Visual Enhancement of Medical Images Via Pixel Duplication

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ABSTRACT

Computers are used for acquisition and analysis of medical images. Two such categories of medical images are retinal images and fetal ultrasound images. In this project, MATLAB software package is used to enhance the visual appearance of images such that diseases and other abnormalities can be more easily seen and examined. We have used specific commands in MATLAB to duplicate pixels of the images. This technique results in an enlarged image. Duplicating pixels have the advantage that after the images undergo operations, such as filtering, less pixel data is lost due to rounding errors, and more of the original visual information is retained. The preliminary results on visual enhancement will be presented here. The final goal of this project is to automate the disease detection process to help the doctors.

INTRODUCTION

Medical images undergo image processing techniques, such as filtering, to eliminate noise and provide useful information on disease states. Unfortunately, such image processing techniques result in loss of information; therefore, we need creative methods to retain the information in the images. We use a computer software tool (MATLAB) to duplicate pixels in images so that they retain as much useful information as possible after these images are filtered. Filtering after pixel duplication keeps the visual information better, which should aid in the proper diagnosis and qualitative measure of the disease states present in the image.

SAMPLES: IMAGES WITH ABNORMALITIES

![Cystic Hygroma](source: www.thefetus.net)

![Fundus Albipunctatus](source: Research.uncl.edu)

Source: www.thefetus.net

Source: Research.uncl.edu

![Normal Retina](source: www.opsweb.org)

Source: www.opsweb.org

METHODOLOGY

Manipulate images to show the maximum amount of data more clearly to the eye without losing important data:

- Duplication
- Filtering
- Mean Filtering

MATLAB code for duplication and filtering of pixels

```matlab
% MATLAB code for duplication and filtering of pixels
% Duplication
for i=1:r,
    for j=1:c,
        for k = 1:z,
            imd2(2*i, 2*j) = im1(i,j);
            imd2(1:2*i, 1:2*j) = im1(i,j);
            imd2(1:2*i, 2:3*j) = im1(i,j);
            imd2(2:3*i, 1:2*j) = im1(i,j);
            imd2(2:3*i, 2:3*j) = im1(i,j);
        end;
    end;
end;
```

ANALYSIS

It is obvious that the 5x5 mean filter applied to the 3x3 pixel duplicated images retains the most detail for qualitative detection of abnormalities and diseases.

RESULTS: PIXEL DUPLICATION AND FILTERING

RETTINA IMAGES

![5x5 Mean Filtered applied to Original Image](source: www.thefetus.net)

![2x2 Pixel Duplication with Mean Filtered 5x5 Twice](source: Research.uncl.edu)

![3x3 Pixel Duplication with Mean Filtered 5x5 Twice](source: Research.uncl.edu)

FETAL ULTRASOUND IMAGES

![Original Image](source: www.thefetus.net)

![Original Image with 2x2 Duplication](source: Research.uncl.edu)

![Original Image with 3x3 Duplication](source: Research.uncl.edu)

![Original Image Mean Filtered 5x5 twice](source: Research.uncl.edu)

![2x2 Duplicated Image with Mean Filtered 5x5 twice](source: Research.uncl.edu)

![3x3 Duplicated Image with Mean Filtered 5x5 Twice](source: Research.uncl.edu)

CONCLUSIONS

We showed through pixel duplication that it is possible to enhance the image visually to detect various abnormalities and diseases. Duplicating the pixels allows the viewer to see that less information is lost when the image undergoes image processing techniques, specifically filtering.

ACKNOWLEDGMENT

We would like to thank our advisor Dr. Ruby Mehrubeoglu for giving us the opportunity to work on this project as sophomores and also for all the guidance and knowledge she has given us. We would also like to thank Dr. Suzette Chopin and Dr. Harvey Knutt for their support for undergraduate research.

This work is supported by NIH-EARDA Pilot projects Grant HD 052357, and by the offices of graduate studies and research.