Volume 1, Issue 5 December 2015 ISSN NO: 2454 - 7514

North Asian International Research Journal Consortium

North Asian International Research Journal

Of

Science, Engineering and Information Technology

Welcome to NAIRJC

ISSN NO: 2454 -7514

North Asian International Research Journal of Science, Engineering & Information Technology is a research journal, published monthly in English, Hindi, Urdu all research papers submitted to the journal will be double-blind peer reviewed referred by members of the editorial board. Readers will include investigator in Universities, Research Institutes Government and Industry with research interest in the general subjects

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A REVIEW ON VIDEO FUSION TECHNIQUES

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ABSTRACT:

Video fusion is processes of combining complementary information from a set of frames of input videos. The resultant fused video gives large and reliable information. Video fusion techniques can improve the quality and increase the application of these data. This presented approach will be based on a literature review on some of the data fusion techniques like Discrete Wavelet transform based fusion, Principal component analysis (PCA) based fusion, Intensity Hue Saturation fusion, High pass filter technique etc. Digital video has become ubiquitous and indispensable in our everyday lives. Video signals are subject to noise contaminations during acquisition and transmission. Video fusion is and will be an indispensable part of numerous current and future reconnaissance frameworks. In any case, next to zero precise endeavors has been made up to now on mulling over the relative benefits of different fusion techniques and their strategies and their adequacy on genuine multi-sensor imagery. In this paper, we presented various techniques and related literature survey for video fusion.

Keywords- ***Video Fusion, video noising, video quality enhancement, DWT, PCA.***

1. INTRODUCTION

As video reconnaissance (surveillance) equipments and cell phones, for example, digital cameras, smart phones and net books are progressively broadly sent, cams are required to obtain, record and at times compress and transmit video content in all lighting and climate conditions. The dominant parts of cams, nonetheless, are not particularly intended to be generally useful and climate verification, rendering the video footage unusable for discriminating applications under numerous circumstances [1]. Image and video transforming and enhancement including gamma amendment, de-hazing, de-blurring and so on are all around mulled over ranges with numerous effective algorithms proposed throughout the years. Albeit diverse algorithms perform well for distinctive lighting impairments, they often require tedious and sometimes manual input-dependent fine-tuning of algorithm parameters. Furthermore, diverse specific types of impairments frequently require distinctive particular algorithms [2]. Video fusion is a process that combines visual data from different sensors to obtain a single composite video preserving the information of the sources. The availability of a system, enhancing human ability to perceive the observed scenario, is crucial to improve the performance of a surveillance system [3]. The term fusion in general means an approach to extract information acquired in several domains. Video fusion is the process of combining relevant information from two or more videos into a single video. The resulting video will be more informative than any of the input video [4]. The goal of video

fusion is to integrate complementary multi-sensor, multi-temporal and/or multi-view information into one new video containing information, the quality of which cannot be achieved otherwise. Basically Video is the continuous form of image data called frames. And the filtered frames from the captured video are fused into a single video by using the video fusion technique.

2. VIDEO FUSION

Generally, Fusion is the union of different things by, and Imaging is making a representation or imitation of an object. Thus, Fusion Imaging is simply defined as Melting together images from different modalities to create a new (hybrid) image.

Hence, Video fusion is the process of combining relevant information from two or more videos into a single video. The resulting video will be more informative than any of the input video. Imaging and its applications are one of the primary concerns of today's technology and innovation [5]. Various types of imaging tools and algorithms are being developed to have a better understanding of what is really happening in the visual scene which is observed on any media. On the other hand; in some applications, one image acquired from a specific scene or situation is not enough. Therefore engineers try to maximize the information carried on an image or video.

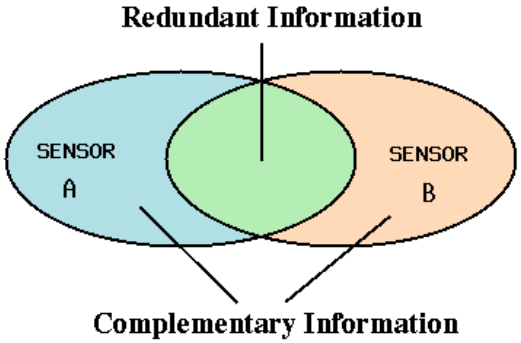

Figure 1: Definition of Data Fusion

Data and video fusion algorithms have been developed for decades to meet the needs to gather utmost information from a video or an image. For this purpose, sometimes multiple cameras, each of which has different sensor characteristics are put together to investigate the visual situation thoroughly. In some cases just one capture device – possibly a camera– is used with different sensor settings. These tricks are applied just to gather more information from a field of view.

Data fusion is the key point for all the problems that cannot be handled with just one source. In imaging technology, data fusion is applied in such a way that multiple images or frames are fed to a synthesizer which produces a single output while holding the information carried by all the inputs. Multiple images means that either one camera shoots more than one image with different exposures or two different cameras with different sensor characteristics (electro-optic, infrared camera etc.) capture the same scene.

The main idea in video fusion is to collect all the valuable information from each video and put them together in the resulting fused video. Valuable information refers to the parts of the frame that is attached to HVS (Human Visual System). It is known that HVS is more sensitive to the visually salient regions. Usually, the salient regions are formed by the contrast differences, in other words the edges in the image. Signal processing theory tells that the edges in an image lie on the higher frequencies.

3. NOISE

Video is the continuous form of image data called frames. There are several ways through which noise can be introduced into data, depending on how the data is retrieved. This is the main problem in remote sensing applications. Satellite videos, containing the

noise signals and lead to a distortion and not being able to understand. So to study it properly, requires the use of appropriate filters to limit or reduce much of the noise. It helps the possibility of better interpretation of the content of the data. The videos captured by multiple sensors can be differently noised depending on the proximity to the object, environmental disturbances and sensor features and they may be noised to same intensity some times. There are different types of noises are added to the data depending on the nature of sensor, application, hardware etc. Gaussian noise, uniform noise, impulse noise, gamma noise, exponential noise etc. are some of the noise models in image processing.

Satellite communications is growing rapidly in various fields like GPS. In general satellite gives the information in the form of images and videos. This data is often corrupted during acquisition, transmission or due to faulty memory locations in hardware. This creates loss of information. The noise density varies depending on various factors namely reflective surfaces, atmospheric variations, noisy communication channels etc.

Noise is undesired information that contaminates an image. Noise appears in an image from various sources. The digital image acquisition process converts an optical image into a continuous electrical signal. This electrical signal sampled, is primary process by which noise appears in digital image.

4. LITERATURE SURVEY

Digital video has become ubiquitous and indispensable in our everyday lives. Video signals are subject to noise contaminations during acquisition and transmission.

a) Contrast enhancement

Video enhancement techniques involve processing an image/frame to make it look better to human viewers. It is usually used for post processing by modifying contrast or dynamic range or both in an image. The aim of contrast enhancement process is to adjust the local contrast in different regions of the image so that the details in dark or bright regions are brought out and revealed to the human viewers. Contract enhancement is usually applied to input images to obtain a superior visual representation of the image by transforming original pixel values using a transform function.

b) Histogram equalization

Histogram equalization is one of the most commonly used methods for contrast enhancement. It attempts to alter the spatial histogram of an image to closely match a uniform distribution. The main objective of this method is to achieve a uniform distributed histogram by using the cumulative density function of the input image. The advantages of the HE include (i) it suffers from the problem of being poorly suited for retaining local detail due to its global treatment of the image. (ii) small-scale details that are often associated with the small bins of the histogram are eliminated. The disadvantage is that it is not a suitable property in some applications such as consumer electronic products, where brightness preservation is necessary to avoid annoying artifacts. The equalization result is usually an undesired loss of visual data, of quality, and of intensity scale.

c) Tone mapping

Tone mapping is another approach contrast enhancement technique. In this method, if we want to output high dynamic range (HDR) image on paper or on a display, we must somehow convert the wide

intensity range in the image to the lower range supported by the display [6]. However, most LCD or CRT displays and print-outs have low dynamic range. Tone mapping technique used in image processing and computer graphics to map of colors to another, often approximate the appearance of high dynamic range images in media with a more limited dynamic range. Tone mapping is done in the luminance channel only and in logarithmic scale. It is used to convert floating point radiance map into 8-bit representation for rendering applications. The two main aims of tone mapping algorithm: preserving image details and providing enough absolute brightness information in low dynamic range tone mapped image.

d) HDR-based video enhancement.

High dynamic range imaging (HDRI or just HDR) is a set of techniques that allow a greater dynamic range of luminances between the lightest and darkest areas of an image than standard digital imaging techniques or photographic methods. This wider dynamic range allows HDR images to more accurately represent the wide range of intensity levels found in real scenes, ranging from direct sunlight to faint starlight [7].

e) HDR-based context enhancement

Video image quality improving technologies produce remarkable achievements as display devices make rapid progress. However, there exist some limitations on intensity representation of display and acquisition devices to reproduce the real world video images. Various context-based contrast enhancement algorithms have been developed and applied to overcome those limitations on intensity representation of display and acquisition devices to reproduce the real world video images. However, there are still some limits including color information change, loss of the lighting information, and excessive enhancement. To resolve these problems, propose HDR imaging context enhancement algorithm. An input image is determined whether or not it requires context enhancement in a pre-processing step using the proposed auto exposure algorithm. Multiple images are generated by applying the intensity mapping function to an input image.

5. SURVEY OF DIFFERENT TECHNIQUES

A) ***Intensity-hue-saturation (IHS)-based***

The fusion of a PAN image that has high spatial but low spectral resolutions with MS images that have low spatial but high spectral resolutions is a key issue in many remote sensing applications that require both high spatial and high spectral resolutions. The fused image may provide feature enhancement and classification accuracy increase. The design of a sensor to provide both resolution requirements is limited by the tradeoff between spectral resolution, spatial resolution, and signal-to-noise ratio of the sensor. The spectral and spatial resolutions have an inverse relationship. Thus, a high spectral resolution results in a low spatial one and vice versa. Hence, there is an increasing use of image processing techniques to fuse the available MS and PAN images. These image processing techniques are known as pan-sharpening or resolution fusion techniques. Pan-sharpening has been an active area of research for more than a decade, and many image fusion techniques and software tools have been developed for specific applications.

In practical applications, the intensity-hue-saturation (IHS) approach is the most widely used. This technique is suitable when exactly three MS bands are concerned. Aside from its fast computing capability for fusing images, this method can extend

the traditional three-order transformations to an arbitrary order.

B) ***DWT based Image Fusion***

For the remotely-sensed images, some have good spectral information, and the others have high geometric resolution, how to integrate the information of these two kinds of images into one kinds of images is a very attractive thing in image processing, which is also called the image fusion [8]. For the purpose of realization of this task, we often need some algorithms to fuse the information of these two kinds of images, and however we find few such algorithms. In recent ten years, a new mathematical theory called "Wavelet theory" (Charles K.Chui, 1992) has gradually been used in the fields of graphics and imagery, and been proved to be an effective tool to process the signals in multi-scale spaces. In this theory two images to be processed are firstly decomposed into sub-images with the same resolution at the same levels and different resolution among different levels, and then the information fusion is performed using high-frequency sub-images under the "gradient" criterion, and finally these sub-images are reconstructed into the result image with plentiful information. Since the geometric resolution of the image depends on the high-frequency information in it, therefore this image fusion algorithm can acquire good results.

C) ***Principal component analysis (PCA) based Fusion***

Principal component analysis is a statistical analysis for dimension reduction. It basically projects data from its original space to its Eigen space to increase the variance and reduce the covariance by retaining the components corresponding to the largest Eigen values and discarding other components. PCA helps to reduce redundant information and highlight the components with biggest influence so as to increase the signal-to-noise ratio. PCA is also a linear transformation that is easy to be implemented for applications in which huge amount of data is to be analyzed. PCA is widely used in data compression and pattern matching by expressing the data in a way to highlight the similarities and differences without much loss of information.

PCA is also a linear transformation that is easy to be implemented for applications in which huge amount of data is to be analyzed. PCA is widely used in data compression and pattern matching by expressing the data in a way to highlight the similarities and differences without much loss of information [9].

D) ***High-Pass Filter Technique for Fusion***

Image fusion combines complementary image data, most commonly low spectral-high spatial resolution data with high spectral-low spatial resolution optical data. HPFA is an image fusion method in the spatial domain, which inserts structural and textural details of the higher resolution image into the lower resolution image, whose spectral properties are thereby largely retained. Using various input image pairs, workable sets of HPFA parameters have been derived with regard to high-pass filter properties and injection weights. Improvements are the standardization of the HPFA parameters over a wide range of image resolution ratios and the controlled trade-off between resulting image sharpness and spectral properties.

Image fusion techniques amalgamate the physical properties of the source images into a new image. The most frequent application for image fusion is what many authors call resolution merging or pan-sharpening, where multispectral data of coarser spatial resolution are merged with data of finer

spatial resolution, usually panchromatic (PAN) imagery. The result is an artificial multispectral image with the spatial resolution of the panchromatic image [10].

Image fusion procedures are often subdivided according to the abstraction level of the fusion, where pixel-based, feature based, and decision-based approaches within pixel-based image fusion, a rough distinction can be made between the commonly applied spectral substitution techniques (Intensity-Hue-Saturation (IHS), Principal Components (PC)), arithmetic merging (e.g., multiplicative merging, Brovey transform), and methods in the spatial domain (e.g., wavelet, HPFA). Theoretical limitations of IHS sharpening and suggests that sharpening of the bands individually may be preferable [11].

The HPFA fusion method in its original implementation is only minimally described in the literature and is very straightforward. The basic idea is analogous to the more complex methods of this family, such as wavelet.

6. CONCLUSION

Video fusion has become important in digital image processing research area. The main objective of video fusion is to combine information from various source input videos and take two or more frames of the same scene to obtain a video with completely information. But the challenge is to how evaluate the information of the input video with better quality of frame. Thus, various techniques of fusion like PCA, Wavelet transformation, high pass filtering method, IHS, component analysis or it is also done with the feature extraction method, based on which the research activities are mainly in the area of developing fusion algorithms that improves the information content of the composite imagery, and for making the system robust to the variations in the scene, such as dust or smoke, and environmental conditions, i.e. day or and night. The main objective of video Fusion Schemes is to Extract all the useful information from the source videos and do not introduce artifacts or inconsistencies which will distract human observers or the following processing. Thus it is Reliable and robust to imperfections.

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