



Digital Image Magnification Using Modified K times Image Zooming Technique

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ABSTRACT:

Nowadays in digital image processing techniques, magnification process is aimed at enlargement of the size of the image. Numerous studies involving the magnification of digital images already employed previously were often used to magnify or enlarge a particular region of interest of the digital image. This research is aimed to create new technique in digital image magnification with k times zooming method which is called modified k time zooming method . The magnification process is created by using a method similar to k times zooming method by eliminating the drawback that k times zooming method have . The proposed method i.e modified k times image zooming method gives the advantage that k times image zooming method have over nearest neighbor interpolation and bilinear interpolation but by eliminating the difficulty of the k times image zooming method of sorting at the end .

KEYWORDS:Digital Image Magnification , K Times Zooming , Bilinear Interpolation , Nearest Neighbour Interpolation, Sorting .

I. INTRODUCTION

Nowadays, Digital Image processing finds major application in quite a few important sectors in day to day lives. As for example it has found wide application in the medical field, remote sensing, machine vision, pattern recognition, video processing and hence in film and entertainment, microscopic imaging and many other fields.

This paper concentrates on zooming of images which is an integral part of digital image processing[1]. By zooming an image basically an image is enlarged or a particular part of the image is enlarged with the help of certain mathematical transformations or formulas so that a magnified, clear and detailed image or a part of image is obtained without much noise in it, from the input image. There are various applications of imagemagnification or zooming such as digital video, magnification of images over the internet, magnification of images sent from satellites, magnification of images from surveillance cameras, magnification of images from medical field, compact discs, visible wireless telephones, digital camera[2], database containing images, electronically published images etc.

For users to have fine and better images , images needs to be zoomed in or zoomed out totally or certain parts of it, images may even require to reproduce to better resolutions from lower resolutions or vice versa. Resizing of an image is thus required when it is required to decrease or enhance the number of pixels of an image and even remapping may be required in different cases such as lens distortion correction, perspective change and rotation of images.Zooming can be viewed as the homogeneous scaling of a certain part of an image which is considered as the region of interest, that is the part of image to be zoomed. It can also be the whole image itself in a special case. One of the most interesting and amazing feature of a digital image is that mathematical and analytical operations can be performed on it. This feature and technique might help to get information and clues about various things. For example medical scientists and neurologists might like to zoom into specific regions of interest of a MRI scan or PET scan of a person for their further analysis or for deciding their following course of action. Detective agencies might be interested to zoom into specific regions of various digital images of surveillance cameras to get clues for their cases. Also for better browsing speeds over the internet one may require to convert higher resolution images to images of lower resolution over specific link in the internet.

The zooming algorithms in general use the pixels given in the input image and try to maintain as much information possible from the input to the output image and try to minimize noise in the output image as much as it is possible. But

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for higher zooming factors and edges in the image where there is very large amounts of sudden changes in the pixel data the zoomed output image is not able to match up to the quality of the input image. Also considering the fact that one needs to achieve speed, quality and accuracy, they are quite difficult to get with the same algorithm or technique, as there is no general unifying theory of image enhancement [3].

So in this paper focus is given to remove the disadvantage of sorting various pixel data required in the K times zooming technique and thus enhance the speed of the algorithm.

This paper consists of the following sections:

- Image zooming technique reviews
- Proposed method of zooming the image
- The results of simulation and related discussion
- Conclusion
- Scope of further development work

II. IMAGE ZOOMING TECHNIQUES REVIEWS

Various kinds of interpolation techniques[4] form the basis of majority of the common methods of zooming images. Image magnification is done using interpolation on the digital input image to obtain the zoomed output image. One of such conventional interpolation technique is pixel replication method (or nearest neighbor interpolation) in which replication of the neighboring pixels are done. Another technique is bilinear interpolation method [5]. In order to magnify the input image, pixels need to be inserted into it and the values to be inserted in the input image to generate the zoomed output image. These new pixel values are generated using interpolation from the surrounding pixel values of the original input image to be zoomed. Even there have been application of weighted medians to interpolate values of new pixels, for example in interfacing progressive video conversion in television systems. The utility of weighted median techniques[6] was quite handy in the preservation of edges present in the original input image as the distortion of the image in the edges were significantly reduced. For a better idea let's take a small matrix (since an image is represented as a matrix format) that is to be zoomed 2 times using the median values of the two closest pixels (of the original input matrix) neighboring to the new pixel is utilized:

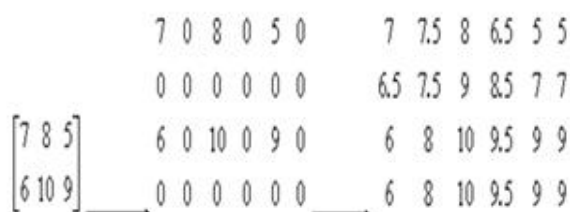


Fig 1. Interpolation Concept

By the zooming of an image we understand that we have to increase the dimensions of an image according to a provided input factor. For example if the input zoom factor is 100% then the output image needs to be 2 times of the input image. There might also be the requirement of different zooming factors lengthwise and a different zooming factor breadthwise, needing a different length to width ratio of the output image compared to the original input image. Now let us suppose that we are provided with a common factor by which we need to magnify the image, the easiest way would be to keep on doubling the original input image using interpolation unless we zoom the image by a factor just greater than the input zooming factor provided to us and then we can subsample this larger image at regular intervals to match the input zooming factor provided to us. Through interpolation one tries to approximate the pixel color and its intensity. Such an image magnification technique is shown in the following example shown below:

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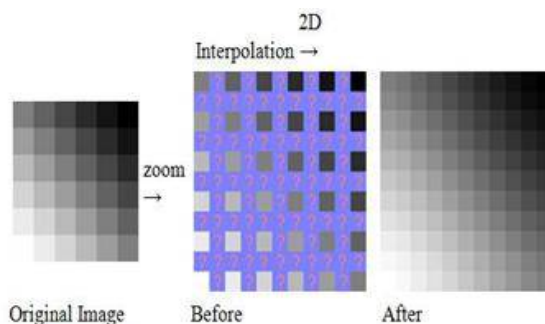


Fig 2. Image Zooming Based on Interpolation

But in real life images and the images that we deal with most frequently the pixel values might change quite abruptly from one pixel to the neighbouring pixel unlike the example provided above. Better interpolation can be performed by acquiring more knowledge of the surrounding pixels. So deterioration of results is more rapid when an image is stretched, since no details are added to the image that is absent by the method of interpolation. Interpolation can be adaptive and nonadaptive. Changes in adaptive methods are based on what they are interpolating (like smooth texture vs. sharp edge), whereas all pixels in the image are treated equally in case of non-adaptive methods. Other methods in image zooming include Partial Differential Equations and method based sampling [3].

III. PROPOSED METHOD OF IMAGE ZOOMING

The method which is being introduced here is a modified K times image zooming technique which will eliminate the drawback that K times image zooming [10] have. K times image zooming is one of the most perfect zooming algorithm which is better than pixel replication (nearest neighbour) method and bilinear interpolation method because it overcomes the challenges of both bilinear interpolation and pixel replication. Here K in this K times zooming algorithm stands for zooming factor. The working principle of K times image zooming is shown below before presenting the Modified K times image zooming method.

Working of K times image zooming method

Step 1: First of all, two adjacent pixels are taken row wise. Then the smaller pixel value is subtracted from the greater one. We call this output (OPT).

Step 2: The output(OPT) is divided with the zooming factor (K). Now the result is added to the smaller value and is placed between those two adjacent pixels.

Step 3: OPT value is added again to the value just placed between adjacent pixels and is again placed in between the previous putted value and the pixel which had the greater pixel value taken in step 1. This step is repeated until k1 values are placed between the two pixels taken in step 1.

Step 4: After inserting the values k1 times between the adjacent pixels, the inserted values are sorted, so there remains a symmetry between them.

Step 5: Whole process from step 1 to 4 is repeated but with next two adjacent pixels rowwise till row length 1 times for each rows in the image matrix.

Step 6: Now two adjacent pixels are taken column wise. Then the smaller pixel value is subtracted from the greater one. We call this output (OPT).

Step 7: The output(OPT) is divided with the zooming factor (K). Now the result is added to the smaller value and is placed between those two adjacent pixels.

Step 8: OPT value is added again to the value just placed between adjacent pixels and is again placed in between the previous putted value and the pixel which had the greater pixel value taken in step 1. This step is repeated until k1 values are placed between the two pixels taken in step 6.

Step 9: After inserting the values k1 times between the adjacent pixels, the inserted values are sorted, so there remains a symmetry between them.

Step 10: Whole process from step 6 to 9 is repeated but with next two adjacent pixels columnwise till row length 1 times for each columns in the image matrix

Now the zoomed image is obtained.

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Working of Modified K times image zooming method (The Proposed Method):

Step 1 : m = number of rows of the input matrix A. Step 2 : n = number of columns of the input matrix A.

Step 3 : Now the input matrix A with m rows and n columns , $[A (m,n)]$ is created.

Step 4 : Now the elements of the matrix A are taken as input and the Matrix $[A (m,n)]$ is prepared.

Step 5 : k = input for the amount of zooming required is taken as input.

Step 6: We now prepare a matrix B with m rows and $\{n + (n-1)*(k-1)\}$ columns . [Since for row wise zooming we need to insert $(k-1)$ elements between each adjacent pixels of each row .].

Thus the B matrix now prepared is like ,

$[B (m, \{n + (n-1)*(k-1)\})]$. Also, let us take , $z=n+\{(n-1)*(k-1)\}$ or, $z=(n-1)*k+1$;

Step 7 : Now, the matrix B is prepared with the help of the following pseudo code:

```
for(i=0;i<m;i++)
{
    j=0;    B[i,j]=A[i,j];
    for(j=1;j<n;j++)
    {
        B[i,(j*k)]=A[i,j];          s = {B[i,(j*k)]-B[i,((j-1)*k)]}/k;
        for(l=k-1;l>=1;l--)
        {
            B[i, {(j*k)-l}] = Round(B[i,((j-1)*k)] + {(k-1)*s} );
        }
    }
}
```

Step 8 : So, in the 7th step k times zooming is done row wise and an intermediate matrix B is obtained , note that sorting [5] is not required at this step as the values are already placed in a sorted manner.

Step 9 : Now after this we prepare a matrix C , which will be our output matrix , i.e. the matrix which is zoomed k times, column and row wise.

So, this matrix will be having $\{m + ((m-1)*(k-1))\}$ rows and $\{n + ((n-1)*(k-1))\}$ columns.

So, now the C matrix to be prepared will be like : $[C (\{m + (m-1)*(k-1)\}, z)]$.

Now let $y=m+\{(m-1)*(k-1)\}$ or, $y=(m-1)*k+1$;

Thus the C matrix prepared is like $[C(y,z)]$.

Step 10 : Now the values in the C matrix are inserted with the following pseudo code in the following manner:

```
for(i=0;i<z;i++)
{
    j=0;
    C[j,i]=B[j,i];
    for(j=1;j<m;j++)
    {
        C[(j*k),i]=B[j,i];
        s = {C[(j*k),i]-C[((j-1)*k),i]}/k;
        for(l=k-1;l>=1;l--)
        {
            C[ {(j*k)-l}, i] = Round(C[((j-1)*k),i] + {(k-1)*s} );
        }
    }
}
```

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}

}

Step 11 : The output , that is the zoomed image matrix is the C matrix.

Step 12 :End

[Note:-For all the above matrices A,B & C, we consider that the starting index of each matrix is (0,0) .]

So, here we can see that sorting is not required at the end , i.e. in this modified K times image zooming technique , hence one of the disadvantages of K times zooming technique can be avoided by using this modified k times zooming technique .

IV. SIMULATION AND RESULTS

We have performed quite a few simulations with the modified K times zooming technique as discussed in this paper with grayscale images as input. We have performed the simulations using Octave 4.0.0 [6].

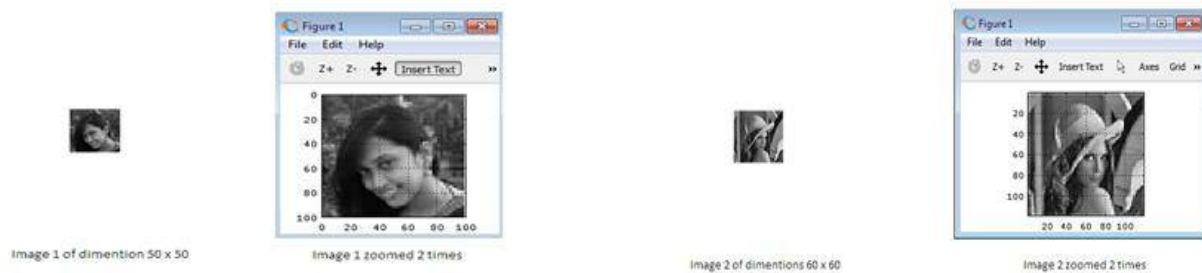


Fig. 3. Image 1 of dimension 50 x 50 zoomed 2 times

Fig 4. Image 2 of dimension 60 x 60 zoomed 2 times

It is observed from the resultant images that our modified k times zooming technique gives similar result when normal k times zooming method is applied. But the drawback of the k times zooming method which requires the sorting of the newly inserted pixel values at the end is eliminated by our proposed modified k times zooming technique.

V. CONCLUSION AND FUTURE WORK

The So, in fact in this paper an enhanced method of zooming images is being proposed , that is the “modified K times zooming technique”, which is based on the idea of speeding up the already existing technique of “ K times image zooming ”.

Through the proposed technique the aim is to achieve the same quality of zooming as obtained from K times image zooming technique but to eliminate its drawback of sorting the newly inserted pixels at the end. This proposed method have been tested for various standard grayscale images[14] as input for various values of K, that is, the zooming factor. The various simulations have shown that the modified K times zooming technique is better than the existing standard K times zooming technique in terms of speed as sorting is removed in the calculation.

Using both the algorithms i.e K times zooming technique and the one discussed in this paper i.e modified K times zooming technique a common problem is found. The problem is that the low frequency components[15] in the image gets zoomed quite well but the algorithm faces problem zooming the high frequency components[16]. Wherever there are edges in the image it is found that a certain level of distortion is associated with it. That is for high difference of pixel values for contiguous pixels in the original input image poses problems for the quality of the output image. Thus there is the need of further enhance of the algorithm for edge detection, filtering technique application and enhanced mathematical and analytical modelling so that this problem can be minimized or may be eliminated completely.



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BIOGRAPHY



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