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, making use of image interpolation and Sobel edge detection techniques.

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.

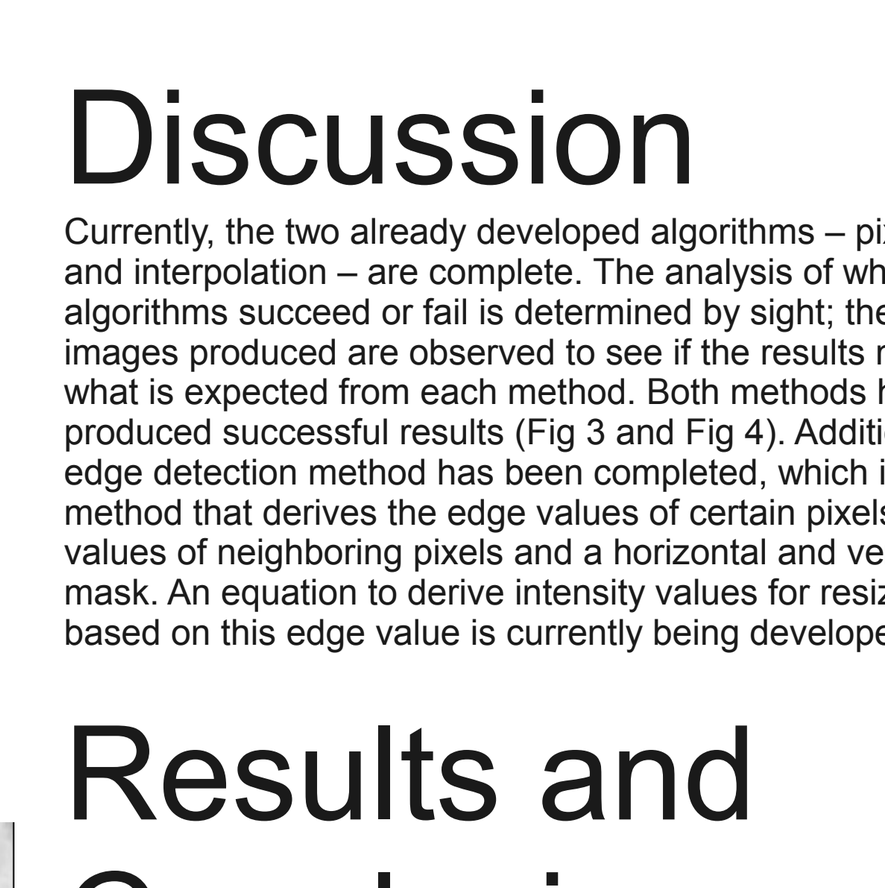

Fig 1. Pixel replication vs. interpolation

Fig 2. Original, unmodified image

Fig 3. Image enlarged by pixel replication method

Fig 4. Image enlarged by interpolation method

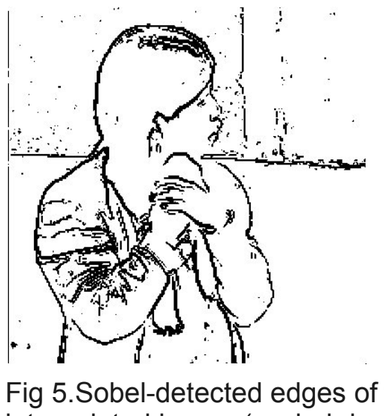

Fig 5.Sobel-detected edges of the interpolated image (scaled down)

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

For testing purposes, enlargements of the original image produced by traditional methods, and those were compared with the output produced by the new method. Progress was made with incorporating an edge detection technique into a more standard interpolation algorithm that was developed, but the equations worked with were unsatisfactory, either making the image look discontinuous or not showing enough of a difference from the typical interpolation method. I considered adjusting the equation to work with more variables than just edge value, but there was an error of input. There were many things I wanted to do with this project that I did not quite get to accomplish. Of course, given more time I would continue to work on my project until it yielded the results I was aiming for, but there are additional steps that could be taken in future research. One aspect I would modify about my project in the future is the input. While the .pgm image format is a convenient one to use to get the basic algorithm running, it is not the most commonly used image format. I would like to expand my project to take additional image inputs, such as .jpgs and .gifs. Additionally, the project could be expanded to include color rather than just working in grayscale.