Comparison of Digital Image Filtering Techniques

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Abstract

This project explores digital image filtering techniques by comparing the median and frequency filters. By testing the filters with images varying in object type (people, landscapes, or objects) and noise composition, the project determines the advantages and disadvantages of each in specific situations.

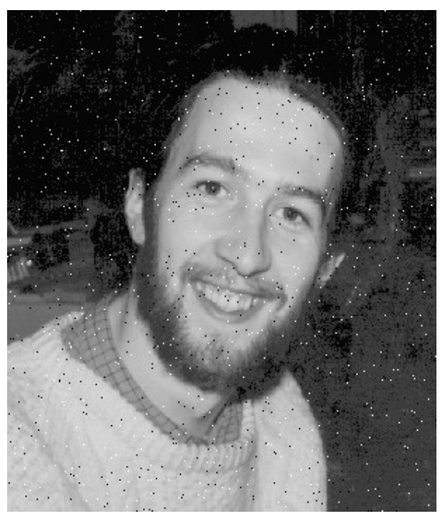
Introduction and Background

Digital image processing such as filtering was first developed in the 1960's. As computers became cheaper and faster, real-time image processing became available and its applications boomed. Digital filtering attempts to clear out noise, or useless and distracting information, in pictures. Examples of noise include missing pixels and wrong pixels. Noise is inevitable when converting analog information into a digital form. Such a conversion occurs inside a digital camera, when the camera takes the analog picture from the lens and stores it as a digital file.

Larger Purpose

The field of image processing has wide and important uses. The results of this project will influence how images are processed and enhanced. Applications stemming from the results of this project will be important to image and video enhancement applications because this research project provides insights on the best techniques in filtering and enhancing each kind of image.

Sample Effects



Before median filter

After median filter

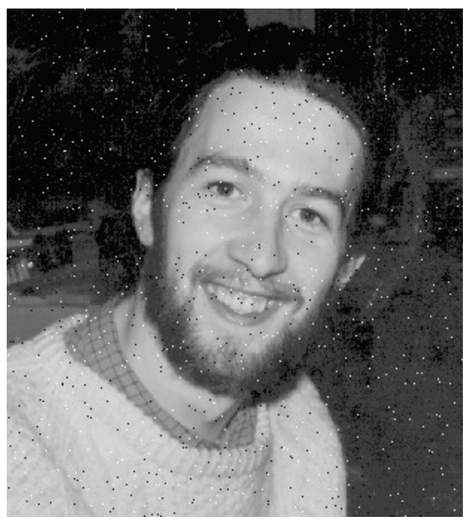
Procedures and Methods

This study will involve two filtering techniques: median filtering, and frequency filtering. First of all, algorithms will be developed for each of the two methods. A variety of images will be put through the two filtering techniques to determine which filtering techniques work best for which types of images. The variety of images used will include images of people, objects, and landscapes. The quality, or the amount of noise, of the images used will be another independent variable.

The quality of filtered images will determined in a subjective manner through surveying a pool of people. The effects of human errors and subjectivity does not detract from this study because image filtering is done for subjective aesthetic qualities in the first place.

Median Filter

Due to its relative simplicity, the median filter may be encapsulated into one module without any problems of over-complexity or size. The median filter is a Gaussian filter that slides a window of a certain size across each pixel of the image. The size of the window in this program is three by three. At each position of the window, the nine pixels values inside that window are copied and sorted. The value of the center pixel of the window is replaced with the median value of the nine pixels in the window. The implementation of this program does not do anything with the pixels on the edges.
During the course of developing the median filter, a problem was encountered in which the filter eliminates the the salt and pepper noise as intended, but the pixels were shifted as well.



The output produced is placed next to the original. As obviously seen, even though the filter eliminated the noise, it shifted pixels to destroy the original image.