Multicamera Image Vision with Quality Measure

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Abstract

With the increasing demand of multiview application, quality related issues of multicamera images and videos is now crucial to the building of such applications. Quality of images are depending upon number of factors, which may be configuration of various cameras, stability of camera during taking photo, and the calibration process etc. In the projected literature survey there are various quality assessment methods are developed for images & videos taken from single camera but no more development in multi camera quality assessment. With this intention we develop some objective standard for multi camera system. We recognized that there are two types of distortions exist in multi camera images that are geometric and photometric. To find perceived quality of separate camera image comparable distortion plays very important role. These distortions are converted into components such as luminance, Contrast, edge arrangement & spatial motion. For these components we suggest various algorithms that calculate such components. Multicamera image Vision with quality measure (MIVQM) is calculated by combining three indices which are luminance and contrast, spatial motion 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 multicamera system. And in last, outcomes vs. subjective assessments are verified.

Keywords: *Fidelity Measure, qualitative assessment of images, multicamera image arrays, perceptible quality.*

I. Introduction

MULTICAPTURE of events has becoming crucial to gratify need for new multimedia items due to the speedy enhancement in computing current technologies and electronics world and plummeting Camera cost. Advertisement, distance learning, entertainment, video conferencing, surveillance, photography, sightseeing, and medical training etc. are applications include in such product. Multiview means capturing number of images & scenes using number of camera. And multiview applications is interactivity is a key advantage. The application users have the liberty of selecting view from captured images. Multiview systems are not inadequate to open viewpoint, interactive stereo, 3-Dimensional television and panoramic, stereoscopic video and object tracing [9], [13]. These systems consist following seven processes which consist taking image, camera calibration process, scene arrangement process, implementation process, conversion process, multiview deploying process, and presenting process [9].

Each and every step in the executing process gives the good clarity to the videos & images. Multicamera systems are several and each application has its own mean of acquisition, arrangement & presentation. During the last two decade, the main performance measure in multiview application processing is subjective evaluation. The subjective evaluation having some disadvantages like it is not efficient and it is time consuming. Subjective evaluation is not useful in the real time environment. The quality of multiview systems is depending on presentation. There are various ways are available to present multiview: free viewpoint, communal stereo, 3-Dimenstional TV, panoramic, virtual view synthesis, stereoscopic video and object tracing [13].

More than one camera is used to take a specific scene in the applications of panoramic video. The final outputs come from the cameras are then merged to get the quality we have to use multi mega pixel camera. Two cameras are used in communicating stereoscopic video to take two different looks of an object from various directions. Then, a 3-Dimension view is created by making 2-D projection on the retina of eye. A scene is captured in free viewpoint video by various cameras. In this user has choice to select his own view from number of views. At last in 3-Dimensional TV, a view is taken from various videos, and number of 3-D video is generated. The arrangements of cameras are proper so that we can directly take virtual scene from taken images. Previously mentioned applications share similar various cameras & block processing. From captured views photometric and geometric distortion are removed to improve quality of scene to be displayed. Various scenes are captured by various cameras that are varying in pixel rate, color combination, suppressing the noise and presentation. The calibration process find outs the important information to map individual view with real world. The result of multicamera is depend on composed functions, standardization process, scene capturing.

Hence, it is impossible to define a unique quality metric that will achieve the better quality of all multi camera systems at once. So we define a multi camera image vision with quality measure (MIVQM), which was checked with Panoramic image applications. The outcome metrics achieves the visual effects of artifact that are introduced to achieve the final image quality. This metric result serves to improve the quality measures of above examples while considering synthetic artifacts.

In multi camera systems distortions are categorized into two distortions, first is geometric distortion a n d another is photometric distortion [2]. Multiple image quality vision with measure (MIVQM) is consisting of 3 types of indices: first luminance and contrast, second is the spatial motion, and third is the edge-based arrangement. First & third are used to measure photometric distortions where as the second & third are used to measure geometric distortions.

II. LITERATURE SURVEY

Distortion found in multicamera images are categorized as one is photometric and another one is geometric distortion and Combining multicamera images. G. AlRegib et. al. [2], the author proposed that geometric and photometric distortions are the classifications of distortions in the multicamera system. L. Cui et.al. [6], the authors proposed that due to geometric distortions and photometric distortion, due to which we cannot get proper information due improper structure which include improper texture presentation. P. J. Burt et. al. [14], the authors in proposed that the multimedia image is created by grouping and merging number of images into a one single image. They also mentioned that without any distortion comparable image is build by grouping and merging number of images. J. Starck et. al. [5], the authors propose a free view point video production objective metric. These metrics utilized for managing details of structure for perfect locating scene of the 3-dimentional structure.

1. Photometric Distortion

It is first type of image distortion in multicamera systems. Examples of such type of distortions noise in available images, blurness and blocking in images. These types of distortions are intrinsic because of acquisition apparatus and extrinsic because of compression problem, problematic transmission channels and image improvement. Calculating the impact of these distortion types on quality is important to improve new video & image application. These are visible in variations in levels of brightness and color depth across complete display area.

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

2. Geometric Distortion

It is second type of image distortion in multicamera systems. Examples of such type of distortions blurness , not proper alignments and not proper continuities in images. These types of distortions are exist due to calibration errors among nearest cameras and due to scene location calculations. These are further categorized into following two form planner and perspective distortions. First one occurs due to rotating image, mapping images. Second one occurs during mapping of the image from 3 dimensional planes to 2 dimensional planes.

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.

III. PROPOSED WORK

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

a Algorithm for deriving Contrast & Luminance

b Algorithm for determine Spatial Motion

c Algorithm for deriving Edge Based Structural

i) How to calculate contrast and Luminance

a) It finds variations in luminance and contrast among structured regions.

b) Because of variation in various cameras or Various ways of processing of scene, non uniform levels of distortion occurs.

Equation for Luminance and Contrast are as

$$L_i = \frac{2\mu_i\mu_j + C_1}{\mu_i^2 + \mu_j^2 + C_1}$$

$$C_i = \frac{2\sigma_i\sigma_j + C_2}{\sigma_i^2 + \sigma_j^2 + C_2}$$

ii) How to calculate spatial motion values

a) Displacement of pixel locations of operational image with comparative image results in geometric type of distortion.

b) In 2-Dimensional such displacement is measurable to spatial motion of videos from single view.

c) The value of displacement can be determined as,

$$(M, N) = \frac{\sqrt{v_m^2 + v_n^2}}{\sqrt{2p^2}}$$

d) Photometric distortion can cause changes in intensity values and Entropy value is can be calculated as,

$$(m, n) = -\sum_{i=0}^{L} p(i)\log_2(p(i))$$

e) The index value is calculated as,

[M, N] = [(M, N)] * [(M, N)]

iii) How to determine Edge-based structural values

a) The intensity values of pixels on the edges get changes when image get blurred.

b) We can calculate such type of loss by comparing local edge information due to both type of distortion.

To determine edge based structural index,

$$E_{i,j} = \frac{1}{MN}\sum_{m=0}^{M}\sum_{n=0}^{N}\left(1 - \left|\frac{T_i[m,n]T_j[m,n]}{T_i[m,n]}\right|\right)$$

iv) Finally MIVQM is calculated as

$MIVQM_{i,j} = LC_{i,j}S_{i,j}E_{i,j}$

IV. SYSTEM DESIGN

A. System Architecture

In this architecture we show the how system works first we take one reference image then calculate its original parameters calculates its luminance, contrast and mean intensity. Then take number of images from multicamera divide all images in macro blocks then calculate mean intensity of each block. Then calculate pixel displacement value of operational image with respect to reference image. Then calculate entropy value of operational image with respect to reference image based on pixel displacement factor. Then normalize the blocks using entropy values. Then finally construct the resulted image by merging the blocks.

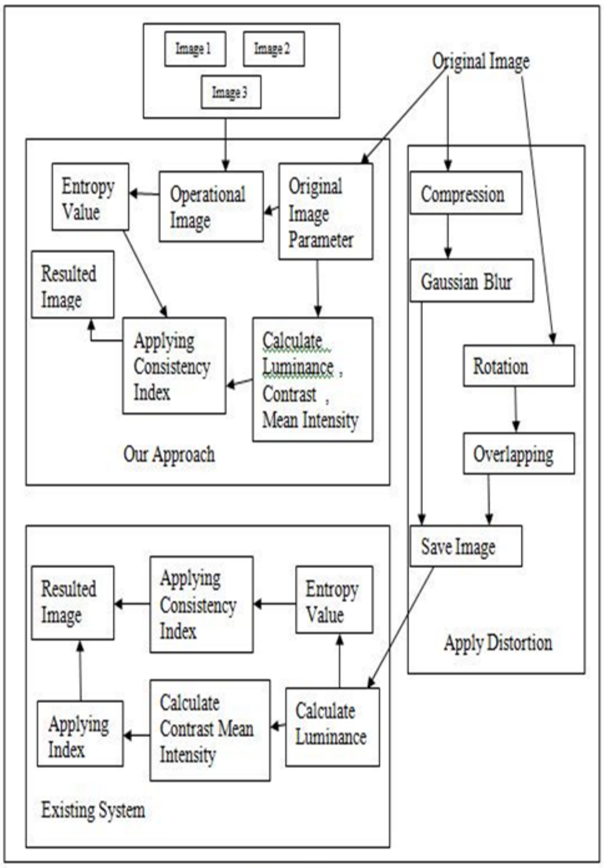

Figure1. System Architecture

B. Activity Diagrams

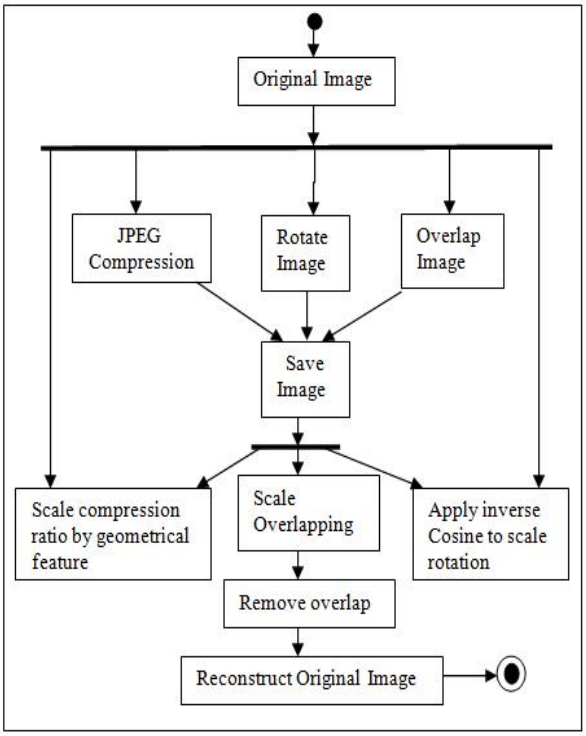

Figure 2 Activity Diagram of MIVQM for Perspective.

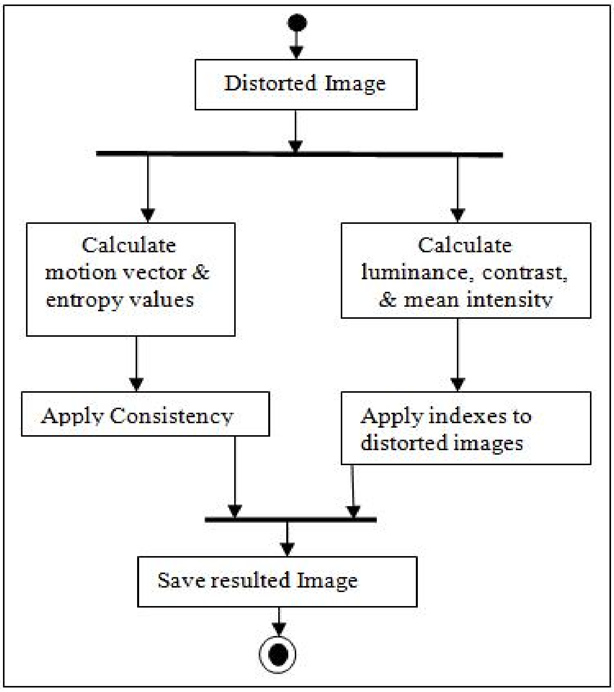

Figure 3 Activity Diagram of MIVQM for Blur Images

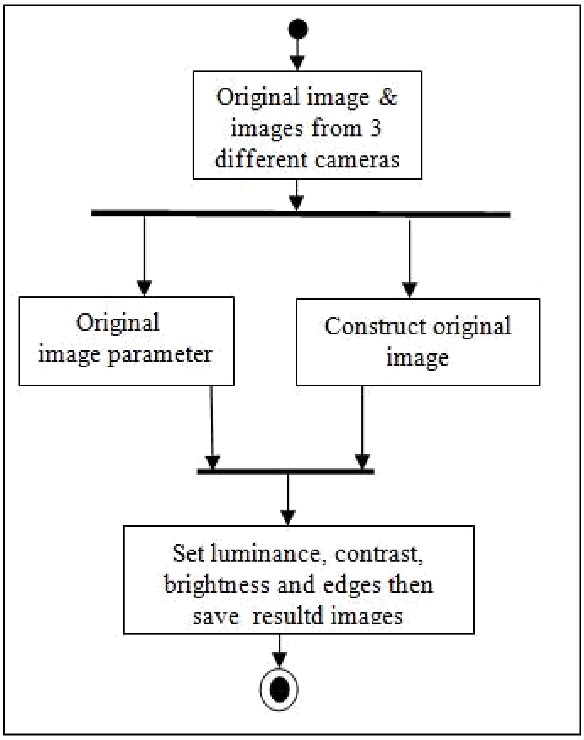

Figure 4 Activity Diagram of MIVQM

V. ALGORITHMS FOR PROPOSED SYETEM

A. Algorithm for MIQM Proposed Approach for Photometric Distortion

Assumption: Original and Distorted Images are of same size

Step 0: Start

Step 1: Get Original Image I

Step 2: Get Distorted Image J

Step 3: Dividing both the Images in Macro Blocks

Step 4: Calculate Mean Intensity μ of each Block I, J (Average of RGB Value of the Block)

Step 5: Set C1 and C2 Values to Non Zero

Step 6: FOR Each Macro Block I, J

Step 7: Calculate Luminance lI, J

Step 8: l I, J = ((2* μI *μJ) +C1) / (μI^2+μJ^2 +C1) Step 9: Calculate Standard Deviation σ of Intensity

Values of each Block I, J Step 10: Calculate contrast CI, J

Step 11: CI, J = (2 * σI * σJ) +C2 /(σI^2 + σJ^2+C2) Step 12: Apply lI on lJ

Step 13: Apply CI on CJ

Step 14: Save Resulted Image Step 15: Stop

B. Algorithm for MIQM Proposed for Geometric Distortions:

Step 0: Start

Step 1: Get Original Image I

Step 2: Get Distorted Image J

Step 3: Calculate Pixel Displacement of J WRT to I Step 4: Calculate Entropy (Average Information Of Image) of J WRT to I Based on Pixel Displacement factor

Step 5: Normalize the pixel of J Using Mean Intensity μI and Entropy

Step 6: Stop.

C. Algorithm for MIQM our Approach:

Step 0: Start

Step 1: Get Original Image I

Step 2: Get Operative Image J

Step 3: Dividing both the Images in Macro Blocks Step 4: For each of macro Blocks I and J

Step 5: Calculate Mean Intensity μ of each Block I, J (Average of RGB Value of the Block)

Step 6: Apply μIonμJ

Step 7: Calculate Pixel Displacement of J WRT to I Step 8: Calculate Entropy of J WRT to I Based on Pixel Displacement factor

Step 9: Normalize the blocks using Entropy values

Step 10: Construct Image By merging blocks

Step 11: Save Resulted Image Step 12: Stop

VI. RESULTS

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.

VII. CONCLUSION

In this work, we have presented the several multicamera systems and recognized various distortions like photometric distortion and geometric distortion which challenges quality of every multi camera applications. We discuss various examples which show how these distortions affect the quality of multi camera images. Then, we presented a Multi camera image vision with quality measure (MIVQM) as a combination of three indices measures. The derivations for every indices measure are presented. Atlast MIVQM is executed on images from database. A number of tests performed to check the images quality in database. The results and examples showed that MIVQM outperform for multi camera image quality assessment. So, it is necessary to consider the Multi camera Image vision with quality measure (MIVQM) f i x e d derivation from which we can use this method for other type of multicamera applications.. By using this MIVQM concept we can use it to remove distortions in images which are taken through different megapixels cameras and increase picture quality of image.

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