

A NOVEL REAL TIME APPLICATION OF DIFFERENTIAL LAPSE TECHNIQUE

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ABSTRACT: *In today's rapidly growing era communication field is the most researched area in which now and then we see new technologies coming in the market. The communication application mainly uses either images or technique communication system for understanding about any subject. Technique Communication is the most versatile application which has seen many advances since last few years. With the understanding gained from the time lapse technique, the proposed work describes a real time application of the differential time lapse technique which has been experimented on two real time applications and the results obtained are analyzed and justified with the theoretical value. Time Lapse technique capturing approach is an efficient mechanism to record the events that are processing / developing / moving very slowly. In this approach, a series of snaps of a subject under study are taken at a regular interval of time. and finally selected frames are arranged in a sequence to form a small technique file. Differential time lapse technique is the technique which allows removing the irrelevant details from the technique file. This reduces the time required visualize the whole technique as well as it reduces the storage requirements of the particular technique file. One of the most vital applications of the differential time lapse technique can be in the sorting of the goods by comparing the reference image of the standard frame with the other goods which needs to be sorted out some predefined fashion. The proposed algorithm has been implemented in MATLAB and the results as tested for certain case study has been discussed to prove the efficiency and accuracy of the method.*

Keywords— *Time Lapse Technique, DTLV, Lossless Watermarking, Pixel difference value.*

I: INTRODUCTION

Time lapse technique is an handy method which has proved to an efficient mechanism for visualizing the processes that are changing at a very slower rate and also which needs to be monitored in real time. Time Lapse technique are mostly used to capture the natural phenomenon like motion of sun or a growing process of a plant or any other natural process which takes very large amount of time in terms of days or years for its completion. In time lapse techniques mostly the frames are captured at a much lesser rate as compared to its playback speed. The camera which is connected to the system takes the live streams of the frames that can be easily processed by the Matlab algorithm which has been designed to process the various frames. Periodic form of Time Lapse technique can be formed by sampling the live frames which are taken at a regular interval of predefined time. These periodic time lapse technique can be much more useful to study the natural phenomenon. For representing the non natural phenomenon, a special form of non periodic time lapse technique which is known as Differential Time Lapse Technique can be used [1]. In the case of the differential time lapse technique several frames are

arranged to form a technique files. These frames are selected on the basis of the predefined criteria. Initial or the first frame is stored first in the technique file. The next frame selected is compared with the previously stored frame by a pixel to pixel bit mapping algorithm. For the cases only when the pixel difference value has variations greater than predefined static value that particular frame is stored in the formation of the output technique file. For the frames in which the pixel value is differed by an amount greater than Pixel Difference Value (PDV), that particular pixel is treated as a modified pixel [2,3]. The total number of such modified pixels are recorded and if the total number of modified pixels are more than 20% (Value may change according to the application requirements) of the number of pixels in the frame, than that particular frame is selected and stored in the output technique file. In the case if the modified pixel value is less than specified value (20 % here) than that particular frame is discarded. All the frames selected as per the pixel mapping algorithm are processed by a visual lossless watermarking algorithm so as to get date and time stamp on each frame. Here we have used lossless

water marking method so as to get the finer details of the subject under study.

II: DIFFERENTIAL TIME LAPSE TECHNIQUE

For the frame selection from the live streaming captured by the technique detecting device, edge detection method, bitwise pixel mapping technique etc can be used. The goal should be to have a simplest algorithm which provides accurate results in smaller time span. This is required as we are designing a real time application [4]. In the proposed method we have used a bit by bit pixel mapping based algorithm to detect the variations. A simplified general algorithm for the DTLV is as shown in the figure 1. The first frame captured by the camera gets stored as the default image in the technique file for every process. All the successive frames undergo a test via pixel mapping algorithm to check and analyses the variations. If the variations are more than the predefined value than those particular frames are saved and rest all frames are discarded [5]. Such images are to be discarded which has changes in the intensity level but does not have any remarkable modifications on the subject under study.

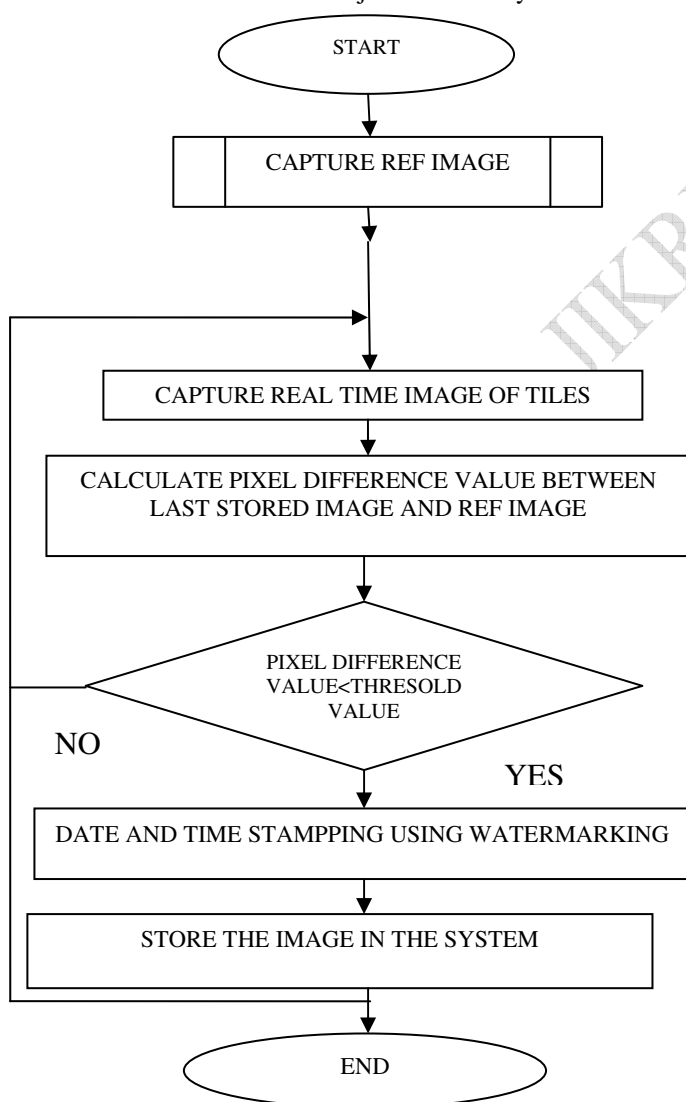


Fig 1. Algorithm for Differential Time Lapse

Technique

III: EFFECT OF ENVIRONMENTAL CHANGES

As shown in the sequences of images in below figure, the pixel values are multiplied by a factor 2.5 according to which the contrast level also changes.

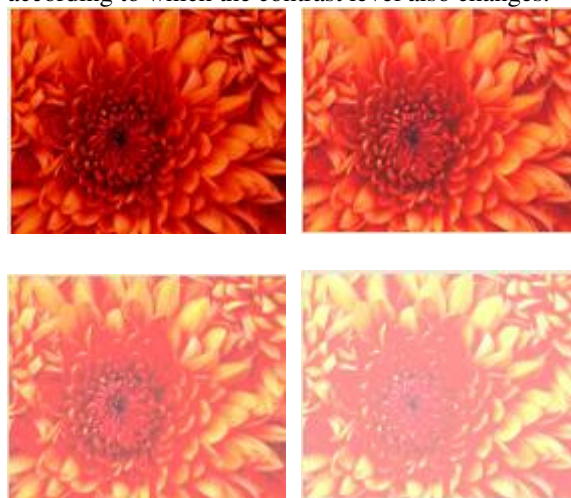


Fig 2. Effect of variation in Contrast

Following example describes the sequence of images in which the pixel value is successively added up with a factor of 15, so as to increase the brightness of the particular frame. The changes which are taking place may not be visible for a sequence of images that are taken at a regular interval of time. The changes can be seen if we have a comparison of the first and the last image. As per the proposed work the frames which have variation in brightness / contrast should not be selected for the calculation of the results of separation of the tiles. To avoid such conflicts the pixel threshold value is set at around 20 or higher, so that the effect of the brightness and contrast are eliminated from the final output.



Fig 3. Effect of variation in Brightness

IV: SELECTION CRITERIA OF FRAME

The effect on the frames due to the pixel difference cut off can be viewed and understood with the help of the following example in which a sequence of snaps are taken at a periodic or we can say regular interval of time as described below.

Table 1. THE PIXEL DIFFERENCE VALUE FOR DIFFERENT PDT AND PDC FOR FIGURE 2 (READING X/150)

5411	5405	5352	5023	4947	4695	4572	4365	4064	3472	2905	2477	1993	1318	374	0
5653	5627	5617	5186	5036	4841	4709	4500	4124	3452	2762	2289	1659	674	0	374
5309	5287	5184	4793	4617	4422	4204	3980	3492	2806	2077	1410	572	0	674	1318
5027	4955	4867	4457	4256	3924	3646	3338	2838	2146	198	425	0	572	1659	1993
4984	4861	4812	4328	4105	3707	3408	3035	2395	1521	467	0	425	1410	2289	2477
4943	4842	4742	4157	3887	3414	2981	2619	1788	635	0	467	198	2077	2762	2905
4404	4257	3394	3382	3080	2578	2103	1496	583	0	635	1521	2146	2806	3452	3472
3769	3514	3292	2716	2234	375	1125	396	0	583	1788	2395	2838	3492	4124	4064
3413	3117	2847	2307	1787	1088	403	0	396	1496	2619	3035	3338	3980	4500	4365
3034	2766	2492	1820	1139	391	0	403	1125	2103	2981	3408	3646	4204	4709	4572
2739	2377	1983	1160	360	0	391	1088	375	2578	3414	3707	3924	4422	4841	4695
2194	1714	1092	314	0	360	1139	1787	2234	3080	3887	4105	4256	4617	5036	4947
1653	1000	348	0	314	1160	1820	2307	2716	3382	4157	4328	4457	4793	5186	5023
837	290	0	348	1092	1983	2492	2847	3292	3394	4742	4812	4867	5184	5617	5352
193	0	290	1000	1714	2377	2766	3117	3514	4257	4842	4861	4955	5287	5627	5405
0	193	837	1653	2194	2739	3034	3413	3769	4404	4943	4984	5027	5309	5653	5411

The pixel difference values are calculated for pixel difference threshold equals to 20 and 30, shown in table 1. The reading on right-top above diagonal zero are for pixel difference threshold set to 20, while the reading on left-down below diagonal zero are for pixel difference threshold set to 30. The color cut off map is shown for different pixel difference cut off values set to 5000, 9000, 12000, 17000, 21000 and 25000. The reading shown in the table should be multiply by 100 to get actual value of pixel difference cut off. It is easily seen from the table as the time difference increased the difference in pixel values are increased. However, at one stage this difference cross the reference level and that frames are selected for store. It is easily seen from the table that, the effect of threshold again makes large contribution in selection of the frame. If the threshold is kept low too, fine details are also covered. If threshold is kept high,

only large movement will be covered. However, we have to trade off between the fine detail and size of the image.

Result Analysis :

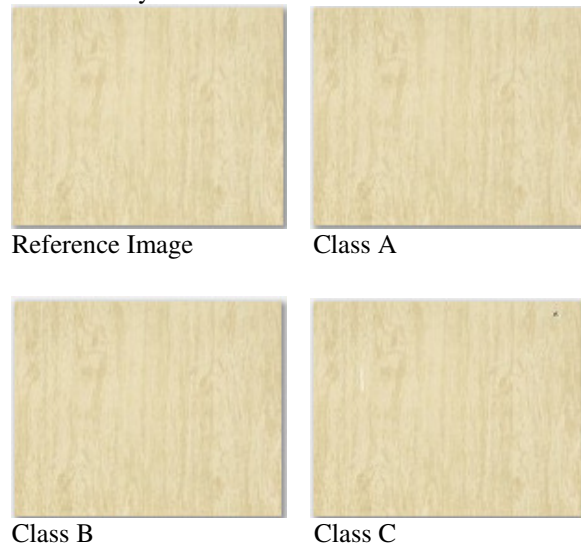


Fig 4. Result: Case I

The proposed algorithm has been designed to categorize the vitrified tiles according to their quality in three different classes. For this differential time lapse technique has been used which compares the reference image with the other images of the tiles and provides the results according to the pixel difference value. The pixel difference value for different class has been predefined as a static value for a given situation. Here in this case the pixel difference values are 21, 65 and 171 for class A, class B and class C tiles respectively. Following figure describes another example of the other kind of tiles.

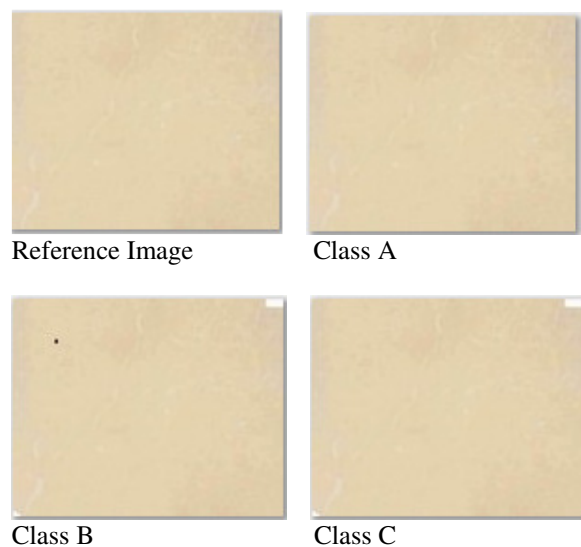


Fig 5. Result: Case II

The number of the frame if selected are high some fine details can be covered, hence depends on the applications the threshold and the selection criteria should be finalized. The table along with the graph for the sequence of the figure is shown above for the different threshold value like 10, 15 and 20 respectively. In the graph the different color maps are used to shows the different pixel difference value. The pixel difference values are increasing more rapidly in pixel difference threshold set to 20 compared 30. The change in color are made to show that the different cut off values set to 5000, 9000, 12000, 17000, 21000 and 25000.

V: DATE & TIME STAMPING

The selected frames which have changes as per the algorithm are stored in the final technique file. While capturing the frames, the date and time at which that particular frame has been captured becomes very much important in understanding the finer details of the subject under study. For these date and time stamping a lossless visual watermarking method is used. Here the date and time of the system with which the frame capturing device is connected while implementation is considered to be as the reference time. The stamping method results into the numeric characters that are represented with the help of the binary representation as shown in the figure 6 [6,7,8,9].

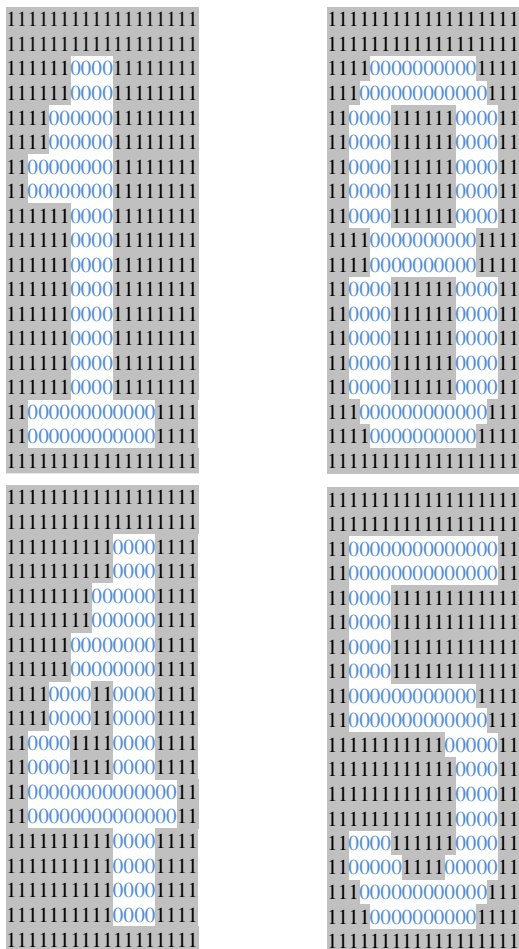


Fig 6. Time-stamping using Visual lossless Watermarking

With the help of the lossless watermarking algorithm the pattern for each character to be stamped if found. Algorithm also produces resultant pixel image of size 20x18. For each predefined location pixel to pixel mapping is done. In the numeric character if the pixel value is equal to 1, than the respective image pixel is kept as it is. If the pixel value is not equal to 1 than the pixel value is increased by a factor of 30 percent or reduced by same percentage depending on whether the pixel is bright or dark. Figure 6 shows the original, time stamped and recovered image.



Fig 7. Time & Date stamping Analysis

The numbers are stored in the form of binary digits having array of 20x18 characters. The numbers which are denoted by '0' are highlighted and it represents the character to be displayed. With the help of a MATLAB based algorithm time stamping is done for the recorded images. The locations where the time stamp is to be done are fixed within the pixel values ranging from 1:20 x 1:144 for date stamping and 21:40 x 1:144 for time-stamping.

VI: CONCLUSION

One of the most important features of the proposed work here is that it provides efficient method for real time applications such as described here. The classification of the tiles done here is 99.99 % accurate and it takes much lesser time than the manual efforts which may not such accurate. With the help of the proposed work, vitrified tiles factories can have automated system for saving the crucial man power. Also the proposed work can be modified for different pixel values for getting the finer sorting of the tiles. So we can say that this particular real

time application can easily be modified for future requirements.

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