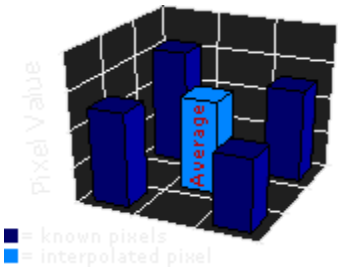
Image Super Resolution

First we will take a look at these pretrained models and what it does. Before that, when you increase the dimension of an image, by default it uses bicubic interpolation which is used in photoshop and most of the photo editing tools.

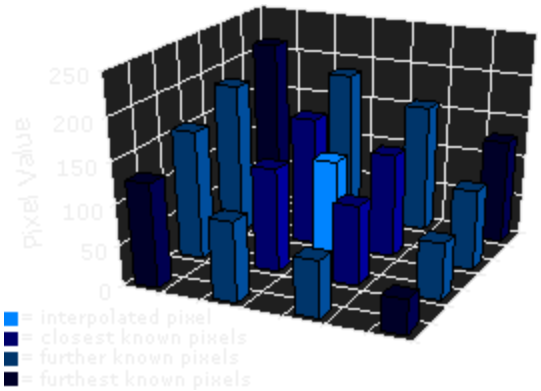
Bicubic interpolation vs Bilinear Interpolation

1.Bilinear Interpolation



Bilinear interpolation considers the closest 2x2 neighborhood of known pixel values surrounding the unknown pixel. It then takes a weighted average of these 4 pixels to arrive at its final interpolated value. This results in much smoother looking images than nearest neighbors. The diagram to the left is for a case when all known pixel distances are equal, so the interpolated value is simply their sum divided by four.

2.Bicubic interpolation



Bicubic goes one step beyond bilinear by considering the closest 4x4 neighborhood of known pixels — for a total of 16 pixels. Since these are at various distances from the unknown pixel, closer pixels are given a higher weighting in the calculation. Bicubic produces noticeably sharper images than the previous two methods, and is perhaps the ideal combination of processing time and output quality. For this reason it is a standard in many image editing programs (including Adobe Photoshop), printer drivers and in-camera interpolation.

1.EDSR: In the bicubic image, there is a lot of pixelation going on — but in the super resolution image significantly more smooth and less pixelated.

2.The result of applying the ESPCN for super resolution with OpenCV.

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Again, on the top we have our original input image. After applying standard bicubic interpolation we have the middle image. And on the bottom we have the output of applying the ESPCN super resolution model. The best way you can see the difference between these two super resolution models is to study the butterfly's wings.

Notice how the bicubic interpolation method looks more noisy and distorted, while the ESPCN output image is significantly more smooth. The good news here is that the ESPCN model is significantly faster, capable of taking a 400x240px image and upsampling it to a 1600x960px model at the rate of 13 FPS on a CPU.

3.Applying the FSRCNN model for OpenCV super resolution.

Pause a second and take a look at Allen Grant's jacket (the man wearing the blue denim shirt). In the bicubic interpolation image, this shirt is grainy. But in the FSRCNN output, the jacket is far more smoothed. Similar to the ESPCN super resolution model, FSRCNN took only 0.08 seconds to upsample the image (a rate of ~12 FPS).

4:Using the LapSRN model to increase the image resolution by 8x with OpenCV super resolution.

This model is the slowest, taking over 4.5 seconds to increase the resolution of a 400x267px input to an output of 3200x2136px. Given that we are increasing the spatial resolution by 8x, this timing result makes sense.

That said, the output of the LapSRN super resolution model is fantastic. Look at the zebra stripes between the bicubic interpolation output (middle) and the LapSRN output (bottom). The stripes on the zebra are crisp and defined, unlike the bicubic output.