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The Applications based on Video Motion Magnification Techniques

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Abstract

This research study's major goal is to present an important overview of recent work on applications based on Video Motion magnification (VMM) approaches during the course of the last 10 years. Over the past few years, video motion magnification (VMM) technologies have attracted a lot of attention and research, particularly as applications based on video motion have become more and more necessary. With an increase in the number of recommended procedures, surveying and evaluation become necessary. In this study, we will highlight how the survey was focused on several articles that used motion video augmentation techniques in their applications. We contrast these applications as well.

Introduction

Video magnification is the process of enlarging a video image to see things that the human eye cannot normally see. It is based on work done at the Massachusetts Institute of Technology and refers to it as Eulerian Video Magnification (EVM). Where people's videos are, it often detects changes in skin color due to changing temperature. We notice this in the video image as the pictures are redder of the person's face, arm or body, due to the blood circulation (Bharadwaj et al., 2013). There are many methods of enlarging video today and many of them are not yet commercially available. Dynamic Video Motion Magnification (DVMAG) is a proposed improvement on top of the Eulerian algorithm. Allows accurate zooming of the video scene in the context of a larger image. Zooming in on video has the potential to transform people's observation and detect movements that are too small for the human eye to make. It is ideal for monitoring and other applications, such as monitoring infants and the elderly.

Recently, proposed many of applications based vedio Motion magnification techniques. In this review, work ways to build many application depend on vedio Motion magnification (VMM) techniques. The remaining portions of this research article were organized as follows: The literature survey of various systems in the last years is offered in Section 2. In Section 3 the comparative schemes analyses that debated in section 2. As a final, the Section 4 shows the conclusions.

Dataset

The nature of the data set used in research over the past few years, in the application of various fields in the use of Video Motion Magnification (VMM) techniques. Part of this research has configured the dataset according to their specific applications and uses different types and sizes of cameras to record video clips. Others took data set from websites, which are: (1) Videos that the MIT Computer Science and Artificial Intelligence Laboratory has utilized

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(CSAIL); (2) Used 400 sets of videos from the DFDC Kaggle dataset; (3) The CASME II database is online public available now for testing.

Eulerian Video Motion Magnification (EVM)

The system uses a typical video clip as input, amplifies minute spatial changes, and outputs bigger variations of those little motions to reveal concealed vital indicators. Figure (1) depicts how the system's algorithms work. To highlight the small changes in the video, spatiotemporal processing is combined (Javaid et al., 2013).

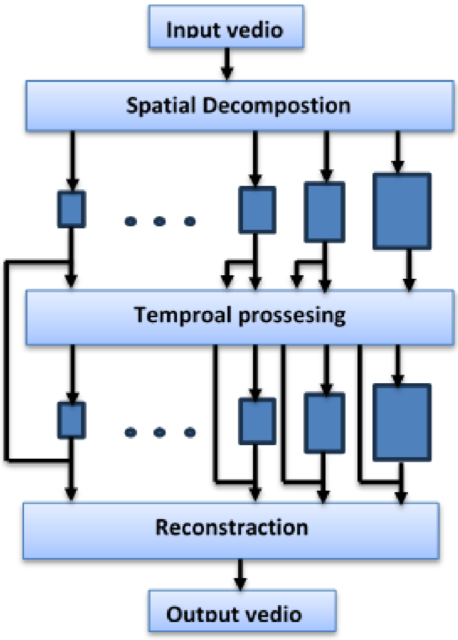

Figure 1. Eulerian Video Motion Magnification

Input : video
Output : the video's amplify minute movements.
Step 1 : Spatial Decompose: Start by breaking down a basic input video frame into distinct spatial pools of frequencies. Then, using different video decomposition techniques like Laplacian, Steerable, and Gaussian pyramids, you can see how the performance of the movies has improved.
Step 2 : Temporal Filtering: It uses a temporal filtering procedure on the frames after taking the series of pixel values through time in order to recover hidden signals.
Step 3 : Amplified Resultant Signals: In order to disclose hidden information in the movies, the output signals from the temporal processing are then multiplied by a specific factor (α).
Step 4 : Output the Amplified Result: An output video is produced by collapsing a pyramid after these amplified signals are added to the input signals.

Literature Survey

Notes in the last few years, there are various applications in various field employed one of on Vedio Motion Magnification (VMM) techniques to have satisfied. In this section we discuss some of these researches.

In 2012, this research study Hao-Yu et al. (2013) the technology demonstrated clearly by capturing video as input and enhancing subtle color differences and undetectable motions. This approach used only spatio-temporal processing to amplify temporal color changes during movement, and does not follow properties or compute optical flow. This approach, which is based on Eulerian, is successful in recognizing informational signals, amplifying small movements in real-world films, and processing temporary pixels in a fixed geographical area.

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According Balakrishnan et al. (2013) video was used as an input and tracking feature to measure heart rate and pulse from precise head movement generated by the Newton's pumping response to each heartbeat. Using frequency filtering and PCA together, they were able to identify which motion component belonged to the pulse and then extract the path peaks to identify individual pulses. The technology accurately predicted heart rates that were nearly identical to an EKG and picked up certain aspects of heart rate variability when tested on 18 people.

The subtle or undetectable movements simply using the video clip as a direct input, which are not perceptible with the human eye (Sarode & Mandaogade, 2014). The approach amplifies temporal changes only using spatiotemporal processing; Do not rely on technology such as feature tracking or optical flow computing to amplify motion.

In the study Alghoul et al. (2015), I identified two new methods for extracting heart rate variability (HRV) from video sources. Independent Component Analysis (ICA) technology is behind the first method, while Eulerian Video Magnification (EVM) technology supports the second method. For knowledge, this is a successful method for extracting physiological characteristics from PPG data using EVM technology. This procedure was evaluated on 12 people of different backgrounds, ethnicities, and skin colours.

In 2016, Adaptive Euler Video Magnification (AEVM) methods were developed by Bennett & Knoefel (2016) demonstrate how the adaptive EVM approach, which has been proposed, can extract an actual physiological signal rather than just an enhanced noise signal. In addition, thermal video can be used in this paper in conjunction with adaptive EVM techniques that have been proposed for use in extracting physiological information.

Presented adaptive EVM approaches for core temperature signal extraction, core signal recognition and classification, and noise amplification along with thermal video capabilities (Bennett et al., 2017). This study also demonstrated the need for additional study of thermal video and Eulerian processing while extracting critical health indicators and highlighted the advantages of thermal videos augmented by Eulerian over optical videos.

Suggested a technique for amplifying subtle movements in visual data. proposed method used complex waves (CWTs) for frequency band amplification, data analysis and data analysis (Fahmy. The proposed method has been applied to several video signals, and the efficacy of our micro-motion amplification was evaluated compared to other recent successful studies. Exploring filters created specifically for CWTs to detect and amplify micro-motion may be a promising area of research.

In Yu et al. (2017) suggested strategy in this study comprises six phases. Users are given the option to select the amplification region, and after the video sequence's images are converted from RGB to YIQ, the three components are combined into a Laplace pyramid shape, the nuance is determined by a band-pass filter, and all components that pass through the filter are amplified by a factor of, the user can view the results. In order to recover the video object, all YIQ components are eventually retrieved and transformed to RGB models. It has been demonstrated that the proposed technique offers greater specificity and accuracy.

According Verma & Raman (2018) used their proposed method to enhance small changes in the video presented in this work using motion amplification with lower noise output. Movement in the piece is amplified by spatiotemporal filtering. Each frame undergoes multi-scale analysis using the fast local Laplacian filter, which uses perceived edge smoothing. By using edge-perceived hierarchical decomposition, motion amplified video distortions are reduced and the transient signal-to-noise ratio increased.

Technology included three core processes: automated feature score tracking, video amplification, and regions of interest (ROI) recognition. proposed approach gives a new

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approach to obtain automatic recognition of regions of interest (ROI) and speed up processing (Kumar et al., 2018). The efficiency of the proposal is demonstrated by qualitative examination of the experimental results.

In Takeda et al. (2019) described a novel application of the indicator in neuroscience. In order to improve the representation of movement, this study defines partial variance as the ability to detect only minute changes. The proposed method achieves impressive amplification results that are superior to those obtained using the latest technology because it only introduces subtle changes while ignoring the useless changes caused by image noise.

Presented a method for obtaining discrete temporal information from an animal video which is Eulerian video amplification (Lauridsen et al., 2019). When something, like heart rate, cannot be recorded through contact, this can be employed in experimental and comparative physiology.

In Laha et al. (2019) showed three stages: picture registration, segmentation of the retinal vascular system, and amplifying segmentation under video guidance. A novel wavelet-based recording technique was employed to spatially align individual frames of the fluorescein angiography (FA) video during the image recording stage. In addition, all frames are now recorded in the middle frame to remove frame movement and slight noise. The capsule-dependent neural network architecture divides the retinal vessels in the second stage. Show that using both parameters, as well as qualitative and quantitative results, this innovative implementation of capsule network design goes far beyond the contemporary CNN U-Net. Last but not least, we show directed hashing.

In order to preprocess videos and take advantage of the results as a measure of whether they are deeply faked, and in this paper Euler Video Magnification was used (Das et al., 2021). EVM-based motion and color amplification on videos to see if differences can tell the difference between original and fake movies.

Based on performance standards, construct and evaluate video amplification techniques in this study (Yadav et al., 2020). There are many ways to do video amplification, including hardware and software techniques. The Eulerian method of video amplification is quick and easy, but it only works with lower amplification factors since noise gets worse as the amplification factor rises.

Cai et al. (2022) saw the introduction of a brand-new method for using spectra to powerfully magnify big motions by Enjian Cai and colleagues publication. Artificial limitations are avoided by utilizing the spectra, which also amplifies little motions at identical frequency levels while disregarding larger ones in other spectral pixels. This was accomplished by constructing an experimental Bayesian model using an axial-core chirplet transformation (SCT) that gave excellent spectral resolution and strong noise performance in the analysis of non-stationary nonlinear signals. The model was applicable to the full time series. Bayesian base-embedded SCT (BE-SCT) is a significant advancement that has been published. Two digital experiments show how effective it is compared to current techniques. A thorough analytical framework that captures global motion has been created for use in spectrum-perceived motion amplification, and the suggested usage

Zhang et al. (2022), a study used motion amplification technologies to enhance the microexpression features. A motion magnification multi-feature relation network (MMFRN) was also suggested; it combines video motion amplification with two feature relation modules. The spatial feature gets increased as the extraction of the spatial feature, required for classification, is completed. We also transferred the Resnet50 network in order to extract the global characteristics and improve feature comprehensiveness. Through the parameter

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hyperparameter amplification factor, the features' magnification is managed. The best magnification factor is chosen after comparing its influence on the outcomes.

In Flotho et al. (2022) presented a non-supervised technique based on the Lagrangian approach with OF forward warping amplification for amplifying micromotions in facial recordings. By minimizing a double sparse decomposition model for OF and a thresholding approach to identify the pertinent regions, the real regions for OF amplification were discovered. The thresholding technique currently used to distinguish between microexpressions and other motions is still subject to development. The duration of each move, for instance, could be taken into account. However, a simple thresholding was already sufficient in the case of the CASME II dataset, where eye movements are the only notable face motions aside from microexpressions.

Analyzing the Systems in Comparison

Table 1. Analysis of Some of the Differences between Application Video Motion Magnification

Ref.	Year	Dataset	Feature Extraction	Application Accuracy	Method
4	2012	Created Database	Extract facial features to extract pulse rate	Accuracy in imagining the blood flow as it fills the face, expands, and displays tiny thoughts.	Spatial decomposition, temporal filtering
5	2013	Videos were captured in natural light with a Panasonic Lumix GF2 Amera.	To measure the delicate head's heartbeat and rate of pulse.	The technique produced heart rates that were nearly equal to those of an ECG	Tracks features and principal component analysis (PCA)
6	2014	Created Database	Utilizing feature tracking, determine the head's movement.	They can demonstrate the minute movements in daily life and visualize the ulnar artery's pulse and movement when blood is flowing amplified.	Spatio-Temporal Algorithm
7	2015	created a database using a camera to capture a person's face	To extract physiological parameters From photoplethysmogr aphy (PPG) signal from the human's face through a camera	The two approaches we used one based on the ICA and the other on the EVM are contrasted in the proposed system..	Independent Component Analysis(ICA) EulerianVideo Magnification (EVM)
8	2016	An related data gathering device, a Hexoskin smart shirt, and An infrared camera from the FLIR A-Series was used.	Extraction of physiological signals like heart rate	This study looks at the possibilities of using thermal video and EVM to extract bodily information, particularly heart rate.	Adaptive EulerianVideo Magnification Methods
9	2017	Utilizing both video data from thermal and optical cameras was obtained.	The core temperature signal is extracted	With the use of this technique, the differences between Eulerian noise enhancement and Eulerian signal enhancement were better understood..	Processing of Thermal Video Using Adaptive Eulerian Video

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10	2017	Created Database	Video signal analysis and amplification Subtle vibrations/movements to make it visible..	To investigate certain design-based CWT filters for improved micro-movement detection and magnification.	Micro-movement magnification with CWT
11	2017	Created Database	a conversion between the RGB and YIQ models.	In terms of video magnification, this technique is more effective and has higher SNR.	Region-Based Euler video magnification method.
12	2018	using videos produced by the MIT Computer Science and Artificial Intelligence Laboratory (CSAIL)	To determine the difference in time between the two provided frames	Aside from motion magnification, the suggested technique tries to remove noise and artifacts from the video that was created.	Edge-Aware Motion Magnification
13	2018	Created Database	Amplifying minute movements in a video featuring both large and little movements against a still background.	The suggested method makes use of a recently developed block-based spiral search strategy to create even for incredibly small motions, a large motion magnification and automatically identify RoIs.	Automated RoI Selection (A RS) and Spatial Co-ordinate Approach (S C A)
14	2019	The Describable Textures Dataset	Detects only significant subtle changes and rejects ones brought on by photography noise that are not significante,	Developed a somewhat anisotropic filter using FA, and the filter allows for greater and more spectacular zoom..	Fractional nisotropic filter, edge-aware rgularization,
15	2019	Actual videos as well as artificial ones enhanced with ground truth.	To extract hidden temporal information from animal video graphic data.	Using the filter for a better and more spectacular zoom is made possible by this way of filter design.	Fractional Anisotropy in Temporal Distribution
16	2020	1, 402 Frames make to the 1, gathered fluorescein angiography video collection.	Fluorescein angiography (FA) video analysis, both quantitative and qualitative	This study aims to provide a support tool for quantifying, evaluating, and analyzing fluorescein angiography (FA) recordings of the retinal blood vessel anatomy.	A novel wavelet-based registration method
17	2020	Used 400 sets of videos from the DFDC Kaggle dataset	Detection of deepfake videos.	This methodology, which was derived from the Euler technique, trains three models to distinguish between movies that have been edited and those that haven't. The findings are then compared to those of other methods.	Euler Video Magnification
18	2020	The Motorola G4 Plus and Samsung Galaxy 7 rear cameras both record	To put the video magnification techniques into practice and	This approach analyzes comparative performance. the distinctive	Phase Video Magnification

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		videos at a resolution of 1080p 30 frames per second.	evaluate them based on performance metrics..	Color intensity, execution time, PSNR, amplification factor, and motion amplification are the performance metrics used.	
19	2021	On both real-world and created videos, the approach is illustrated.	To calculate the parameters of static and dynamic models	In its methodology, it provides nonstationary nonlinear signal analysis with strong spectral resolution and stable performance against noise.	Bayesian-rule embedded SCT (BE-SCT)
20	2022	Used CASME II database	To zoom Small gestures to make feature connection extraction and observation simple	Reduces the misclassification issue brought on by the one-to-one connection between face coding units and microexpressions when the magnification is appropriate.	Motionmagnification Multi-Feature Relation Network (MMFRN)
21	2022	Used the CASME II [37] dataset.	For magnifying micromotions in facial videos based on the Lagrangian approach with OF forward warping amplification.	The method is able to successfully decompose the of field into reasonable components.using this decomposition	local Lagrangian motion magnification of facial micromovements.

Conclusion

Reviewing this study, we reviewed the timeline of a number of applications based on Motion Magnification during the period (2012-2020). Applications based on Motion Magnification become a de facto task in many systems especially in these applications in artificial intelligence, computer vision, image processing, and computer graphics. Many industries, including medicine, biology, mechanical engineering, and civil engineering can benefit from our visualization. These techniques increase the efficiency of classification approaches and ensure fast and high-accuracy results. Each tool has some advantages and disadvantages that we will try to solve by developing new technologies.

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