of Proposed method

Figure-2.2 shows the flow of the proposed method. In proposed method give input as a mask region, which is removed. Then moving object segmentation is performed for two purposes first is that segmentation of foreground object or blobs into small or constituent objects and then link object frame by frame. Segmented object stored in a database which is used during inpainting occluded object.

2.2.1 Background Subtraction Module

In this module foreground and background segmented. Using gaussion mixture model background subtraction preformed. Gaussion mixture model work well when background variation is present and if large illumination change. Gaussion mixture model defines the observing probability of current pixel value.

2.2.2 Object detection and tracking

After a background subtraction module detects the object then, track the object frame by frame. Kalman filter is used to track the object frame by frame. Kalman filter basically contains the two step first is time update and second is measurement update.

1. Time Update equation
2. Measurement Update equation

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The time update step is known as a predictor and measurement step is also known as a corrector. Predictor step predicts the future step based on current observation. And corrector step correct the current step and it is also responsible for the feedback loop. Kalman filter predict the past, present and future step.

2.2.3 Target Removal

Target Removal is specified by the user which is to be removed from the video after target removal fill the hole region using exemplar based inpainting and runtime object inpainting exemplar based method is used to inpaint the background and runtime object inpainting is used to inpaint the foreground object.

2.2.4 Exemplar based Inpainting

The Exemplar method can essentially replicate both texture and structure. However, the success of the method depends highly on the order in which the filling proceeds. The procedure involves selecting a target region to be filled. The size of the template window is specified as a 9x9 pixel window. After the target region and window size have been decided on, we calculate the confidence term and the data term. Each pixel, in the algorithm, has a specific color value, and a confidence value that represents the confidence in the color value. Furthermore, patches along the fill front have a priority value which establishes the order in which the patches are filled. The general structure of the algorithm is as follows –

A representation of the process is explained as:

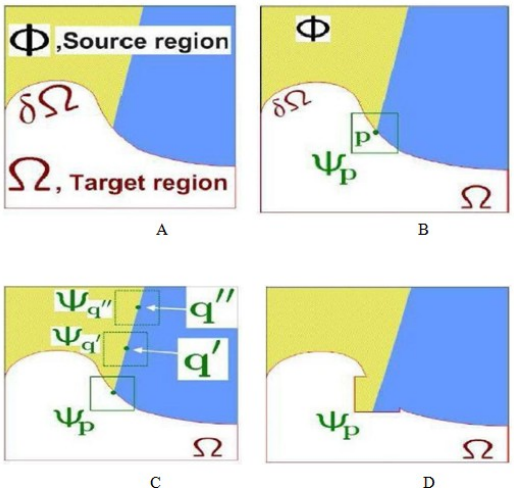

Fig. 2.1 Target removal and region filling

Figure 2.1 shows structure propagation by exemplar-based texture synthesis (a) Original image, with the target region Ω, its contour δΩ, and the source region Φ clearly marked. (b) We want to synthesize the area defined by the patch Ψp centred on the point pЄδΩ. (c) The most likely candidate matches for Ψp lie along the boundary between the two textures in the source region, e.g., Ψq´ and Ψq´´ (d) The best matching patch in the candidates set has been copied into the position occupied by Ψp.

3. IMPLEMENTATION OF BOTH METHODS

The implementation of video painting is done in MATLAB with the help of image processing toolbox and GUI of the input video frames for the existing occlusion based and proposed exempler based method.

The screenshot is shown in Figure 3.1.1 jumping girl input video database and Fig. 3.1.2 jumping girl occlusion or mask. Those objects which we want to remove from input video for that we have given input as mask. From input video database removed the static object. And output of these video as shown below in sub sequent figure 3.1.3 to figure 3.1.10 for different video frames.

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The above screenshot shows that inpainting of moving object and the jumping girl database give better result than beach umbrella database because in jumping girl database background is static and in beach umbrella background is moving. The proposed method work well for single moving object. The proposed method takes less time to run.

Existing Result With Standard Method

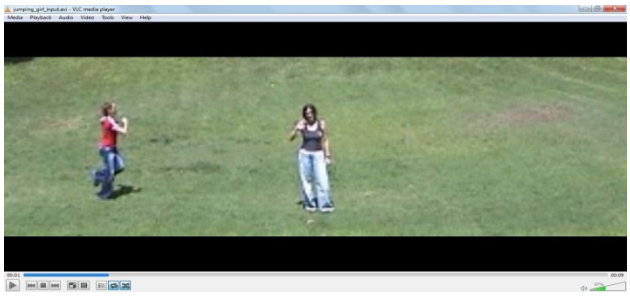

Fig 3.1.1 Jumping girl Input video Database

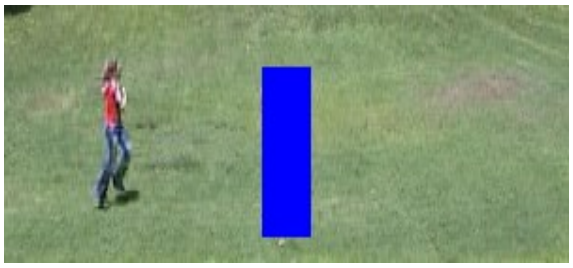

Fig 3.1.2 Jumping girl occlusion or mask

Inpainting of Static Object With Standard Data Based

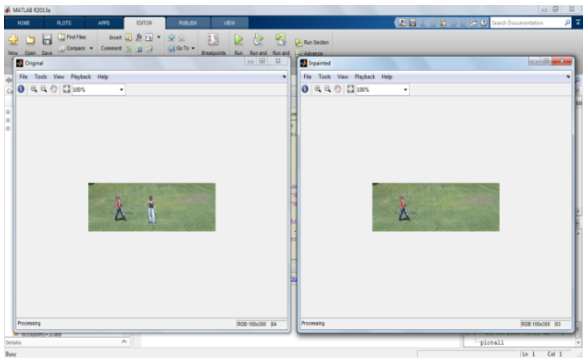

Fig 3.1.3 Frame 54 to 63

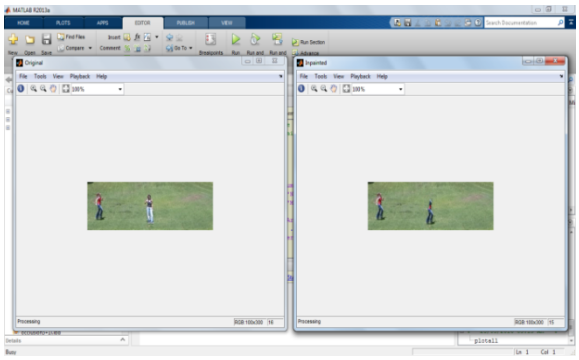

Fig 3.1.4 Frame 68 to 75

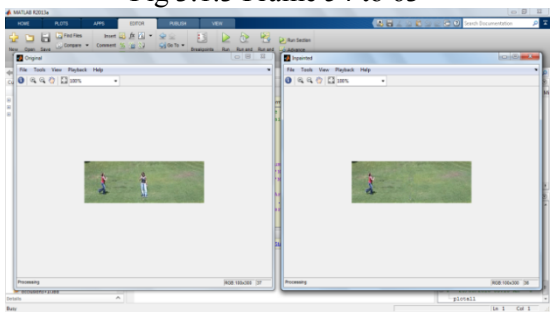

Fig 3.1.5 Frame 93 to 97

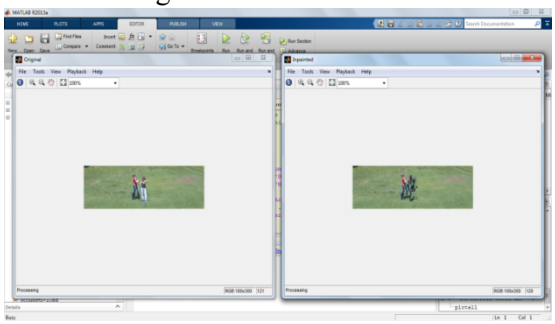

Fig 3.1.6 Frame 121 to 128

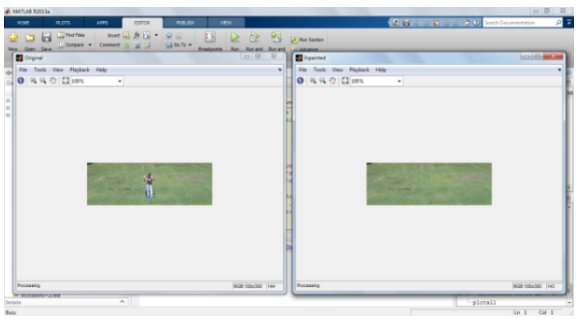

Fig 3.1.7 Frame 144 to 145

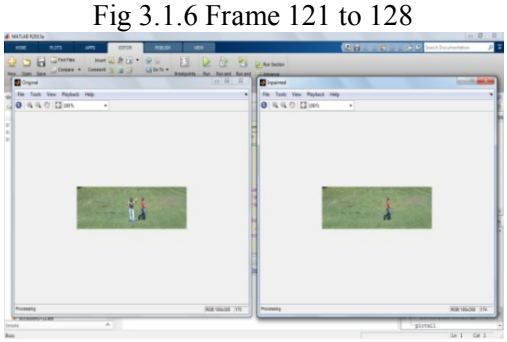

Fig. 3.1.8 Frame 173 to 175

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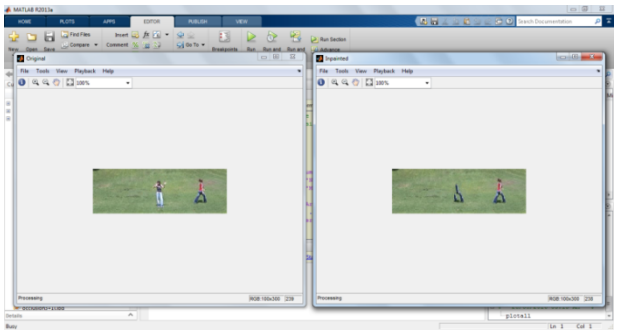

Fig 3.1.9 Frame 229 to 238

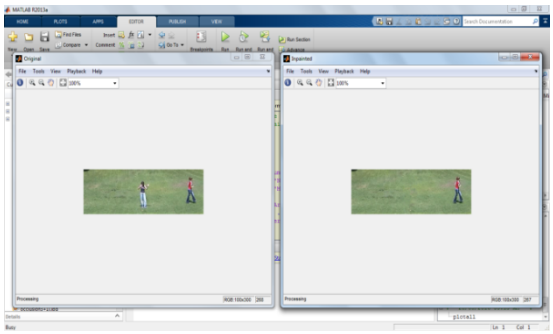

Fig.3.1.10 Frame 258 to 268

The figure 3.2.1 to figure 3.2.9 shows the proposed exempler based method for video inpainting on input database video "c.mp4". Her we get better result for static object.

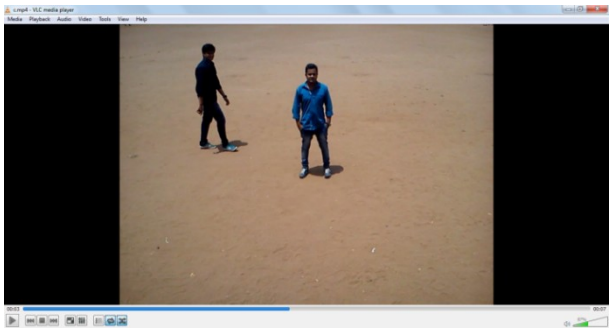

Fig 3.2.1 Input video Database

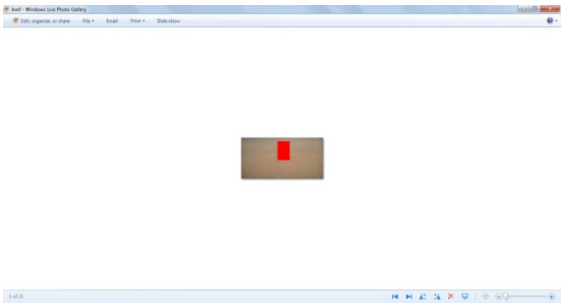

Fig.3.2.2 Occlusion or mask

Inpainting of Static Object with Exemplar Based Method

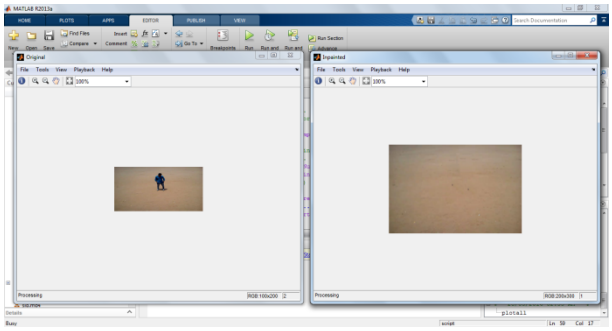

Fig 3.2.3 Frame 2 to 5

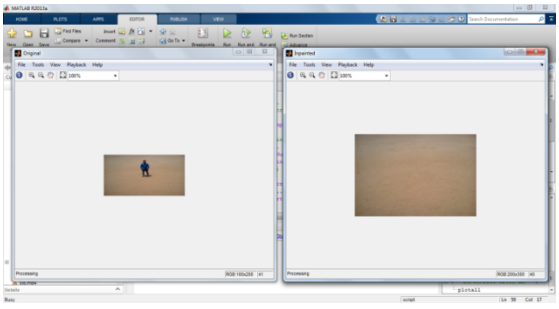

Fig 3.2.4 Frame 41 to 48

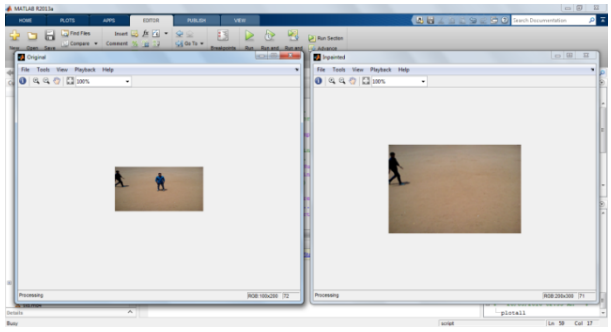

Fig 3.2.5 Frame 70 to 73

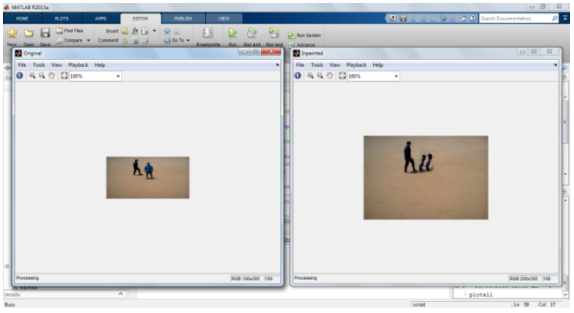

Fig 3.2.6 Frame 105 to 109

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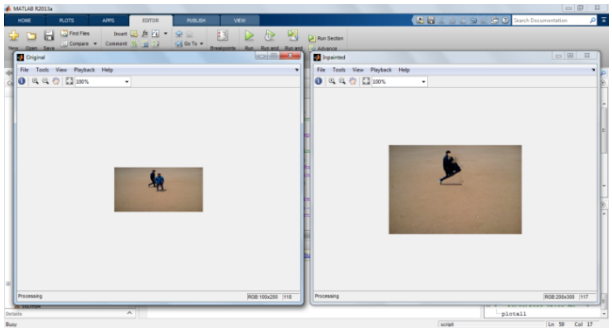

Fig 3.2.7 Frame 114 to 117

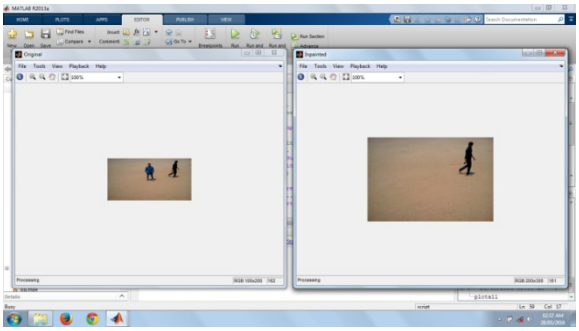

Fig 3.2.8 Frame 142 to 143

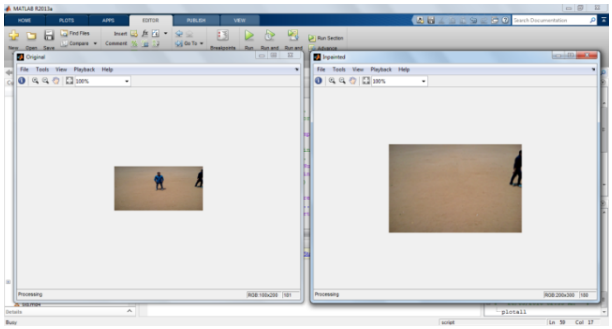

Fig 3.2.9 Frame 183 to 187

4. RESULT DISCUSSION

The proposed exempler based method is compared with standard occlusion method based on time required for the video frames inpainting process. Table-1. Shows the total time required for two videos using standard and our proposed method for different mask windows.

Table 1. Time Analysis of existing and proposed method

Algorithm	Video Name	Inpainting W=3X3	Inpainting w=5X5	Inpainting w=7X7
Standard	Jumping Girl.mp4	162sec	485 sec	374 sec
Proposed	C.mp4	80 sec	121 sec	97 sec

5. CONCLUSION

This work was started by studying many research papers on this topic. On the basis of literature survey done on various methods of video inpainting, the proposed method is being implemented and inpainting concept is incorporated and results are found to be improved. The specified standard database is used for the experiments. The proposed method is compared with existing approximate nearest neighbor method. In proposed method time taken is less compare to existing standard method.

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