

Interpolation is the process of estimating color intensities at unknown locations in a given image by using known intensities of nearby locations. There are different forms of it depending on the number of nearby known locations used and the way in which their intensities are used.



Fig 1: Input Image (103 * 103)



Fig 2: Enlarged Image (307 * 205)
(Nearest Neighbour Interpolation)



Fig 3: Enlarged Image (307 * 205)
(Bilinear Interpolation)

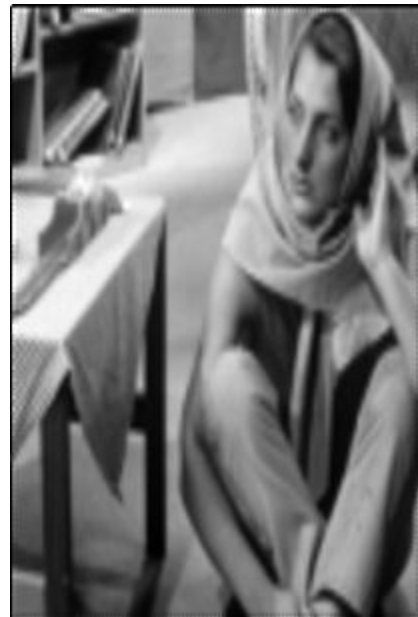


Fig 4: Enlarged Image (307 * 205)
(Bicubic Interpolation)

Above figures depict the enlargement of image in Fig 1 using different types of interpolation.

Nearest-neighbour interpolation uses 4 known locations which forms the vertices of the square in which the unknown location lies, but only uses the intensity of one amongst these whichever is nearer to the unknown as the intensity of unknown location. This leads to drastic changes in the intensities along the image and can be easily seen at the edges of the objects present inside the input image in Fig 2.

Bilinear interpolation on the other hand uses the intensities of all the four known locations, weights them using the geometry and results in a new intensity value that is assigned to the unknown location. This leads to a much smoother image as compared to Nearest-neighbour as seen in Fig 3. This is more visible at the edges of the objects in the image (as there is a major color transition between the object and its background).

Bicubic interpolation makes use of 16 known locations in the neighbourhood of unknown location thus leading to a more smoother image compared to other two as seen in Fig 4.

Time complexity for calculating each unknown is the same for Nearest-neighbour and Bilinear Interpolation. Its very much large for Bicubic compared to other two, as it involves solving 16 linear equations with 16 unknowns.

Conclusion:

Smoothness: Nearest neighbour Interpolation < Bilinear Interpolation < Bicubic Interpolation

Time Complexity: Nearest neighbour Interpolation = Bilinear Interpolation < Bicubic Interpolation