# HOMOGENEOUS REGION SEGMENTED USING THE MEAN-SHIFT ALGORITHM FOR VIDEO INPAINTING

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**Abstract** -*Although tremendous advancement happen in image processing domain, still "filling the missing areas" is area of concern in it. Though lot of progress has been made in the past years, still lot of work should have to be done.* *To overcome this limitation this paper presents a method of video inpainting frame registration method. MRF based proposed method provide better inpainting quality registration and segmentation method which provide very accurate and reasonable inpainting results*.*To limit the computational time a frame is inpainted by considering a small number of neighboring pictures which are grouped into a group of pictures GoP This drastically reduces the algorithm complexity and makes the approach well suited for near real-time video editing applications as well as for loss concealment applications Experiments with several challenging video sequences show that the proposed method provides visually pleasing results for object removal error concealment and background reconstruction context This energy function is efficient enough to provide high quality results even when the number of pictures in the GoP is rather small Then from the stack of aligned frames an energy function based on both spatial and temporal coherency terms is globally minimized This is achieved by a region-based homography computation method which allows us to strengthen the spatial consistency of aligned frames More specifically to inpaint a frame the method starts by aligning all the frames of the GoP propose a new video inpainting method which applies to both static or free-moving camera videos The method can be used for object removal error concealment and background reconstruction applications.*

***Key Words:*** *Inpainting, registration, homography, etc…*

## 1. INTRODUCTION

**V**IDEO inpainting refers to methods consisting in filling in missing areas in video sequences. The missing areas can be the result of the removal of one or more undesired objects in the scene [1]–[3]. The major issue of video inpainting methods is to fill in the missing part, also called hole. Two widely used alignment approaches are described in the literature, namely the dense and sparse motion-based alignment [6], [7], [10]–[14].

The dense approaches estimate the 2D or 3D motion vectors of each pixel or block in the video in order to infer the camera motion. The 2D methods compute the motion vectors between consecutive frames in the video [6], [7]. The 3D methods estimate the global camera motion by using all frames in the video. This generally provides more accurate results [10] butat the expense of a higher computational cost.Sparse-based methods yield a fast and robust alignment using the correspondence between sparse sets of key points in the frames. These algorithms use the homography transformation which relates the pixel coordinates in the two images. Unfortunately, a single homography transformation is not sufficient to align a pair of images.

### 1.1 Video Inpainting

There exist few video inpainting algorithms. Among them, several methods consists in extending Criminisi et al.'s algorithm [17] to video as in [6]–[8]. They introduce a similarity measure between motion vectors for seeking the best candidate patch to be copied. In 2007, Wexler *et al.* [9] presented an innovative method consisting in filling in the missing regions with the pixel values that ensure the highest spatio-temporal consistency between all overlapping patches. As in image inpainting, a better global coherence, but this time, both in the temporal and spatial dimensions, is obtained by using an MRF-based global optimization. Unfortunately, due to the high-dimensionality of the problem, Wexler et al.'s algorithm is very slow; this makes this algorithm unsuitable for long video sequences and for video sequences having a resolution greater than CIF resolution (320 × 240).
Newson *et al.* [10] significantly improved Wexler's method by extending the PatchMatch algorithm [2] to the spatio-temporal domain. The spatio-temporal PatchMatch computes, in an efficient manner, an approximate nearest neighbors (ANN).

### 1.2 *Registration for Video Inpainting*

There exists a large number of registration methods also called alignment or stitching methods. A review of these methods can be found in [30]. Image registration methods can be roughly classified into two main categories: 2D motion-based methods and methods using homography transformations.

## 2. PROPOSED APPROACH

The proposed approach performs the inpainting of the input video sequence using a sliding temporal group of frames. As illustrated in figure 1, each frame is inpainted using two main steps: registration (step 1) and hole filling (step 2, 3 and 4). For each target frame *It* : R2 → R3 with a hole _*t* ⊂ R2, we align its neighboring frames. Each pixel in _*t* is inpainted using the most similar collocated pixel value in the aligned neighboring frames. Once the target frame has been inpainted, the target frame is replaced in the GoP by the inpainted one. As in [13], two input binary mask are required to indicate the areas we want to remove and the foreground areas.

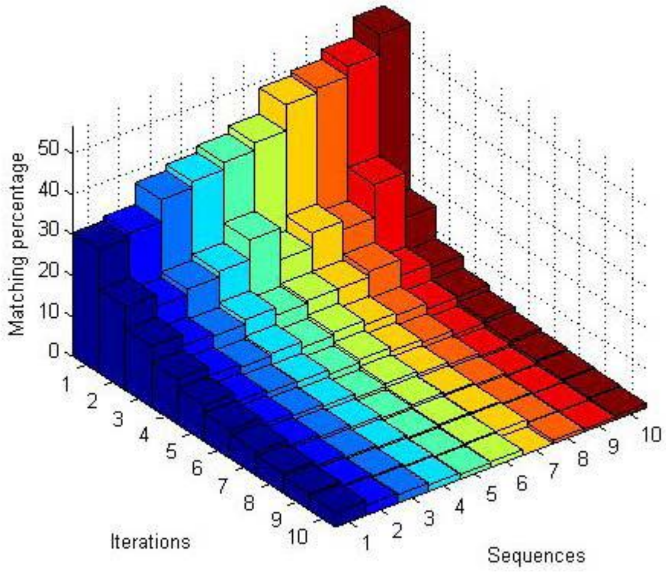


**Fig -1** Percentage of matched features for 10 video sequences in function of the number of iterations *i.*

The proposed method aims at being well suited for various viewpoint changes and motion characteristics, while being fast enough to be reasonably considered as a preprocessing step in video editing algorithms..

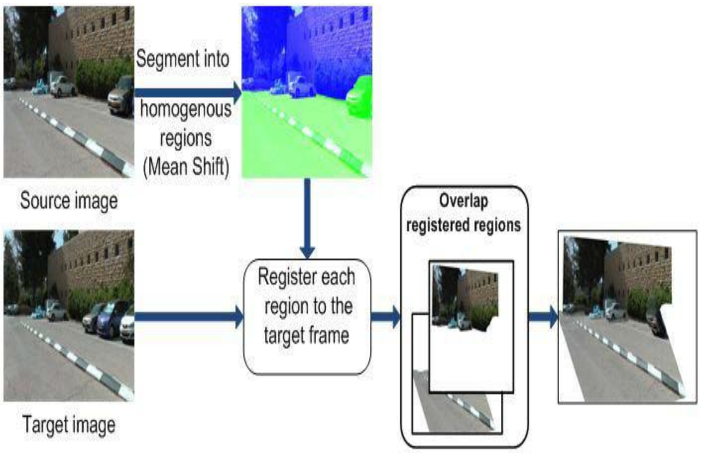


**Fig -2**: Overview of the proposed registration approach.

Once the neighboring frames have been aligned, they form a stack of images from which the inpainting of missing areas is performed. To get spatio-temporal consistency, missing areas of frame *It* are inpainted by minimizing globally (for all pixels in _*t* ) an energy function that expresses this consistency. In other words, each pixel *p* in the hole _*t* ∈ *It* is inpainted using the best collocated pixel value in the 2*M* registered frames ˜ *Ii* , *i* = 1 · · · 2*M*. There are *M* past and future neighboring frames. We draw the reader's attention to the fact that the *M* past neighboring frames have already been inpainted.

Poisson image blending is a popular tool for seamless image cloning . In our approach, we apply the Poisson blending to the inpainted result.

## 3. CONCLUSIONS

Propose a novel video inpainting method. In a first step, neighboring frames are registered with a region-based homography. Each plane in the scene is assimilated to a homogeneous region segmented using the mean-shift algorithm. Inpainting is then performed using a predefined energy cost which is globally minimized. A spatial inpainting is used to guide this minimization leading to improve the quality of the inpainted areas. The proposed approach has a reduced complexity compared to existing methods. Missing areas are filled in by considering a sliding window of 20 frames. Unlike Granados et al.'s method , in which three optimization steps are involved (homography computation, inpainting and illumination handling), our approach uses only two global optimization methods and uses as mentioned previously a reduced number of frames. Experiments show that the proposed approach provides high quality inpainting results.

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