A SURVEY ON "VIDEO DENOISING AND ENHANCEMENT USING OPTICAL FLOW ESTIMATION"

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ABSTRACT

Objective of this paper is to make a survey of the work done describing the researches in the area of video denoising sequentially, so as to get a clear idea on history of techniques developed for process of video denoising and also the current research going on for this era. Many applications make use of video denoising technique. For example, object detection, medical imaging, traffic management, remote sensing imaging, digital entertainment and many more. Image processing investigated the field of video processing. After early 90s, many different techniques were placed to maximize the denoising in the video with retaining the legacy of video signal. The suggested approach uses motion compensation using optical flow. In addition to that, PCA gives fine details of video.

Keyword - *Video denoising, patch processing, PCA, optical flow estimation, non-local means, motion compensation*

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1. INTRODUCTION

Denoising is any signal processing method, which reconstructs the signal from a noisy one. Its goal is to preserve the useful information by removing unnecessary noise. Video denoising is actually process of removing noise from the original video signal, where noise reduction in image can be performed through the frame individually and between the frames. Different denoising methods make different presumptions, depending upon the picture and the kind of picture. Typical noise types are analog and digital.

Analog noise includes film artifacts, VHS artifacts, and Radio channel artifacts. Digital type includes blocking, ringing and block slices. In the paper discussed, the creator considered first edge as foundation edge and contrasting this casing and the present edge to get the distinction. It takes an advantage of motion detection in Real time video streaming using continuously moving frame background. Here the initial step for video denoising is taken as moving object detection and additionally objects tracking.

This method utilizes division of moving articles from stationary foundation objects. This is focused on higher level processing and decreases calculation time. Shadow object segmentation is troublesome and noteworthy because of light changes. A large portion of video denoising method depends up on a single noise for example, Gaussian or background noise. Different statistical distributions are being found with major contributing sources of noise, for example, dark current noise and quantization noise. The most widely recognized way to deal with taking care of impediments in the optical stream literature is to define them as regions where forward and backwards motion estimates are inconsistent. Most methodologies return estimates of motion in the occluded regions, where they cannot be invalidated. 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.

2. OBJECTIVES

1. Improved surface and detail reproduction.
2. The primary protest is to decreasing noise amplitude.

3. LITERATURE SUREVY

In literature survey, the previously developed techniques for video denoising are discussed with their advantages and disadvantages.

lmed Ben Dhaou and lrek Defee 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 [1].

Daniel Pak-Kong Lun and Tai-Chiu Hsung 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 [2].

Rakesh Dugad and Narendra Ahuja, 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 [3].

J. Abbas, M Domariski 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 two-dimensional 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 [4].

Peter Rieder and Gunter Scheffler 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 [5].

Y. H Lohl, L. Y. Chew and U. Chan 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 multi-processing algorithms and techniques are used to denoise more noisy videos. Technique is efficient for the signal system when the system has weak video signal [6].

Aleksandra Pizurica, Vladimir Zlokolica and Wilfried Philips, 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 [7].

V Zlokolica, A. Piitirica, W Philips, 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 [8].

Vladimir Zlokolica, Wilfried Philips and Aleksandra Pizurica 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 [9].

Liwei Guo, Mengyao Ma and Zhiqin Liang 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 [10].

Yan Chen, Oscar C. Au, Xiaopeng Fan presented a paper on, 'Simultaneous MAP-Based Video Denoising and Rate-Distortion 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 [11].

Gijesh Varghese, Zhou Wang 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 [12].

Yunus Emre Kara, Lale Akarun 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 [13].

Haomian Zhengl, Zhu Li, Aggelos K.Katsaggelos, Jia youl 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 [14].

Nazim Ashraf and Hassan Foroosh, 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 [15].

Borislav Anti´c, Timo Milbich and Bj¨orn Ommer, 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 [16].

Jeong-Jik Seo, Jisoo Son, Hyung-Il Kim, Wesley De Neve1, and Yong Man Ro, 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 [17].

3. 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 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].

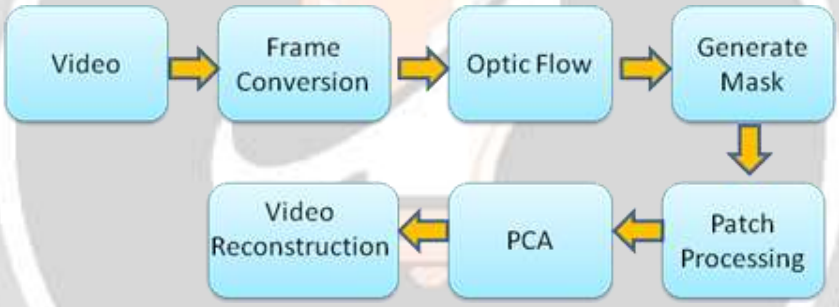

Fig 1:- block diagram of existing system

4. CONCLUSIONS

The proposed methodology has presented a new approach for denoising algorithm combining motion estimation and patch based denoising algorithms. These methods decompose the original data in a predefined basis and cancel coefficients under a certain threshold related to noise statistics. Motion compensation permits the use of spatio-temporal patches for a more robust comparison while the use of PCA for patch denoising preserves texture and details. The comparison with state-of-the-art algorithms illustrates the gain on performance of the proposed approach. The novel denoising algorithm improved the texture and detail reconstruction.

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