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

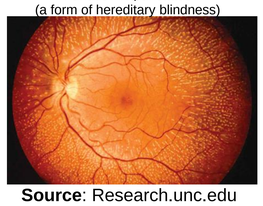
Medical images undergo image processing techniques, such as filtering, to eliminate noise and provide useful information on disease state. Unfortunately, such image processing techniques result in loss of information; therefore, we need creative methods to retain the information in the images. We use 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
(a form of hereditary blindness)



Source: Research.unc.edu

(Normal Retina) (Purtscher's Retinopathy)

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

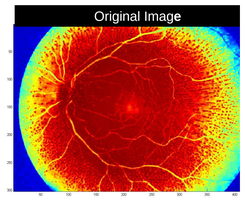
MATLAB code for duplication and filtering of pixels

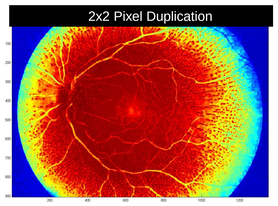
```
[r,c]=size(im1);
imd2 = zeros(2*size(im1));
imd3 = zeros(3*size(im1));

for i=1:r,
    for j=1:c,
        imd2(2*i-1:2*i, 2*j-1:2*j) = im1(i,j);
        imd3(3*i-2:3*i, 3*j-2:3*j) = im1(i,j);
    end;
end;
```

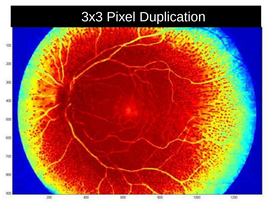
```
for k = 1:z,
    for i=2:r-1,
        for j=2:c-1,
            imgMean(i,j,k) = mean(mean(img(i-1:i+1,j-1:j+1,k)));
        end;
    end;
end;
```

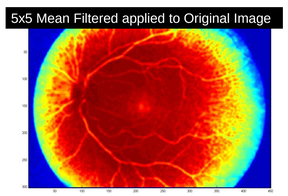
RESULTS: PIXEL DUPLICATION AND FILTERING

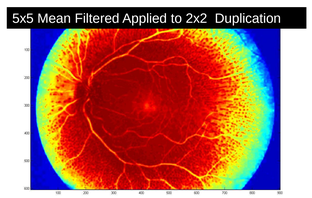
RETINA IMAGES

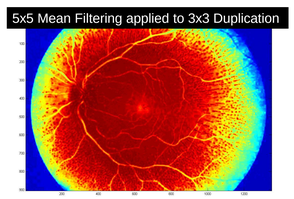




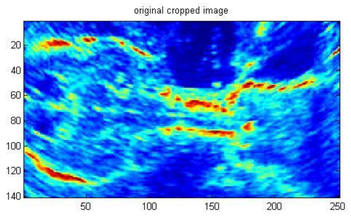


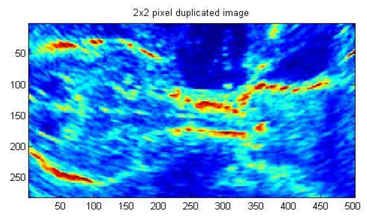


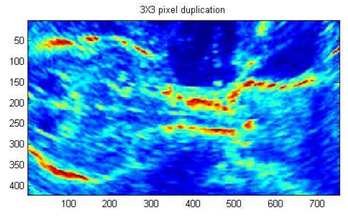


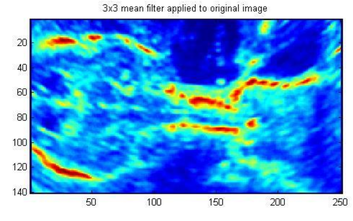


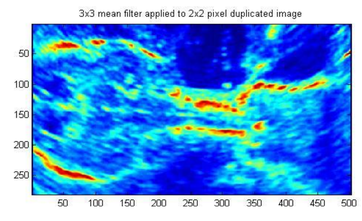
FETAL ULTRASOUND IMAGES

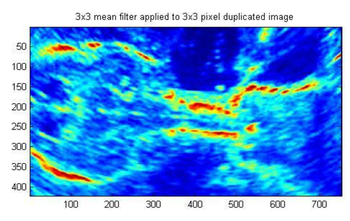


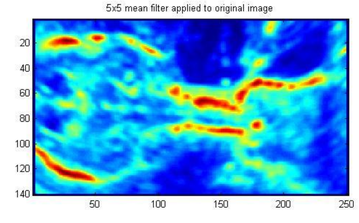


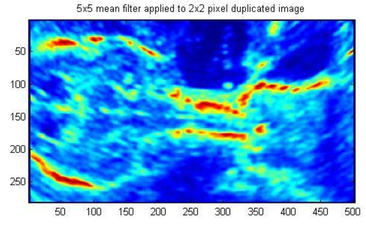


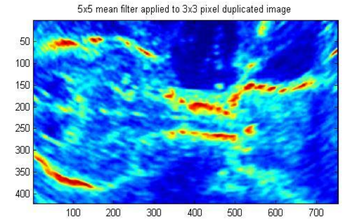










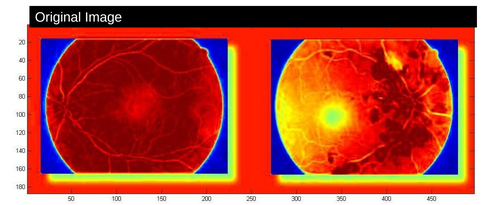


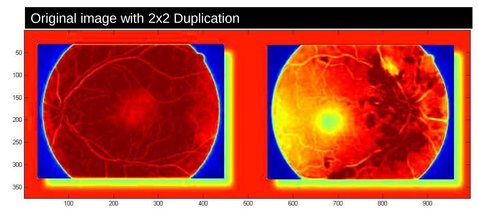
ANALYSIS

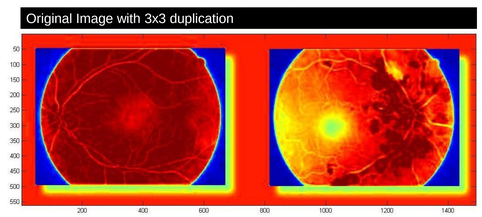
It is obvious that the 5x5 mean filter applied to the 3x3 pixel duplicated images retains the most detail for qualitative detection of abnormalities and diseases.

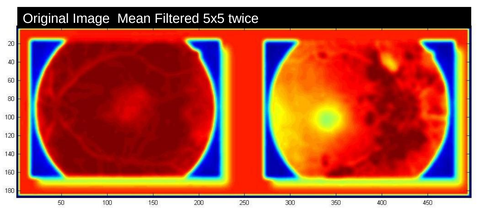
CONCLUSIONS

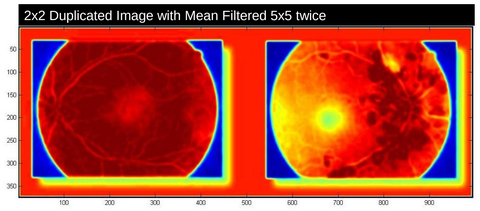
We showed through pixel duplication that it is possible to enhance the image visually to detect various abnormalities and diseases. Duplicating the pixels allows the viewer to see that less information is lost when the image undergoes image processing techniques, specifically filtering.

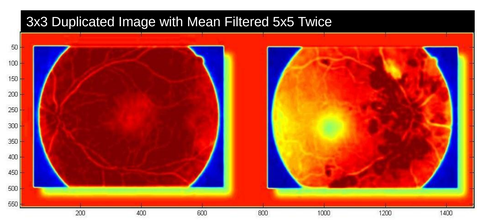












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