# Image Interpolation Based on Many High Quality Standards

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***Abstract:*** The current project work study various resampling methods using some know interpolation function like: Nearest Neighbor, Bilinear, Cardinal cubic spline, Bc-Cubic spline and Lagrange interpolation. Visual comparisons performed between previous mentioned methods using some image to determine the performance of each of them, that the nearest interpolation is a fast function but produce a block, bilinear produce a blurring , the (Bc-cubic spline and cardinal interpolation)is slower and produce some blurring , Lagrange interpolation it's the better one .

***Key Words:*** Nearest Neighbor , Bilinear, Cardinal cubic spline, Bc-Cubic spline and Lagrange interpolation.

## 1. INTRODUCTION:

A digital image is a numeric representation (normally binary) of a two-dimensional image. Depending on whether the image resolution is fixed, it may be of vector or raster type. Without qualifications, the term "digital image" usually refers to raster images also called bitmap images. Raster images have a finite set of digital values, called picture elements or pixels. The digital image contains a fixed number of rows and columns of pixels. Pixels are the smallest individual element in an image, holding quantized values that represent the brightness of a given color at any specific points. Typically, the pixels are stored in computer memory as a raster image or raster map, a two-dimensional array of small integers. These values are often transmitted or stored in a compressed form. Raster images can be created by a variety of input devices and techniques, such as digital cameras, scanners, coordinate-measuring machines, seismographic profiling, airborne radar, and more. They can also be synthesized from arbitrary non-image data, such as mathematical functions or three-dimensional geometric models; the latter being a major sub-area of computer graphics. The field of digital image processing is the study of algorithms for their transformation. Vector images resulted from mathematical geometry (vector). In mathematical terms, a vector consists of point that has both direction and length.Often, both raster and vector elements will be combined in one image; for example, in the case of a billboard with text (vector) and photographs (raster). Images may be two-dimensional, such as a photograph, screen display, and as well as a three-dimensional, such as a statue or hologram. They may be captured by optical devices such as cameras, mirrors, lenses telescopes, microscopes, etc. and natural objects and phenomena, such as the human eye or water surfaces [1].

## 2. DIGITAL IMAGE INTERPOLATION METHODS:

Interpolation is a technique that provides many an image application such as insert between or among others, change by putting in new configuration and image restoration by estimating a missing value by taking an average of known values at neighboring point.

1- Nearest neighbor interpolation:

The synthesis function associated to nearest-neighbor interpolation is the simplest of all, since it is made of a square pulse. Its support is unity; it is an interpolant, and satisfies the partition of unity, provided slight asymmetry is introduced at the edges of the square pulse. The approximation order is one (it reproduces at most the constant). It is discontinuous, thus has no regularity.

The main interest of this synthesis function is its simplicity, which results in the most efficient of all implementations. In fact, for any coordinate x where it is desired to compute the value of the interpolated function $f$ there is only one sample $f$k that contributes, no matter how many dimensions q are involved. The price to pay is a severe loss of quality [2].

2-Bilinear interpolation

Can be used where perfect image transformation with pixel matching is impossible, so that one can calculate and assign appropriate intensity values to pixels. Unlike other interpolation techniques such as nearest neighbor interpolation and bicubic interpolation, bilinear interpolation uses only the 4 nearest pixel values which are located in diagonal directions from a given pixel in order to find the appropriate color intensity values of that pixel.

Bilinear interpolation considers the closest 2x2 neighborhood of known pixel values surrounding the unknown pixel's computed location. It then takes a weighted average of these 4 pixels to arrive at its final interpolated value. The weight on each of the 4 pixel values is based on the computed pixel's distance (in 2D space) from each of the known points,

3-Bc-Cubic spline interpolation:
Is a form of interpolation where the interpolant is a special type of piecewise polynomial called a spline. Spline interpolation is preferred over polynomial interpolation because the interpolation error can be made small even when using low degree polynomials for the spline. Spline interpolation avoids the problem of Runge's phenomenon which occurs when interpolating between equidistant points with high degree polynomials.
4-Cardinal cubic splines interpolation:
Cardinal cubic spline function Depends on one variable a. These splines are derived from BC-splines with B=0 and C=-a.. They are quite popular (probably because they depend on only one variable).
5-lagrange interpolation:
In numerical analysis, the Taylor polynomials are used frequently. As a major drawback for image resampling, the Taylor polynomials are expanded from a single point, which might cause problems when they are applied to image interpolation. Using Lagrange polynomials instead, several points through which the polynomial must pass can be specified [3].

## 3.IMPLEMENTATION AND OPTIMIZATION:

The main form of program in the Fig.(1)

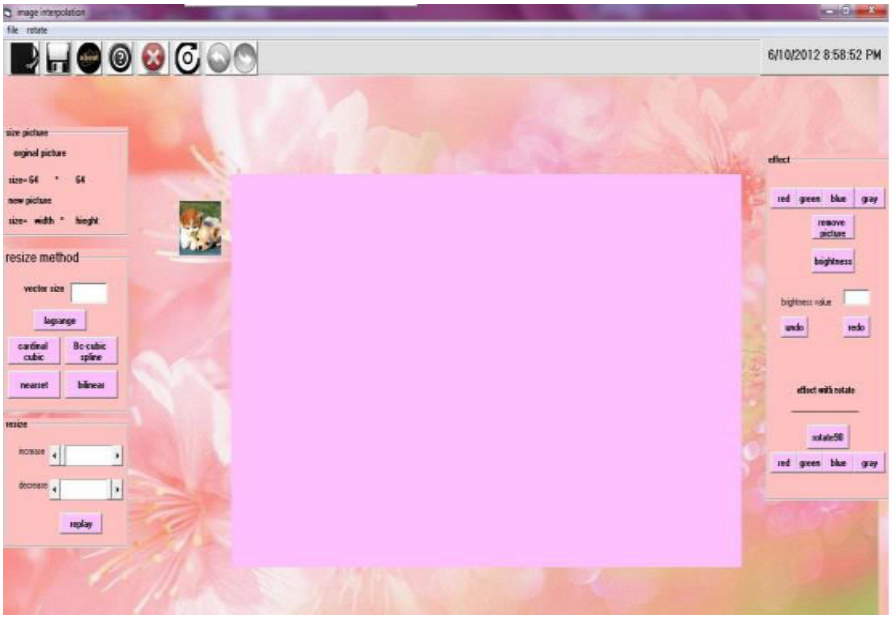



Fig.(1): Main Form

Help form of program appear in Figures (2), (3),( 4) and (5)
**Step1:**open code to load image from the computer

Fig.(2): Help form

**Step2:** Nearest Interpolation code
**Step3:** Bilinear interpolation code
**Step4:**Bc-cubic spline interpolation code
**Step 5**:lagrange interpolation code
**Step6:**cardinal cubic spline interpolation code


Fig.(3): Color image form

**Step7:**brightness code (using Gamma Correction)
**Step8**:color picture code

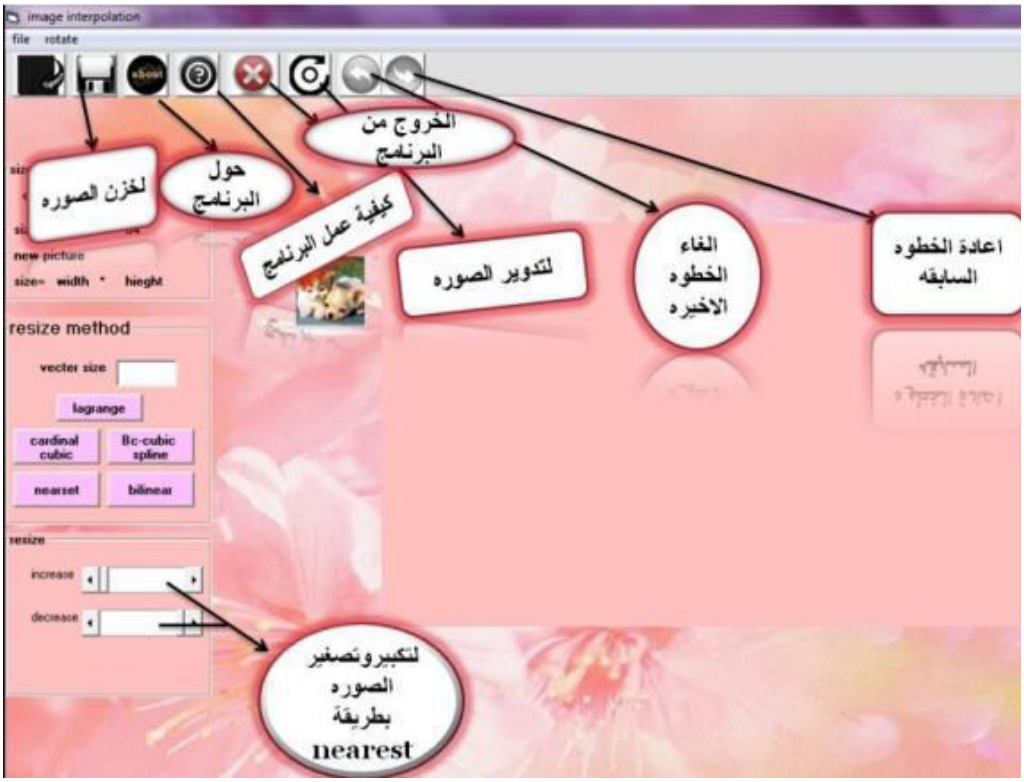
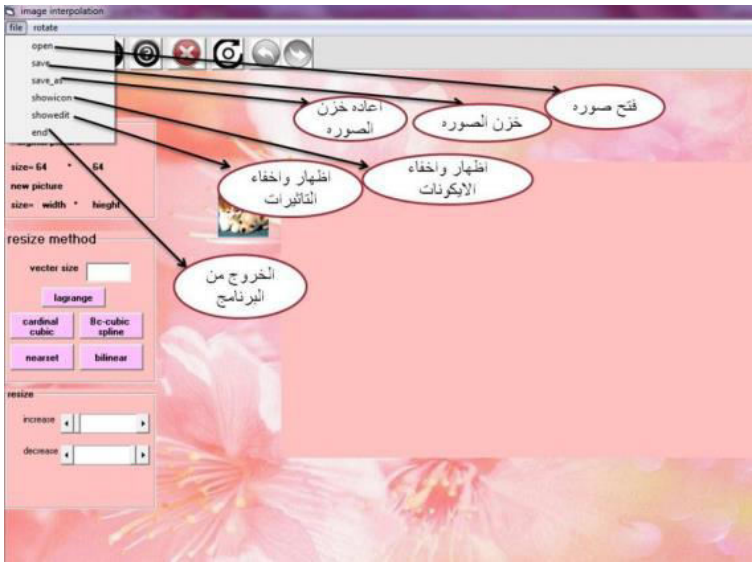



Fig.(3): Resize form

**Step9:**save code




Fig(4): Save list form

## 4. RECOMMENDATIONS:

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## 5. CONCLUSION:

The resulted of processed images in the interpolation method that is used we found that the Nearest Interpolation is a fast function but produce a block, Bilinear Interpolation produce a blurring , the ( Bc-cubic spline and cardinal Interpolation)is slower and produce some blurring ,Lagrange Interpolation it's the better one .

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