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# An Approach for Noise Removal from a Sequence of Video

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**Abstract**—In this paper, various noise removals are compared with rectangular area matching technique. Thresholding is used for estimating these noisy sequences of frame. Noise is a prominent factor that reduces video quality. The various steps for video noise removal are thresholding, filtering and aggregation. All these steps are explained below. The quality of the video is very good, compared to the other paper which is mentioned in literature survey and peak to signal to noise ratio is evaluated.

**Index Terms**— Thresholding, aggregation, Noise frame, PSNR, Noise removal, denoising, Grouping

## 1 Introduction

AN image (from Latin: imago) is an artifact that depicts or records visual perception, for example a two-dimensional picture, that has a similar appearance to some subject – usually a physical object or a person, thus providing a depiction of it.Visual multimedia source that combines sequence of images(frames) to form a moving picture is a video. The video transmits the signal to a screen and processes the order in which the screen captures should be shown. This Video sequences are frequently corrupted by unwanted signals, referred as noise, during transmission or acquisition.

Noise is a prominent factor that reduces video quality. Noise might be added on to a video during acquisition due to bad lighting or sources present in the camera or even during the transmission.Various types of noise can be distinguished, depending on the origin. Noise may be generated by while broadcasting. Table 1 [6-12] show the noise and origin of noise in video signals.

The need for efficient and effective video processing methods has grown with the massive production of digital videos, often taken in poor conditions. No matter how good cameras are, an image improvement is always desirable to extend their range of action.Video Denoising is a video restoration problem in which it attempts to recover video from a degraded video. Various denoising techniques make various assumptions, depending on the type as well as goal of video.

TABLE 1. Noise and Origin of noise

| Origin | Interference type |
| --- | --- |
| Sampling<br>Camera(CCD), film grain | White noise |
| Recording<br>Video tape noise<br>Film damage | White noise<br>Impulsive noise |
| Analogous transmission<br>Channel<br>Satellite | White noise<br>Pattern noise |
| Digital coding(MPEG)<br>Blocking | White noise |
| Digital transmission<br>Faulty bits | Gaussian noise |

In this paper we discuss a block matching 3D algorithm in transform domain for color video denoising. For each image block in each channel, a 3D array is formed by stacking together 2D patches similar to it, a process calledgrouping. The high similarity between grouped blocks in each 3D array

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enables a highly sparserepresentation of the true signal in a 3D transform domain. Thus, a subsequent shrinkage of the transform spectra results in effective noise attenuation. The peculiarity of the proposed method is the application of a grouping constraint.

. The results demonstrate the effectiveness of the proposed grouping constraint and show that the developed denoising algorithm achieves state-of-the-art performance in terms of both peak signal-to-noise ratio and visual quality. Video denosing techniques are extensively used in medical imaging, traffic management and TV broadcasting[13].

## 2 LITERATURE SURVEY

In 2011 [1] proposed denoising scheme based on minimum mean square error (MMSE) filter in the 2D transform domain. A given input noisy frame is processed in terms of blocks and per block two notations are made by using Motion Estimation technique which are current noisy data and multiple prediction blocks within the previously denoised frames and next upcoming noisy frames which comprise a 2D representation array.

Later on,2D transformation of each block within the representational array is done and then prediction of each transformed coefficient of the present block is made by carrying out the weighted average of the coefficients for all transformed blocks that are having similar frequency.

In 2011 [2] Focus has been mainly upon the Spatial based video denoising via wavelet transformation.There are two techniques proposed for spatially denoising of video,they are Integer Wavelet and 2D Discrete Wavelet transform. The first one has high time complexity however gives the most optimum output whereas the second one has less time complexity but with a compromised output. So a balance between the quality and the time of processing has been proposed here.

In 2012 [3] A video denoising approach via decomposition of completed matrix has been suggested here. The noisy video is processed block by block and similar to each processed block is looked for into the other frames too. After that all those similar blocks obtained are placed together and unwanted pixels are removed via fast completiontechnique.

In 2012 [4] Here video denoising based via encoder integration has been suggested. In this, motion estimation is avoided to reduce the time complexity by incorporating the filtering process within the encoding processing. New filters for video encoders are introduced to overcome the limitations of the LMMSE

In 2013 [5] Video denoising based on improved matrix recovery strategy was proposed here. The observations based upon the properties of video and noise are exploited and it has been shown clearly that the usual methods are no longer worthy once impulse and Gaussian noises get induced into the video signal. Impulse noise is considered as sparse matrix within image domain and is removed significantly via matrix recovery whereas the Gaussian noise corrupted video signal is taken as sparse within the 3D total variation domain and a suitable algorithm to filter the noise has been suggested. From the above all, the current technique is giving good quality noise removed frame of video.

## 3 ARCHITECTURE AND WORKING

## 4

The algorithm is defined in two different steps (fig.1.1):

1. The first step, using thresholding, estimates denoised image.
2. The second step uses both the original noisy image and the basic estimate that is obtained in the step1. It uses different filtering.

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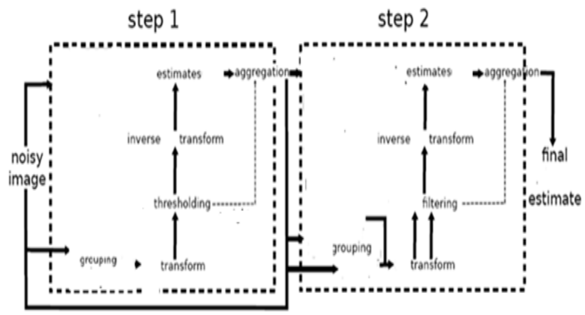


Fig.1.1 Architecture for video denoising

## 3.1 The first denoising step

The current reference patch is denoted by p whose dimension is k x k

#### 3.1.1Grouping

The first substep, where the 2D image patches, q, similar to the current reference patch p are searched in an n1 x n2, p centered neighborhood. Set of similar image patches are obtained by calculating the quadratic distance, which should be less than a threshold value, between the p and q.These similar patches are then stacked together to form a D rectangular area. To speed up the process only N patches that are closest to the reference patch are stacked. The patches are stacked by sorting on the distance from the reference patch, hence the first patch will be p itself since distance p from p is zero. To get the sequence of frame using grouping in matlab uses:

imgArray=cat(3,image1,image2,image3,...).

#### 3.1.2 Collaborative Filtering

A D isometric linear transform is applied to each group obtained after the 'grouping' process. The transformation is followed by a shrinking of the transform spectrum in eqn(1).

$D(P,Q) = \Sigma n1=0N-1\Sigma n2=0\ n-1g(n1,n2)f(n1,n2,p,q)$ …..(1)

Finally to estimate for each patch, inverse linear transform is applied in eqn.(2).

$D-1(P,Q) = \Sigma p=0N-1\Sigma q=0\ n-1D(P,Q)i(n1,n2,p,q)$ ……(2)

#### 3.1.3 Aggregation

Once the collaborative filtering is done, we get an estimate for each used patch and then avariable number of estimates for every pixel. These estimates are saved in two different buffers, as numerator and denominator. The basic estimate after this step is obtained by simply dividing the buffers (numerator and denominator) element by element.

## 3.2 The second denoising step

This is the second part of the algorithm. It uses original noisy image and the basic estimate obtained in the first step. This step follows the procedure as in the first step, except for the difference that it uses a filtering instead of thresholding.

#### 3.2.1Grouping

Two sets of D groups are formed, one by stacking similar patches from noisy image and one by stacking similar patches from the basic estimate.

#### 3.2.2 Collaborative Filtering

Once grouping is done, collaborative filtering can be started. Here, Wiener filtering is applied instead of hard thresholding. It is an element by element multiplication of transform of noisy image and wiener coefficients. It produces an estimate of the group.

#### 3.2.3 Aggregation:

A similar kind of aggregation is performed by dividing the buffers (to estimate for each pixel) which gives the final estimation.

# 4 EXPERIMENTAL RESULTS

The experimental result shows that the applied technique is very good compared to the existing technique and the PSNR ratio is shown in table II. The PSNR ratio shows the quality of the video. The builting noise is removed from this video fig.3.1 and fig.3..3are given sigma as 40 and the corresponding output video's are in fig.3.2,fig.3.4 and the PSNR ratio's are 28.93, 25.51 and 24.98.

It is observed that as assumed sigma value is higher, PSNR decreases. When less amount of noise is present in the video, a small sigma is assumed to get fewer artifacts.

Fig.3.2. Input video frame College

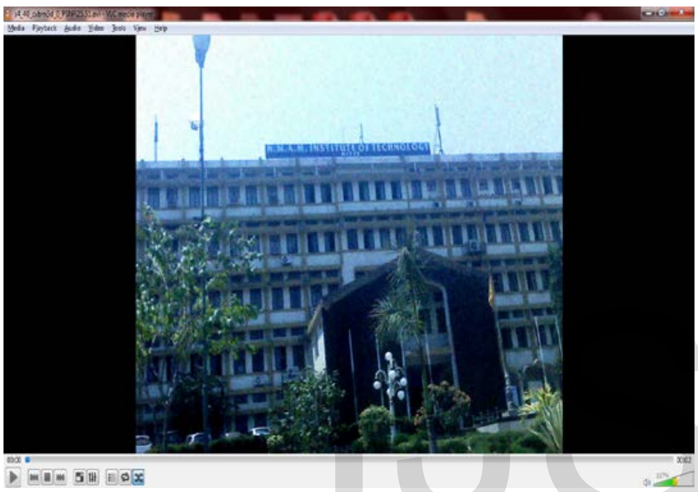

Fig.3.2. Output video frame with sigma = 40 and PSNR = 25.51

Fig.3.3. Input video frame:Basketball

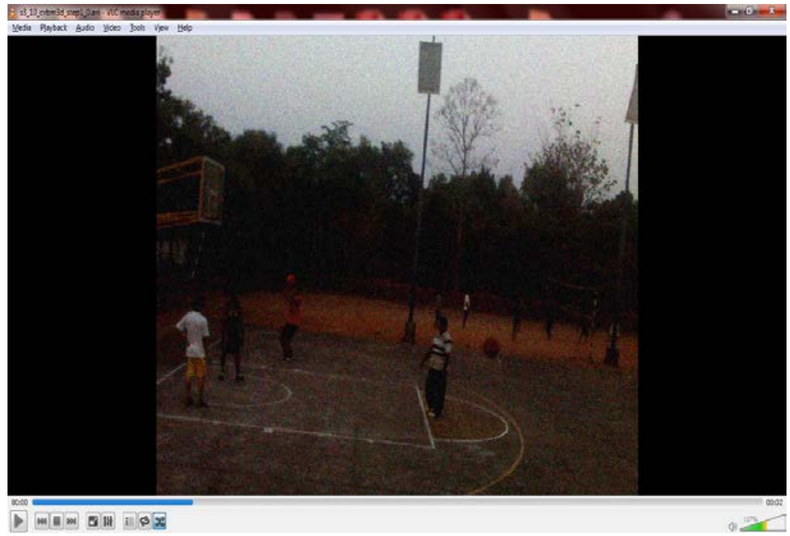

Fig.3.4. Output video frame with sigma = 40 and PSNR = 24.98

Table II: PSNR value for the laboratory video

| Sigma | 5 | 10 | 20 | 30 | 40 | 50 |
|---|---|---|---|---|---|---|
| PSNR | 40.313 | 36.07 | 33.4 | 32.09 | 30.81 | 29.55 |



## 5 CONCLUSIONS

A detailed study on Block Matching 3Dimensional algorithm is carried out and led us to the following conclusions.The algorithm produce state of art performance, on almost all conditions. The filtering improves the quality and regains the lost details in the first step.

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