Image Identification using F-Test

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Abstract— In this paper a new rectification method is proposed. The method is simple and efficient and can deal with all possible types of images. By applying the f-test hypothesis on image we can easily rectify whether the image is real, animated or spherical. The whole rectification process is carried out directly in the images. Here what we do is we choose the block base feature extraction approach. Instead of considering each and every pixel we take few sample of pixel within a block and try to get the mean value so instead of choosing local minima approach we are choosing global minima approach which gives us approximate equal value of minima but not the exact value. Today there many algorithms for image rectification which yields accurate result but increases the algorithm complexity but complexity matters in a real time image processing algorithm. Here we do some real time basic application that reduces the complexity of algorithm and if we are doing the offline process then there will be no need to worry about the complexity of algorithm.

Key words: Local Minima, Global Minima, Real Image, Animated Image, Spherical Image, Real Time Application, F-Test

I. INTRODUCTION

In general we say the image is nothing but the two dimensional array representation i.e 2-D representation of an array.

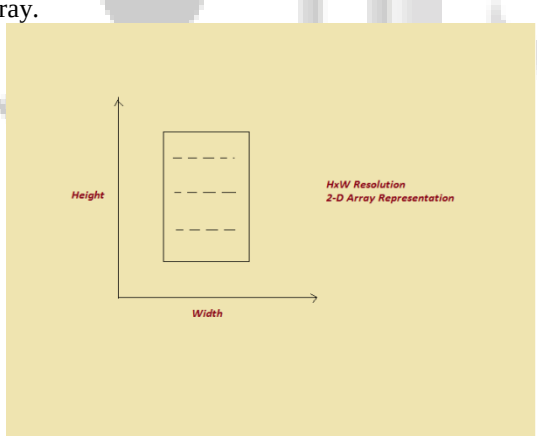

Fig. 1:

So if we say image is of 8-bit then the intensity of pixel ranges from 0-255 means 28=255 here 0 means darker pixel called black color and if it is 255,the result is the brightest represents white. For monochrome image or grayscale image or black and white image the intensity will be range from 0-255.But when we talk about color then there will be 3 matrix of primary color called R,G,B.

Y=0.299R+0.587G+0.114B

By varying the intensity of array 3 matrix we choose the exact color value which we want to display. So here the array 3 matrix represents the different matrix values .If there is a large resolution image like 720x576,1080x1920 etc. there is a high co-relation between two adjacent pixels means the exactly two nearby pixel values are almost similar. So in order to nullify this we generally used transform to nullify this redundancy and get the lesser valued bit at compression.[1] But here we can extract one more feature by testing their hypothesis for different cases. This image have patterns in their pixel values means if the image is real then there is a gradual changes of color are there where as in computer made image there is a sharp change of color can be found. So by exploring this redundancy at decoder we can rectify that whether it is a real image or animated image or spherical image by seeing the changes of pixel intensity[2]. There are many researches going on based on this problem[3]. Here we do some real time basic application which reduces the complexity of program and if we are doing the offline process then there will be no need to worry about complexity of algorithm. So what we do we choose the block base feature extraction approach[4]. In which we choose the first 50x50 pixels and try to find the mean value of it

In order to express it mathematically we can write as, for finding local minima of pixel, we find each and every pixel values and find mean value

$$MAE = \frac{1}{N^2}\sum_{i=0}^{N-1}\sum_{j=0}^{N-1}|Cij + Rij|$$

MAE stands for Mean Absolute Error.

To find the mean value globally we used an approach called as Sum Absolute Error Approach which means we are just taking few sample of entire matrix.

$$SAE = \sum_{i=0}^{N-1}\sum_{j=0}^{N-1}|Cij + Rij|$$

Thus comparison may be simplified further by neglecting the term 1/N2 and simply calculating the sum of absolute error despite of calculating the mean of it. So this the drawbacks of current research that they are not concentrating on complexity simply they gives result which is one more point we need to solve it via program.

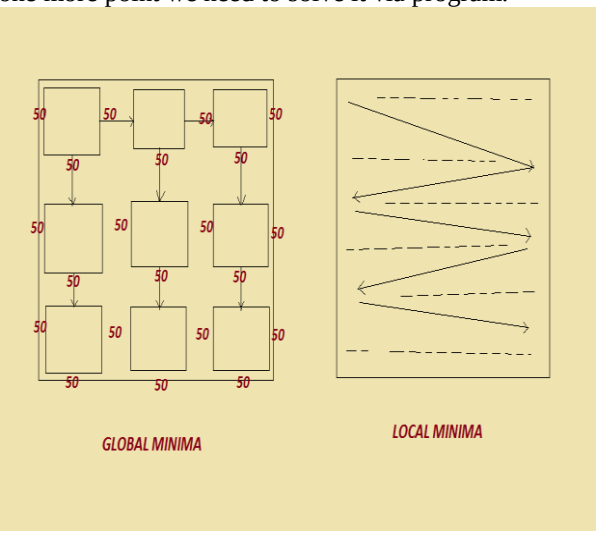

Fig. 2:

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So ,as we can see we usually tends the approximate value of block say 50x50 and apply on entire image by simply applying a for loop for a[i][j] matrix and try to find the mean value of it. If we take each and every pixel into account then it will increase the complexity, and it will give the good result but complexity matters in real time image processing algorithm. So instead of considering each and every pixel we take few sample of pixel by 50x50 block and try to get the mean value which means instead of choosing local minima approach we are choosing global minima approach which gives us approximate equal value of local minima but not the exact value. As shown in the above figure we are taking a few sample of entire image by 50x50 block instead of considering each pixels.

II. F-TEST HYPOTHESIS ON IMAGES

To find whether the image is real, animated or spherical. We have three hypotheses:

1) H0 : Image is Real
2) H1 : Image is Animated
3) H2 : Image is Spherical

Here in this hypothesis we know that image will be any one of this hypothesis by some standard test theorems. Here we are going to compare the variance of the population of this 50x50 blocks . F-test theoretically defines the equality of variance of populations

$$F = \frac{Greater\text{var}iance}{Smaller\text{var}iance}$$

Here we will check the variance of each 50x50 blocks and compare with population means of image pixels by using above formula. And we will find that if there is the much more difference in the value then the sample mean then we will consider H0 is true. If the variance comes small value then we will consider it as a animated image and H1 is true. If the variance comes much smaller value then we will consider it as a spherical image hence H2 will be true. This can be implemented by just putting some threshold value and by applying simply nested if-else loop. So now how this H0, H1, H2 will come true theoretically let's see:

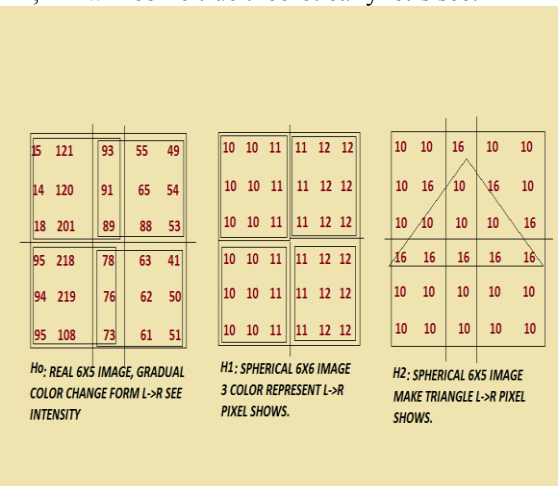

Fig. 3:

A. For Ho Real Image:

There are so many pixel changes are the cause of real life light scene changes, contrast, camera focal length adjustment etc make its value gradual changes. If you see it silently as you move from left to right, it decreases the value means it changes from brighter color to lighter color. Now take if we apply 3x3 block unit & find mean value of that then mean value comes like…

So for first block
(15+121+93+14+120+91+18+201+89)/9 = 762/9 = 84
For others like
(93+55+49+91+65+54+89+88+53)/9 = 637/9 = 70
For bottom ones,
(95+218+78+94+219+76+95+108+73)/9 = 1056/9 = 117
Rest of bottom
(78+63+41+96+62+50+73+61+51)/9 = 555/9 =66
So as we can see, here there are large changes of variance in real life image, so in that case we will say H0 is true & it is a real image.

B. For Animated Image Case:

Here animate images are made in the distinct range of column of pixel intensity because it is created by computer & in that there is no constraint of light scene variation, camera focal length etc. So there will be sharp changes come while color changes.

So if we take a block and we take a mean of it, it will come less different invariance.
So for first block
(10+10+11+10+10+11+10+10+11)/9 = 93/9 = 10
For second block
(11+12+12+11+12+12+11+12+12)/9 = 105/9 =11
For third block
(10+10+11+10+10+11+10+10+11)/9 = 93/9= 10
For fourth block
(11+12+12+11+12+12+12+12+11)/9 = 105/9 =11

So here there is less difference we can see in variance, So in such case we will say H1 is true and it is a Animated image.

C. For Spherical Image:

In a spherical image of shape like square, circle, triangle etc are the spherical shapes.
If we take the image of this we find that there will be almost negligible variance difference with core.
Let's check it
For first 3x3 block the mean will be
(10+10+16+10+16+10+10+10+10)/9 = 102/9 = 11
For second 3x3 block the mean will be
(16+10+10+10+16+10+10+10+16)/9 = 108/9 = 12
For third 3x3 block the mean will be
(16+16+16+10+10+10+10+10+10)/9 = 108/9 = 12
For fourth 3x3 block the mean will be
(16+16+16+10+10+10+10+10+10)/9 =108/9 =12

So as a result shows, due to spherical shape there is a very minor changes we observed in a variance so at time we will say like this is a spherical image , H2 is true.

So this is a theoretical concept of determining the variance which is proportion to same concept we are applying in our image data mining project. So in order to justify simplicity and reduce complexity we take here 50x50 block because at input we don't know the resolution or the size of image, So for minimum criteria we choose 50x50 block. After choosing block we apply it on a image to find the variance by nesting for loops for both rows and columns of an image a [i] [j] and then we will compare these variance and determine some threshold value that if the value lies

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above 50 then the H0 is true and the image is real .If the value lies above 25 and less than 50 then H1 is true and the image is animated. If the value lies below 25 then H2 is true and the image is spherical. Here thresholding value 50 and 25 we are chooses as per by several trials and experiments.

D. Algorithm to Implement:

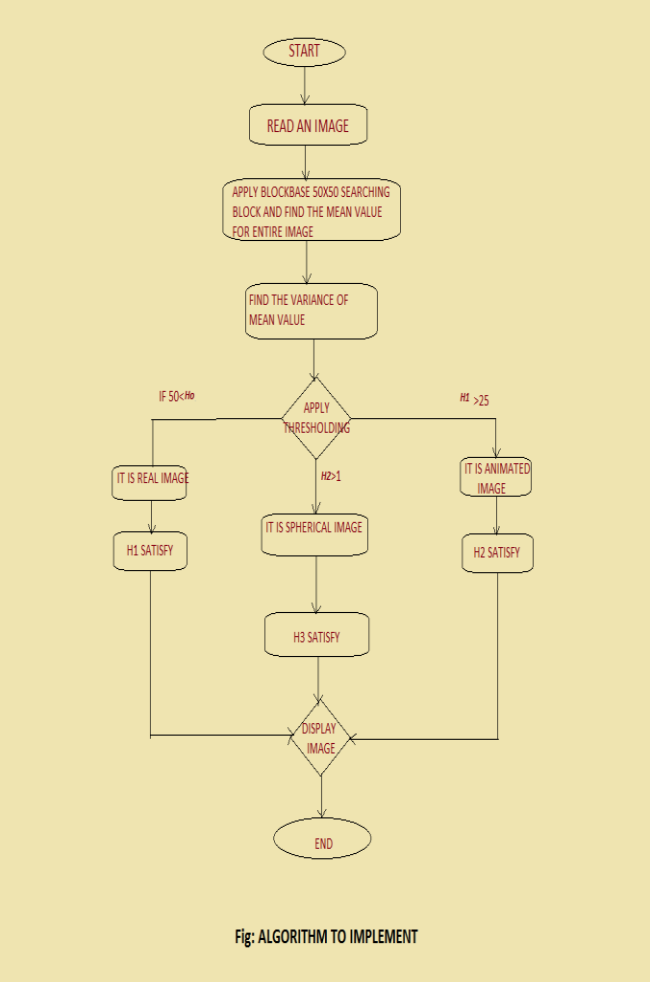

Fig. 4: Algorithm to Implement

III. RESULT AND DISCUSSION

As an example we have taken a computer generated image and an image from a camera which are shown below in figure 1,2, 3 and 4.

Fig. 5:

Fig. 6:

Fig. 7:

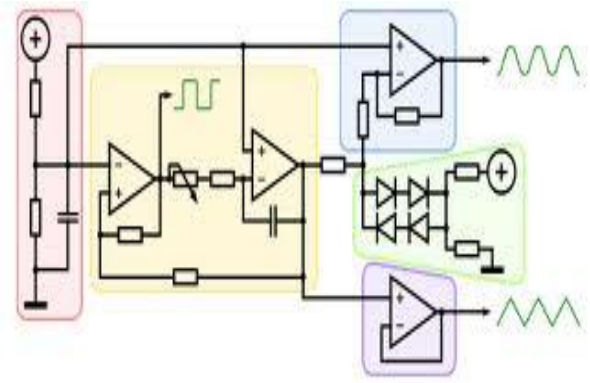

Fig. 8:

After applying the F-test hypothesis on figure .1 to 6, we get the following output

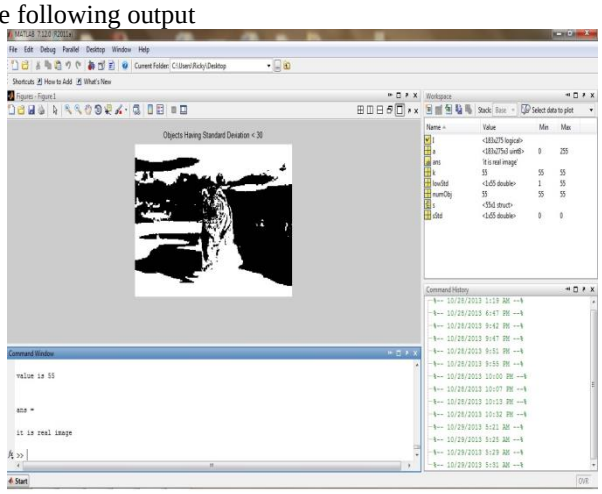

Fig. 9:

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As we can see the figure.1 is a real image as the value is coming 55 which is greater than 50.There is a large change of variance so we can say Ho is true and the image is real.

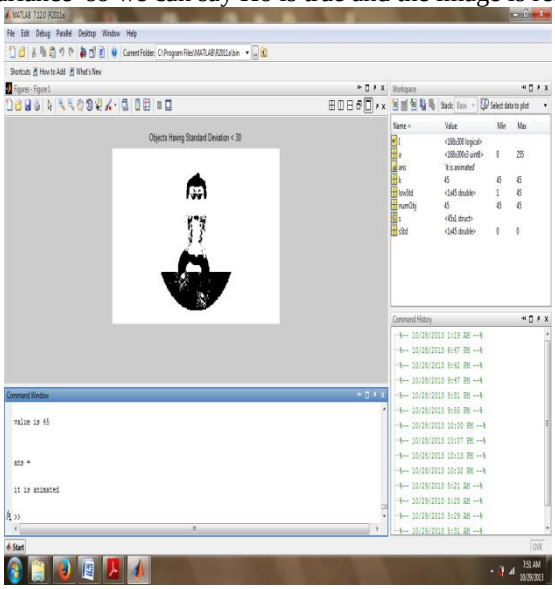

Fig. 10:

As we can see the figure.3 is an animated image as the value is coming 45 which is less than 50.There is a less difference we can see in a variance so we can say H1 is true and the image is an animated image.

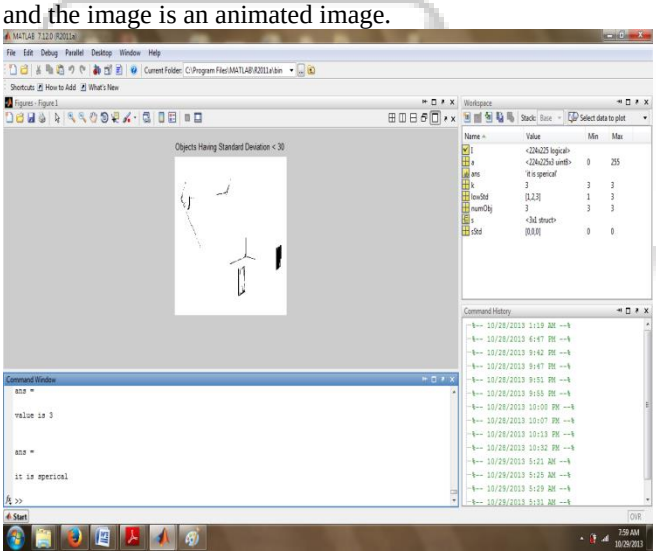

Fig. 11:

As we can see the figure.4 is a spherical image as the value is coming 3 which is much more less than 50.There is a very minor changes observed in a variance so we can say H2 is true and the image is a spherical image.

IV. CONCLUSION

In this paper we have proposed a new rectification algorithm. Although the procedure is relatively simple it can deal with all the possible images. In addition it guarantees the approximate equal value of local minima. Advantages are taken of the fact that the complexity of an algorithm is reduced and the result is very approximate. The method was implemented and used in the context of global minima approach and F-test hypothesis. The possibilities of this new approach are illustrated with some results obtained from real life image and computer generated image.

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