Enhancing the Enlargement of Images
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Abstract

Methods typically used to enlarge images either produce images too jagged or too blurred. The intent of this project is to develop a method for enlarging images that retains the sharpness of edges while still keeping an image that looks smooth and high quality.

Background and Introduction

In image processing, two different methods of image enlargement are most commonly used: pixel replication - which simply repeats each pixel value for the amount of the scale factor - and interpolation - which constructs new data points between two pixels that work as a gradient connecting one pixel to another in the enlarged image. Unfortunately, both methods tend to produce less than desirable results; images resized with the pixel replication method often look very jagged and overly pixelated, while on the other hand, images resized with the interpolation method come out too blurry and with undefined edges. This project aims to find an algorithm that produces high quality enlarged images that can both preserve sharpness and avoid producing an overly pixelated image.

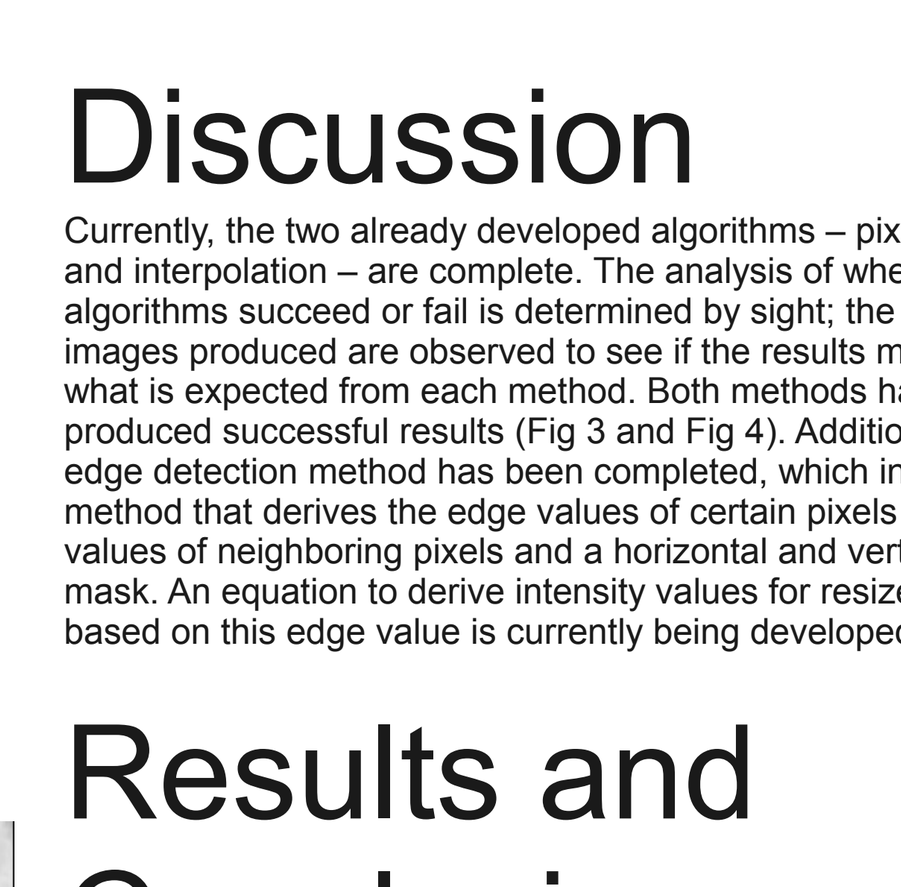

Fig 1. Pixel replication vs. interpolation

Fig 2. Original, unmodified image

Fig 3. Image enlarged by pixel replication method

Fig 4. Image enlarged by interpolation method

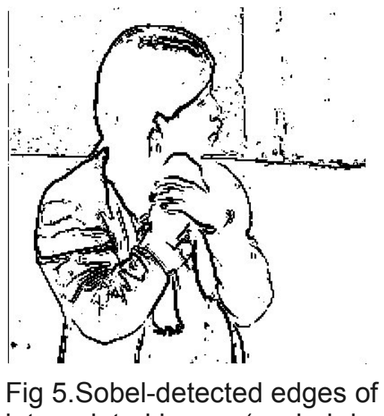

Fig 5.Sobel-detected edges of the interpolated image (scaled down)

Discussion

Currently, the two already developed algorithms – pixel replication and interpolation – are complete. The analysis of whether the algorithms succeed or fail is determined by sight; the output images produced are observed to see if the results match up with what is expected from each method. Both methods have produced successful results (Fig 3 and Fig 4). Additionally, a sobel edge detection method has been completed, which includes a method that derives the edge values of certain pixels using the values of neighboring pixels and a horizontal and vertical gradient mask. An equation to derive intensity values for resized pixels based on this edge value is currently being developed.

Results and Conclusion

In this stage, I plan to spend much of the quarter experimenting and deriving an equation for adjusting intensity values that optimizes image quality. I have started work on this, but the equations I have worked with so far have been unsatisfactory, either making the image look discontinuous or not showing enough of a difference from the typical interpolation method. I am considering adjusting the equation to work with more variables than just edge value. When the project is complete, it should be able to produce high quality images with sharp edges, smooth transitions between intensities of colors, and without unwanted pixelation. For testing purposes, enlargements of the original image are produced using the pixel replication and regular interpolation images, and those will compared with the output produced by the new method. As image quality is not something where you can reach a definitive stopping point, and work on the algorithm should be able to continue until the end of the designated time for the project, and potentially even become a starting point for future researchers to build off of and continue to improve.