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A Review on Video Noise Reduction Techniques

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ABSTRACT: Objective of this paper is to make a review of the work done in the space of video denoising. To get a clear idea on techniques developed for the process of video denoising and the exploration going on. The applications that make use of video denoising techniques are spread over a wide spectrum. For instance, the process involved in object detection, traffic management, digital entertainment, medical imaging, remote sensing imaging, and many more. The explained algorithm is combination of algorithms such as patch based algorithm, PCA reconstruction and denoising process.

KEYWORDS: PCA, optical flow estimation, patch processing, non-local means, motion compensation

I. INTRODUCTION

Rebuilding of noiseless signal from a noisy one is noise reduction or denoising. Objective here is to reserve the advantageous information by removing noise. Noise denoising in image can be performed through the frame individually and also between the frames. Different denoising methods make different presuppositions, aiming to suppress noise from noise contaminated image. Classic noise types are digital and analog. Digital type includes block slices, blocking and ringing. Analog noise includes radio channel artifacts, film artifacts, VHS artifacts. Base paper takes and advantage of motion detection in Real time video streaming using continuously moving frame background. Preliminary footstep for video denoising is taken as moving object detection, background removal and additionally objects tracking.

Various statistical distributions are found with major contributing sources of noise, such as quantization noise, dark current noise, Gaussian noise. This technique employs separation of moving articles from immobile foundation objects. This concentrates on higher level processing and shrinkages calculation time. Major portion of video denoising technique depends up on a single noise such as Gaussian or circumstantial noise. The most widely acknowledged way to deal with taking care of impairments in the optical stream literature is to define them as regions where forward and backwards motion estimates are varying. Most approaches return estimates of motion in the obstructed regions, where they cannot be cancelled. As we have effectively brought up, in an occluded region one can't decide a movement field that maps one picture onto another, because the scene is not visible. Some methodologies, while additionally misusing motion symmetry, discount occlusions by weighting the data fidelity with a monotonically decreasing function. The resulting problem is non-convex, and in this manner the proposed rotating minimization procedures can be prone to local minima. A substitute approach is to define joint movement estimation and occlusion detection in a discrete setting, where it is NPhard. Many approximate and near point solutions using combinatorial optimization technique require fine quantization and thus suffer through a wide number of labels which results in loose approximation bounds. Another class of techniques uses the motion estimation residual for classifying a location as occluded or visible either with a direct threshold on the residual or with a more elaborate probabilistic model.

II. OBJECTIVES

1. Capture fine details in image/video
2. Enhance video quality by removing contaminated signal

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III. LITERATURE SUREVY

In literature survey, the beforehand developed techniques for video denoising are discussed with their advantages and shortcomings.
lmed Ben Dhaou et al [1] had presented the paper, DVC decompression with denoising for picture quality improvement", in which they explained how the digital video cassette for real time video recording applications. Also it is described that how noise can be decreased by digital post-filtering using the approach of wavelet denoising. The basic version of wavelet denoising is implemented and applied to the DVC, so as to get much higher quality of video. The disadvantage of this approach is that at low-light conditions, the picture quality is degraded even if the denoising algorithm is applied.

Daniel Pak-Kong Lun et al [2] had presented a paper on, 'Image Denoising wavelet transform modulus sum'. The research explained the WTMM approach that is wavelet transform modulus maxima to decrease blocking effect of decoded image sequence. SN ratio is increased with this approach and ultimately increased in the quality of image.
Rakesh Dugad et al [3] had presented a paper as 'Video Denoising by Combining Kalman and Wiener Estimates', in which a computationally quick fast scheme for video denoising is presented. spatial redundancy and adaptive edge-preserving Wiener filter are combined using averaging to get denoised frame. IPSNR that is improvement in PSNR compared to the PSNR of corresponding noisy frame gets us a comparison for deriving the increment in denoising.

J. Abbas et al [4] had presented the paper, 'median-based filters with predication error processing for video restoration', in which median based filters are used for denoising of video color sequences. Implementation uses the concept of prediction of pixel value using non-liner filter and then its comparison with corrupted input image. Achievement is to check the improvements respectively in efficiency of video sequence denoising for both twodimensional and three-dimensional filters for motion compensation. As per the results error prediction processing leads to better results than the classic median-based filters. Computational cost is very less.

Peter Rieder et al [5] had presented a paper on, 'New Concepts on denoising and sharpening of video signals'. Concepts in this paper leads to sharpening of images with separating noise from the video. LTI that is Luminance Transition Improvement, Contrast adaptive peaking and CTI that is Chrominance Transition Improvement algorithms are developed in the mentioned approach. The algorithms used can be efficiently and practically realized in hardware. Sharpness and optimum quality are the key aspects for achievements.

Y. H Lohl, et al [6] had presented a paper on, 'Multi-processor denoising of weak video signals in strong noise'. Approach is based on the algorithms, Least square estimation and best Linear unbiased estimation. Practical processing was achieved using DSPs and videos with low SNR values. Practically more efficient multiprocessing algorithms and techniques are used to denoise noisier videos. Technique is efficient for the signal system when the system has weak video signal.

Aleksandra Pizurica et al [7] had presented a paper on 'Combined Wavelet Domain and Temporal Video Denoising'. The newly developed filter in the suggested approach gives a combination of temporal filter in signal domain and spatial noise filter in wavelet domain. This combination gives quantitative as well as qualitative performance. The only drawback is combined filter does not allow real time processing.

V Zlokolica, et al [8] had presented a paper on, 'Recursive temporal denoising and motion estimation of video'. Motion estimation algorithm based technique used for video denoising is discussed. One-level decomposition of wavelet is performed where motion estimation and denoising are performed. Technique showed improved performance than state of art techniques in terms of visually and PSNR. Without introduction of visual artifacts, the noise is efficiently removed by motion estimation and motion compensation.

Vladimir Zlokolica et al [9] had presented a paper on 'Wavelet-Domain Video Denoising Based on Reliability Measures'. In the approach adaptive recursive temporal filtering and estimation of motion are combined in a closed loop and this is followed by intra-frame adaptive filter. The reliability per horizontal and vertical orientation is used in proposed scheme, which considers the spatial orientation of image structures and their motion matching values. The proposed approach gives better output in comparison with state of arts methods in terms of PSNR. The next step is to redefine the motion estimation in order to deal with moving block edges and occlusion.

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Liwei Guo et al [10] had presented a paper on 'Temporal Video Denoising Based on Multihypothesis Motion Compensation'. MHMCF, specified as multihypothesis motion compensated filter, (a recursive temporal denoising filter is proposed. MHMCF combines hypotheses by weighted averaging for supressing noise and estimating actual current pixel value. Approach gives better outputs as it is a purely temporal filter, also preserves spatial details by avoiding the spatial blurring and achieves satisfactory visual display.

Yan Chen et al [11] had presented a paper on, 'Simultaneous MAP-Based Video Denoising and RateDistortion Optimized Video Encoding'. MAP that is maximum a posteriori estimate is used for taking into account the noise conditional density model and priori conditional density model. Also selection of parameters (eg. coding decision vector, regularization parameter) suitable for coding are discussed. The assumption taken here is that the noise satisfies the Gaussian distribution and priori conditional density model is measured by bit rate.

Gijesh Varghese et al [12] had presented a paper on 'Video Denoising Based on a Spatiotemporal Gaussian Scale Mixture Model'. Denoising algorithm based on space and time Gaussian scale mix model in wavelet transform domain. In the next step Bayesian least square estimation algorithm is used for recovering the original video signal from noisy video. Results proved that the proposed technique given better results than the state of art approach in terms of PSNR and structural similarity. Proposed Fourier domain NRCC scheme provides reliable motion estimation. Only drawback is computational complexity and the approach is a bit slow. The future scope is to include denoising all present color channels jointly by including color wavelet coefficient neighbors in GSM model.

Yunus Emre et al [13] had presented the paper, 'Human Action Recognition in Videos Using Keypoint Tracking'. Computer vision based approach for recognition of human action is derived. Technique is independent of zoom level, object location, appearance of person, partial occlusion. Trajectories of track key points are utilized for interpretation of human action in video. Video features are extracted. The descriptors of image are used to extract the histogram of clusters of trajectories.

Haomian Zhengl et al [14] had presented a paper on, 'Indexed spatio-temporal appearance models for query-driven video action recognition'. Partition in appearance space and indexing structure are used for appearance complexity in video action recognition. Dynamic appearance modeling methodology is used to localize the subspace to obtain metric for discrimination appearance. Multi-localized models are utilized and similarity between trajectories is calculated. Advantage is fast computation.

Nazim Ashraf et al [15] had presented a paper on, 'Human action recognition in video data using invariant characteristic vectors'. The concept of characteristic invariant vector is introduced. If motion of sets of points differs up to a similarity transformation, then elements of characteristic invariant vector differ up to some scale independent of directions and cameras. That‟s why characteristic vector can be used for reorganization of set of points. Obtaining Homograph, which is consistent with the epi-polar geometry, is discussed.

Borislav Anti´c et al [16] had presented a paper on, 'Less is more: Video Trimming for Action Recognition'. Method suggests a subsequent classifier which can be used for detection and classification of video which corresponds to some action. A sequential algorithm is used which can decrease the number of interfering action subsequences. This method jointly trains the subsequences and label classifier. A Hollywood dataset is used so that temporal localization can be observed with improved performance.

Jeong-Jik Seo et al [17] had presented a paper on, 'Efficient and Effective Human Action Recognition in Video through Motion Boundary Description with a Compact Set of Trajectories'. The method proposed effective human action recognition, with decreased number of redundant trajectories, using trajectory rejection. The only disadvantage of this method is computational complexity.

IV. PROPOSED METHODOLOGY

The proposed paper that is Patch-Based Video Denoising with Optical Flow Estimation‟ suggests video denoising using combination of motion estimation and optical flow estimation. The last but not the least step uses Principal component analysis technique in order to remove the noise and reconstruct the video. Principal component analysis (PCA) is a statistical procedure that uses an orthogonal transformation to convert a set of observations of possibly correlated variables into a set of values of linearly uncorrelated variables called principal components. PCA is mostly

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used as a tool in exploratory data analysis and for making predictive models. We can consider the flow diagram for existing approach as below [18].

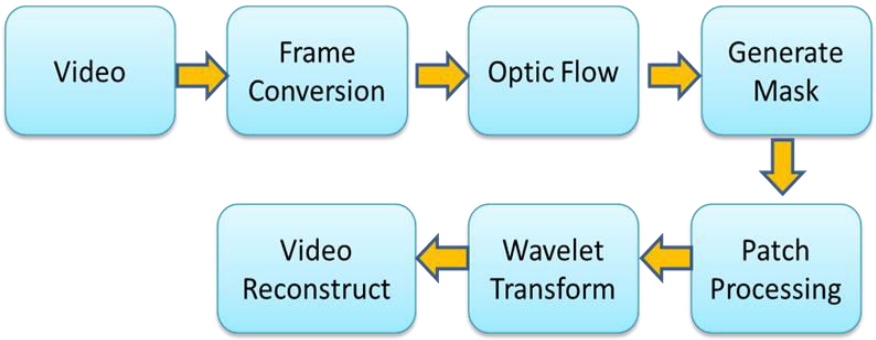

Fig 1: - block diagram of proposed system

V. CONCLUSIONS

The proposed methodology has offered a new approach for denoising algorithm combining motion estimation and patch based denoising algorithms. These methods decay the original data in a predefined basis and cancel coefficients under a certain threshold related to noise statistics. Motion reparation authorizations the use of spatiotemporal patches for a more robust comparison while the use of PCA for patch denoising reserves texture and details. The comparison with state-of-the-art algorithms illustrates the gain on performance of the proposed approach. The novel denoising algorithm enhanced the smoothness and detail reconstruction.

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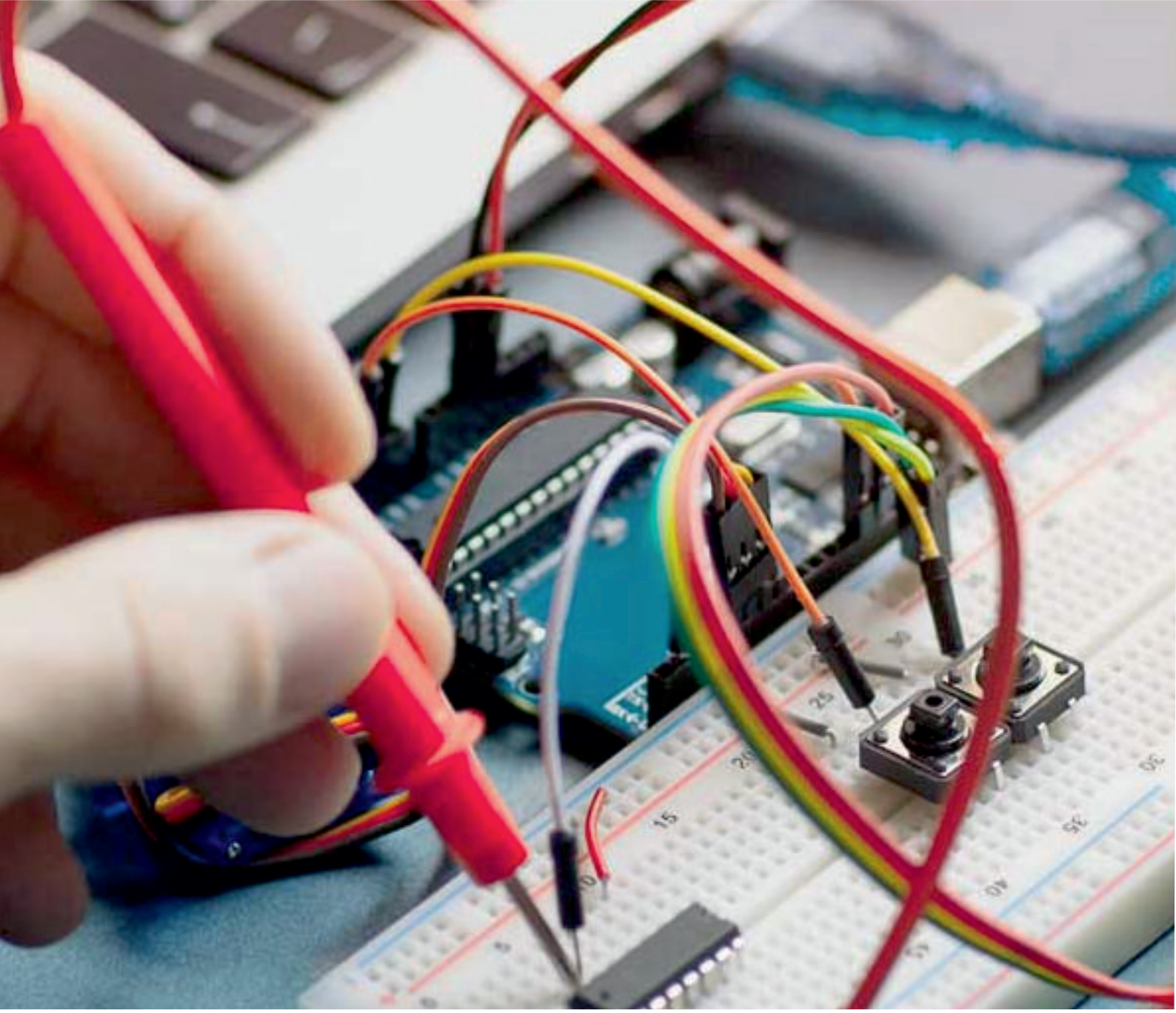

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