ISSN: 0975-766X
CODEN: IJPTFI
Available Online through Research Article
www.ijptonline.com

HIGH QUALITY IMAGE SCALING USING INTERPOLATION TECHNIQUES WITH FILTERS

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Received on: 10.08.2016 *Accepted on: 06.09.2016*

Abstract:

The present paper dealing with Image scaling is the procedure of resizing a digital image, the digital image is converted from low to high resolution and low to high dimension without losing the natural content. It has many phrases in documentsuch as image bilinear interpolation, images resampling, digital resizing, image magnification. The proposed method is implementing two types of non-adaptive and adaptive interpolation algorithms two types. The proposed interpolating from low to high resolution as expected up scaling\up sampling and high to low resolution is down scaling\down sampling.

The proposed method is non-adaptive image bilinear interpolation algorithm to scale images for any given scaling ratio with an improvement scheme to ensure a better image quality metric of the scaled image. The proposed method which has two reference images used one is higher resolution and another one is lower resolution from generated input image and image scaling process.

Keywords: image scaling, filtering, sampling, interpolation.

Introduction:

Digital Image scaling is the procedure of resizing a digital pixel image, involving a deal between efficiency, smoothness and sharpness. In the proposed algorithm, two reference images, one with higher resolution and another with lower resolutions are created using the unique input image and scaling issue. These reference images are used to interpolate two Intermediate images. This process of resizing is referred in documents by many phrases, such as image interpolation, image resize image,un-sampling,digital increasing,and itting images magnification. Animage interpolation algorithm is recycled to change an image aftersingle resolution (dimension) to anotherresolution without loss of natural content in the picture. Image interpolation algorithms can be categorized two types, non-adaptive and adaptive [2,3,4]. In non-adoptive algorithms, computational reason is staticregardless of the input image features, whereas in adaptive algorithms computational logic is dependent upon the central image structures and subjects of the input images. When the image is interpolated from a high resolution to a low resolution it is called image down scaling (or) down sampling. when the image is interpolated from a lesser resolution to a developed resolution, it is mentioned as image upscaling (or) up sampling [5,6]. The bilinear interpolation has variety of applications like computer graphics, editing the picture, medical image construction (or) reconstruction. In detail scaling up is used enlarge the medical images display, scaling down is applied to compress an image to fit size. Tools of image processing viewers such as Adobe Photoshop CS2 software, Fast Stone Photo Resizer, Photo PosPro, Xn Convertetc, Several digital image scaling methods have been offered, of which the most popular methods are: pixel repetition based on nearest neighbour additional algorithm, Pixel interpolation based Bi-linear, Filter/Kernel [7,8]. The proposed system can scale images to any assumed scaling ratio it performs upscaling and down scaling. The images of changing sizes ranging from 150x250, 220x220, 800x600, 600x912 etc.

The screen images with decent visual quality require strong texts and planeimages since this two parts attract most of the visual saliency [9,10]. Therefore, effectiveshade image scaling proceduremust be adaptive to both text and pictorial contents. To balance the visual value and density, we propose a contents adaptive shade image scaling scheme by merging the shadecomfortable analysis with the light-weight linear interpolation. Our system first organizes each section of the screen image into script or pictographic section according to the high gradient pixel number and the pixel color supply. [12,13,14] Next, separately section is scaled by the alteration linear interpolation process (SLI) [8] with adaptive shift offsets. The adaptive movebalances are down enhanced for the text and pictographic regions, respectively. The notice of this paper is organized as follows: Section II introduces the different interpolation techniques. The future content adaptive screen images used in scaling scheme is labelled in Unit III. The experimental results are exposed in Segment IV, followed by the conclusions in Section V.

II. Different Interpolation Techniques

The estimation in image scaling is to consume a situation image as the base image, to construct a new scaled image. In this paper different interpolation techniques are used for image scaling process. The created image can be smaller, larger, or equal in size dependent on the scaling ratio. When expanding an image, we are truly introducing unused seats in the unique base image, which is the procedure of up-sampling [15,16]. From this image we need to interpolate ansuitable pixels value to fill the unfilled spaces, over any of the non-adaptive, adaptive or filter based interpolation methods.

2.1 Linear interpolation:

It is a basic method of interpolation, Here eq-1 shows interpolate and evaluation pixel value of any random point among two or more given points. [17] Statistically linear interpolation is for interpolating roles of one variable (either ‘x’ or ‘y’) on a fixed one D grid.

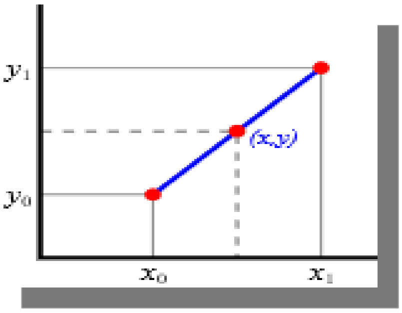


Figure-1.Linear Interpolation.

Equation-1:

$$y = y_1 + (x - x_1)\frac{y_2 - y_1}{x_2 - x_1}$$

2.2 Bilinear Interpolation:

In math, bilinear interpolation process is an addition of linear interpolation images for interpolating functions of two variables (e.g,,X and Y) on a rectangular 2D grid .the key idea is to perform linear interpolation is eq-2 shows first in one direction ,and then again in the other direction. , so once more inside the different direction [18]. Every step is linear within the sampled values and within the position, the interpolation as a full isn’t linear however rather quadratic within the sample location.

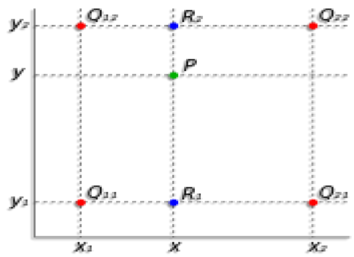


Figure-2. Bilinear interpolation.

Equation-2:

$$f(x,y_1) \approx \frac{x_2 - x}{x_2 - x_1} f(Q_{11}) + \frac{x - x_1}{x_2 - x_1} f(Q_{21})$$
$$f(x,y_2) \approx \frac{x_2 - x}{x_2 - x_1} f(Q_{12}) + \frac{x - x_1}{x_2 - x_1} f(Q_{22})$$

Four red dots show the data points and the green dots is the point at which we need to interpolate the image.

2.3 Non-Linear Technique:

Non-linear by enhancement processes affected by bound image options. the gradient of the high-resolution image from the low-resolution image is best[19]. this system makes an attempt to preserve edges by adding constraints on their orientation.

2.4 Transform Technique:

It's primarily centered on the employment of multi-resolution decomposition, followed by interpolation applied to every level of the decomposition and/or extrapolation of upper resolution levels. These approaches aim at synthesizing the high frequency parts of the increased image by adapting the interpolation to suit the frequency content contained at every level of decomposition.

2.5 Statistical Technique:

The high-resolution image properties of the given low-resolution image. In the high-resolution image is modelled by a field with specially chosen lot abilities to classify the properties of every neighborhood. The chosen potentials permit the classification of pixels by degrees of smoothness or separation, thereby having the ability to properly handle edges [20,21]. Another approach creates a collection of component classifications gathered from the statistics of pixels in typical coaching pictures.

2.6 Filter based interpolation: The filtering-based methods are also known as re-sampling methods as shows in [22]

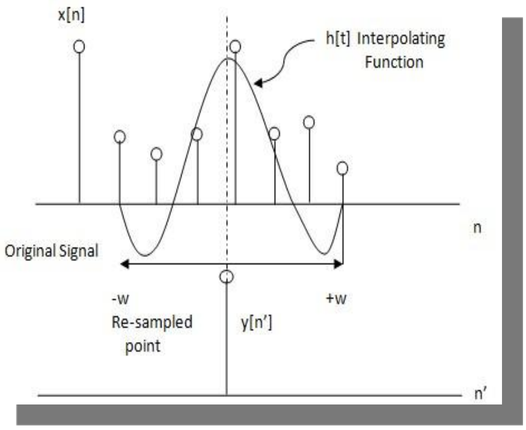


Figure-3: Filter based and re-sampling interpolation.

Figure 3, the re-sampling from one discrete signal x[n'] to a re-sampled signal y[n'], where h[t] is the interpolating function and w is the desired filtering window [23]. In this paper, two different 2-D separate filters are selected, such as Cubic B-Spline kernel and Lanczos3 kernel for replication and contrast of new results.

2.6 Cubic-B spline: It is a procedure of interpolation where the interpolant is a different type of piecewise polynomial called a Spline as shows in equation-3

$$L(x) = \begin{cases} 1 & \text{if } x = 0 \\ \dfrac{a \sin(\pi x) \sin(\pi x/a)}{\pi^2 x^2} & \text{if } 0 < |x| < a \\ 0 & \text{otherwise} \end{cases}$$

2.7 Lanczos filter\re-sampling: It is a mathematical formula used to easilyinsert the value of a digital signal between its samples The Lanczos Kernel purposes are as follows equation-4

$$L(x) = \begin{cases} \operatorname{sinc}(x) \operatorname{sinc}(x/a) & \text{if } -a < x < a \\ 0 & \text{otherwise} \end{cases}$$

Directional interpolation is finished for each Subset and two interpolated principles are attached [6]. Procedure presented before the whole thing for gray scale images only.

III. Proposed algorithm

3.1 Recent algorithm:

Scaling is done on system reference image presented in two ways and making it enlarger or to make it still smaller. By resize an image, if we get any some new image pixels in single interpolation. By shrinking the image estimate that attracted to the correct pixels are picked up to take in recent process, but in this case we are sure about it not the case. Unlike we prove that nearest in verification neighbor shrinking where that pixels are thrown, bilinear shrinking estimates a smaller resolution of the original image. Even though details are lost all the new image pixels in the shrunk of data image do not come directly to from their original,it can be taken by interpolation system, indirectly we are representing to keeping the properties of image lost pixels. It can be understood in my pattern of case, shrinking an image to half size of interpolation continuously process to reduce image quality process – there is an different image interpolation from nearest neighbor to shrinking. This is applied to increase the size of the image in original size.

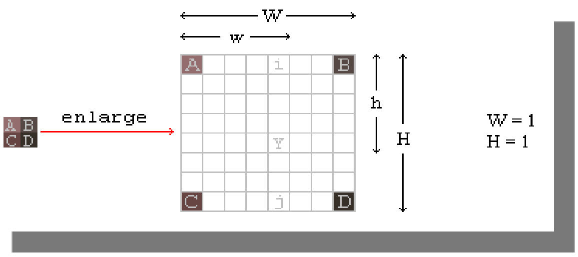


Figure-4: Resizing an image.

IV. Edge Guided Interpolation Method

In interpolation process the leadingproblem is to find out information of missing pixels from neighboring pixels as shown in figure(5).The black spots represent the LR image pixels and the white spots represent the absent HR samples. The edge path is the most important information for the interpolation method. Interpolation process for HR image rebuilding suffers from aliasing problem if signal of LR image is down sampled and beats Nyquist sampling limit.

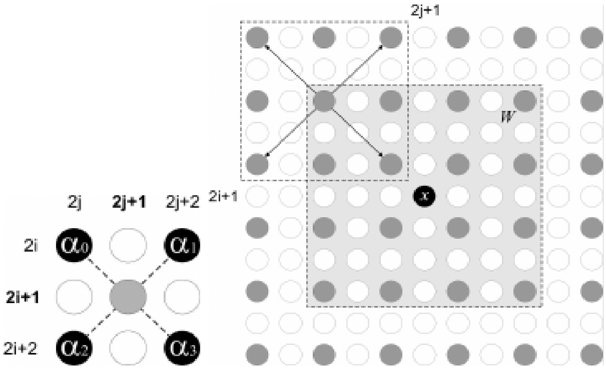


Figure (5):Edge guided interpolation.

In spatial positions our human visual system is very complex to the edges in image so it is important to suppress interpolation objects at the same time upholding the sharpness and geometry of edges [6]. Now we need to be used An Edge-Guided Images Interpolation Process via Directional Filtering and Data Fusion. We can use wavelet created Interpolation method also to do Image Improvement. For edge data we have separated pixels into two:directional and orthogonal subsections. Directional interpolation is finished for each Subset and two interpolated principles are attached [6]. Procedure presented before the whole thing for gray scale images only. So we have complete particularalteration so that it will work for the RGB pictures. As exposed below, we have kept each R,G and B components of one image into three dissimilar images of two imension (same as grayscale image) and give that as a participation to original procedure. Lastly we have merge all three output arrays into single RGBimage.

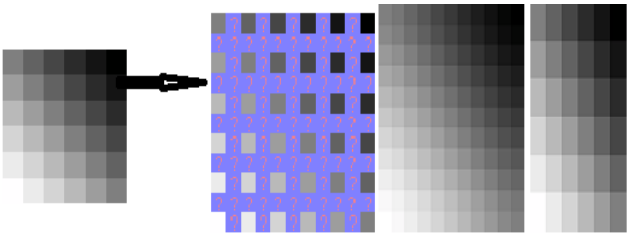
```
For i=1:m
For j=1:n
R(i,j)=input(i,j,1);
g(i,j)=Input(i,j,2);
b(i,j)=Input(i,j,3);
end
for i=1: (2*m)
for j=1: (2*n)
Rgb (i,j,1)=output(i,j);
End
```

End

% same way Rgb (i,j,2)and Rgb(i,j,3)is achieved.

V. Proposed Scaling Algorithm

5.1 Image Resize Example: Images interpolation the whole thing in two instructions, and attempts to complete a best approximation of a pixel's colour and strength based on the standards at surrounding pixels. The nextinstance illustrates how resizing / expansion works of a image:



Original Before Interpolation After Interpolation No interpolation

Figure 6: Scaling interpolation

Different air temperature variations and the ideal gradient upstairs, pixel values canistervariation far more shortly from one place to the following. As through the temperature example, the additional you see about the nearby pixels, the improved the interpolation will develop. Then results speedily deteriorate the extra you stretch an images, and interpolation can never improve detail to your images which is not already existing.

4.1 Scaling:

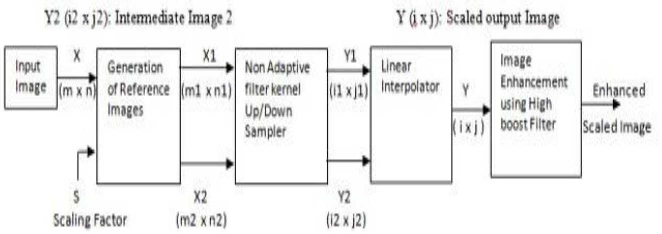


Figure 7: Proposed scaling method.

The flow chart of proposed algorithm is shown in

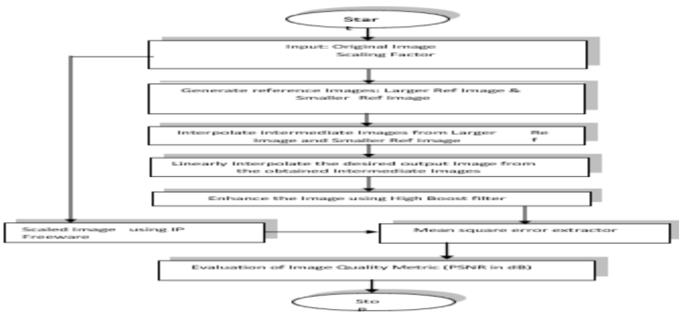


Figure 8: Flow Chart of Proposed Algorithm.

5.2 Algorithm consists of four scaling process

1. **Reference image generation**

Intermediate image generationLinear interpolationHigh Boost filtering for Image enhancement. The last stage of Image Improvement [22] [23] [24] [25] includes a High Boost Filter (HBF) as shown in the Figure 10. This filter is replicated by a simple Averaging Kernel/Cover along with a Removal and an addition. The quality of the scaled output image is meaningfully enhanced using the HBF. Here I have implemented techniques in image resizing namely they are linear techniques ,non-linear techniques


The proposed algorithm makes use of some of the previously mentioned scaling methods. Out of the var ious methods, Lanczos3 kernel is selected for simulation in the proposed algorithm. Figure 7 and Figure 8 show the first three stages. The two reference images are generated (Larger reference image and Smaller reference image) from the input image and scal ing factor, using the Lancoz3 re -sampling method. The input image is scaled by twice the scaling factor i.e. (2*S) to obtain the larger image and is scaled by half the scaling factor (0.5*S) to obtain the smaller image. This initial step to generate the reference images is important, with a view to ensure that the interpolated image is within the range of pixel values of the input image. These reference images are used to obtain the intermediate images having the resolutions as per the desired scaling facto r specified. These two images of same sizes are further used to linearly interpolate the required scaled output image(Y (i x j)) using the interpolation equation.

$$Y = Y1 + h(Y2 - Y1)$$

$$h = \frac{W1 - width}{W1 - W2}$$

W1: Width of larger reference image
W2: Width of smaller reference image
Width: Width of larger reference image

Figure 8: Blocks to Generate Reference Image.

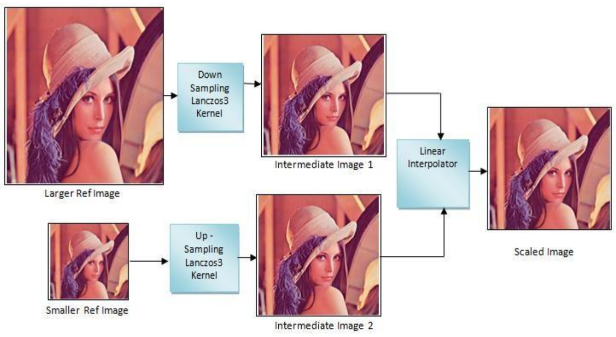


Figure10: Wedges of Proposed procedure to get the Scaled Image.

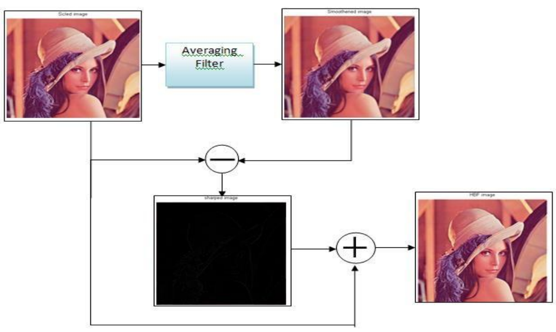


Figure 11: Image Improvement of the Scaled Image using High Boost filtering.

$$\mathrm{PSNR} = 10 * \log_{10}\left(\frac{\mathrm{Max\_peak\_value}^2}{\mathrm{MSE}}\right)$$

The last stage of Image Improvement [22] [23] [24] [25] includes a High Boost Filter (HBF) as shown in the Figure 10. This filter is replicated by a simple Averaging Kernel/Cover along with a Removal and an addition. The quality of the scaled output image is meaningfully enhanced using the HBF.

VI. Results of all comparation tools:

The presentation of the future algorithm, and the quality metric of the improved scaled image is measured using a Mean Square Blunder Extractor. The extractor needs two images of same dimensions to evaluate the error among them. In instruction to evaluate the quality of the scaled image attained from the pA, judgement is done a scaled image attained aftera Images Process freeware such ssessment(IRV), Adobe Photoshop, Fast Stone Photo Resizer(FSPR), Image Analyzer, XnConvert, Photo PosPro etc. In this presented paper we have designated Irfan View and FastStone Photo Resizer for arrangement purpose. The image quality metric: Peak Signal to Noise Ratio PSNR is normally used to quantity the quality of the image. It is uttered in decibel rule (dB). From top to bottom value of PSNR indicates a high quality of image. It is well-defined via Mean Square Error (MSE). Lower value of MSE consequences in High value of PSNR [12]. The Extractor uses the following associations to evaluate the PSNR: algorithm I have used scaling an image verifies in separate two ways, one is making enlarger or to making it small image. By enlarging an image, some new pixels are constructed by reference of an interpolation. By resize an image, if we get any some new image pixels in single interpolation.

Figure 12: Several Original Images of changed resolutions selected for scaling by a factor of S=1.5 (150%).

VII. Conclusion

In this paper I have verified that image enlargement using by bilinear interpolation programs and I have concluded that when process resizing an image we have the pixels height, width of a image will reduced when enlarging an image through this function the interpolation taken in image resize. Here I have implemented methods in image resizing namely they are linear methods ,non-linear methods, transform methods and statistical techniques are used and recent algorithm I have used scaling an image verifies in separate two ways, one is making enlarger or to making it small image. By expanding an images, some original pixels are built by the reference of an interpolation. Which will attempt to tempt to think the right pixels are selected to keep while the others are placing it away, but we should not use in this case? To present nearest neighbor shrinking where pixels are thrown, bilinear shrinking estimates a smaller resolution of the original image. using interpolation techniques is done scaling an images with different resulotions.

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