A Survey on Multi-camera Image Quality Measures Analysis

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ABSTRACT

Most important measures in image research is the analysis of image quality. Quality analysis of images plays very important role in generation of multi viewed images and for the automatic image development in near future. Image quality measure can be performed by two ways subjective and objective. There are various subjective & objectives quality analysis technics are emerged in past year but these are applicable on single camera images. In multi camera images very less research is carried out for the quality analysis. Multi image is nothing but combining multiple images or events into single image. In multi camera images the quality is depend on various factors like configuration, calibration, features of different cameras used to take the images. In multi camera images we can find two types of distortions like photometric and geometric. This paper deals with the various methods and their results to achieve the quality of multi camera images. Here main focus is on the methods like PSNR, MSSIM & VIF and the results of these methods is compared with MIVQM Multi camera image Vision with quality measure (MIVQM) is calculated by combining indices like spatial motion, luminance and contrast and edge based arrangement. The result and comparison with the other measures, like Peak Signal-to Noise Ratio (PSNR), Mean Structural Similarity (SSIM), and Visual Information Fidelity (VIF) prove that MIVQM surpass other measure to capture the quality of images from multi camera system.

Keyword: *-Fidelity Measure, qualitative assessment of images, multi camera image arrays, perceptible quality*

1. INTRODUCTION

Introduction In past year's multi camera images comes in picture and added tremendous interest into satisfying needs of multimedia products. Distance learning, various medical trainings, entertainment and surveillance and many more areas get benefited. User can define view point within captured scene is key advantage of multi view application. In last decades performance metrics of multi view videos and images processing by subjective evaluation methods was dominant in performance. Quality of images and videos are best assessed by subjective evaluation methods but due to the use of subjective testing is inefficient and time consuming such methods is not applicable for real time processing.

For developing videos and multi view applications objective metric plays very vital role in predicting the perceived quality of videos and multi view images. Objective metrics is the set of metrics which measures perceived quality of images & videos. In single camera images & videos are not get affected by distortion but due to nature & application of multi camera systems may face such distortions. Single view objective assessment of image quality measures is not sufficient for perceptual quality assessment of multiview images and videos [1]. This paper describes distortion types geometric and photometric are analyzed by term like contrast, luminance, spatial motion and edge based structural components.

Its very crucial to capture events from new multimedia items due to rapid development in technologies and the increasing cost of the instruments. Video conferencing, advertisement, entertainment, distance learning, photography, surveillance, medical training and sightseeing, etc. are applications include in such multi view product. Multi view means capturing number of images & scenes using number of different cameras. Multi view systems are not inadequate to 3-Dimensional television, interactive stereo, open viewpoint and panoramic, stereoscopic video

and object tracing [9], [13]. Process is followed by following processes which consists of capturing image, calibration process, and arrangement of scenes, implementation process, convert process, multiview deployment process, and representing process [9].

There are several application of multi view system accordingly each application has its own arrangement of instruments. In multi view application processing subjective evaluation is the main performance measure, but it has some disadvantages like inefficient and time consuming. It is not useful in real time environment. There are different ways are available to represent multi view like communal stereo, stereoscopic video and object tracing, free viewpoint, panoramic, 3-Dimenstional TV, virtual view synthesis, [13].

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2. LITERATURE SURVEY

In multi camera images distortions are categorized as photometric and geometric distortions [2]. In multi camera images distortions are measured in terms of spatial index motion, luminance index, contrast index and edge based structural index. By using luminance and contrast index photometric distortions are measured. Geometric distortions are measured using edge based structural index and spatial motion index. The quality is get affected by different types of distortions. L. Cui et.al. [6] Proposed Geometric and photometric distortions are the classifications of distortions in the multi camera system. P. J. Burt et. al. [14] authors proposed that due to geometric distortions and photometric distortion, we cannot get proper information because of improper structure which includes improper texture presentation.

1. Photometric Distortion

In single camera image photometric distortion is defined as noise in available images, blurness and blocking in images which will attracts visual attention. These types of distortions are extrinsic because of compression problem and intrinsic because of acquisition apparatus and problematic transmission channels and image improvement. To improve new video & image application the impact of calculating these distortion types on quality is important. These are visible in variations in levels of brightness and color depth across complete display area. Due to non heterogeneity between individual camera qualities distortion occurs such variations are called as Variational Photometric Distortion.

These distortions are measured by Luminance & Contrast and Edge-based structural indices.

Fig.1. Photometric Distortion Examples
(a) No distortion (left), compressed (right). (b) Blurred (left), blurred (right). (c) Blurred (left), compressed (middle), no distortion (right). (d) Compressed (left), no distortion (middle), compressed (right).

2. Geometric Distortion

It is second type of image distortion in multicamera systems. Overlapping of the pixels on each other or shifting of the pixels is one of the types of example in geometric distortion. In multi camera images or scenes are captured different cameras places at different positions and taken by different angles.

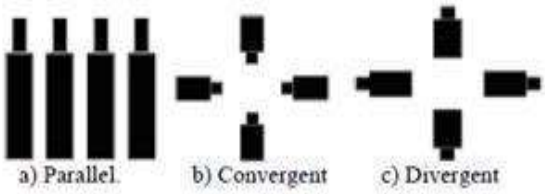

Fig. 2. Possible camera configuration views
a) Parallel b) Convergent c) Divergent

Geometric distortion exists in multi view images & videos due different camera configurations, positions and different angles means due to different types of orientations and calibration parameters.

Examples of such type of distortions are non proper alignments, blurness, and not proper continuation in images. These types of distortions are found due to calibration processing errors among various camera positions and due to calculations of scene locations. Linear and perspective distortions are two types of geometric distortion. Linear distortion occurs due to rotating images, mapping images and Perspective distortion occurs during mapping of the image from 3 dimensional planes to 2 dimensional planes.

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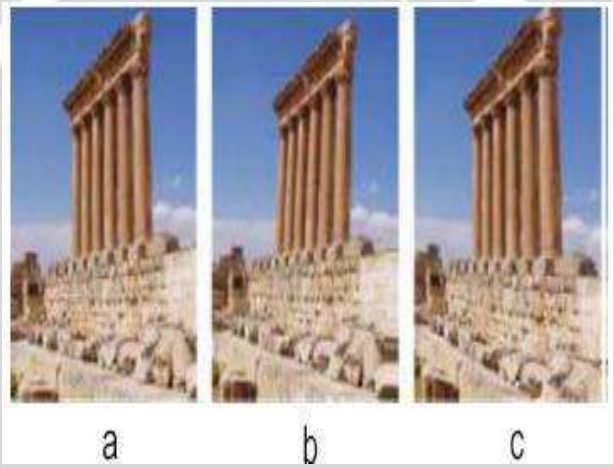

Fig. 3 Geometric distortion examples

a) Original b) Planar (rotation) c) Perspective (no distortion)

3. Combining Multicamera Images

Single camera is used to capture the high resolution images. Then each image was split into multiple images with overlap areas and each varies with other. Then distortion is applied on each separate image. Then all images are combined in single image that is reference image is build by merging all images without any distortion.

3. QUALITY ANALYSIS

Using automatic and semi automatic methods extraction of data measurement and information from an image is extracted for the image analysis. Image processing techniques such as restoration, coding and enhancement are differentiated with image analysis. Final output of the image quality analysis is the numerical one rather than image or picture [11].

Image analysis technique is nothing but extracting information from an image. Every image is consisting of edges and shades of grey edges. Low frequency information is nothing but example of shades in images and change in grey level is corresponds to high frequency. Edge detection is process of high frequency information. Edge is nothing but external information of image. With the help of segmentation and texture internal features of image are calculated. Segmentation of an image means separating certain features of the image, while treating other part as a background. If the image consists of a number of features of interest then we segment them one after the.

Roughness and spatial repetition period of local structure used to quantitatively describe the texture of an image. For the uniform texture segmenting the image is necessary before measurement. From multiple images domains like spectral and spatial are the main methods for feature separation [12].

Fig. 4 (a) Original Image

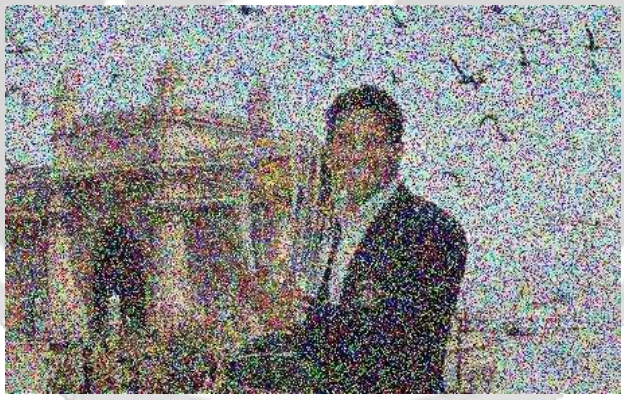

Fig. 4 (b) Photometric Distorted Image

4. CALCUATIONS OF QUALITY PARAMETERS

SSIM and MSSIM are the two algorithms mostly used to calculate Texture index of an image. To achieve the best performance getting single scale approach by applying appropriate scale SSIM algorithms is used selecting proper scale dependence on different viewing conditions. SSIM fails in adapting such conditions so researchers work on this and design new algorithm MS-SSIM Multi –scale Structural Similarity Index to overcome the drawbacks of SSIM. In the quality assessment algorithm different resolutions and viewing conditions are incorporated in multi scale methods are benefited over SSIM. In MS-SSIM algorithm after taking the reference and test images as input, MS-SSIM algorithm performs down sampling an iterative manner and low-pass filtering.

Fig. 6 (a) Original Image

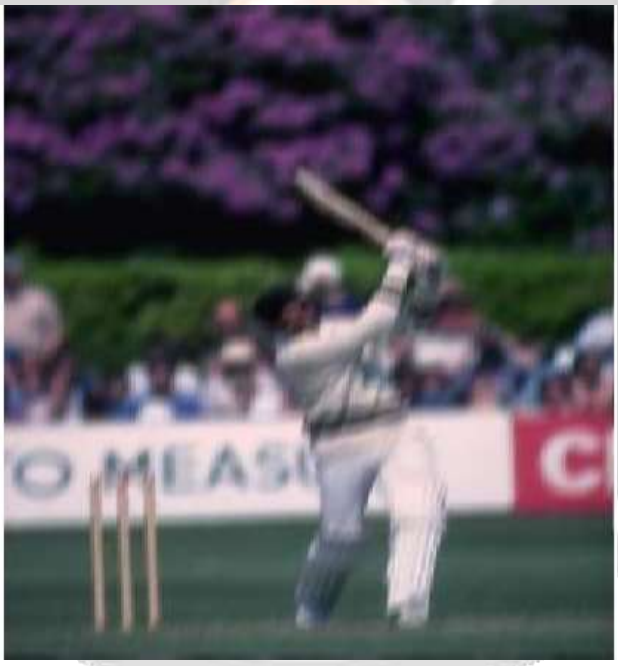

Fig. 6 (b) Geometric Distorted Image

Visual information fidelity (VIF):

VIF algorithm models natural images in the wavelet domain using Gaussian scale mixtures (GSMs). Images and videos that are taken from natural environment by using high quality capturing devices operating in visual spectrum are classified as natural scenes. A simple ratio of the two information measurements relates very well with visual quality

$$\mathrm{VIF} = \frac{\sum_{j \in subbands} I(\vec{C}^{N,j}; \vec{F}^{N,j} \mid s^{N,j})}{\sum_{j \in subbands} I(\vec{C}^{N,j}; \vec{E}^{N,j} \mid s^{N,j})}$$

Extracting diagonal of correlation coefficient matrix between two images to be compared is used to VIF. The correlation coefficient matrix of n random variables X1, ..., Xn is the n × n matrix whose i,j entry is correlation (Xi, Xj), If the measures of correlation used are product-moment coefficients, the correlation matrix is the same as the covariance matrix of the standard random variables Xi / σ (Xi) for i = 1, ..., n. This applies to both the matrix of correlations ("σ" is the population standard deviation), and to the matrix of sample correlations ("σ" denotes the sample standard deviation). Consequently both matrix are a positive-semi-definite matrix.

PSNR/ MSE:

The ratio between the maximum possible powers of a signal to the power of noise which affects the fidelity of its representation is nothing but Peak Signal to Noise Ratio. Since signals have a wide dynamic range, Peak signal to noise ratio is measured in logarithmic decibel scale. Peak signal to Noise ratio is most commonly used to ensure the quality of reconstructed lossy compression codec's the signal in this case is the original data and the noise is the error caused by compression. When comparing compression codec, PSNR is an approximation to human Perception of reconstruction (POR) quality. A higher PSNR indicates higher reconstruction quality. PSNR is most easily defined by means of mean squared error (MSE).

MIVQM:

The goal of MIQM is to derive a new quality measurement for multi-camera images. Since the quality of images are affected by multiple factors such like number of cameras, camera configuration, calibration process, quality assessment for such an image should take all these into consideration. To design an objective metric for multi-camera images, the visual distortion is identified into two types, photometric distortion and geometric distortion, which can be translated into luminance, contrast, spatial motion and edge-based structure components. The main idea of the paper is to first quantify each component by proposing different index values and then to combine those indexes into one quality, MIQM, to capture the perceptual quality of multiview images. And calculation on a macro block level is a basic method. MIQM represents measurement that is full -reference and designed to assess multi-view images, where the reference is regarded as the set of images taken by identical cameras.

In this paper Quality assessment of Multicamera images is comprised of three different indices algorithms

i. Algorithm for deriving Contrast & Luminance
ii. Algorithm for determine Spatial Motion
iii. Algorithm for deriving Edge Based Structural

5. CONCLUSIONS

In this paper we study the different types of distortion in Multicamera images, their assessment by using the techniques like statistical parameters and by MIQM in objective ways We Observed that MIQM shows the large range of Image Quality analysis and it analyses the perticular image interms of Luminance and contrast index (LC) , spatial Motion index and Texture Index

We execute different subjective tests to determine the quality of the images from the database. We consider all examples of panoramic image application. MIVQM as a combination of three indices measures with formulas and result for each index metrics. The results and examples show that MIVQM outperforms better quality measures assessment.

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