Cairo University
Faculty of Enigeering

Utilizing PDEs In Image Denoising

Presented for MTH 2175 project

Presented to:

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IMAGE DENOISING

Appendix

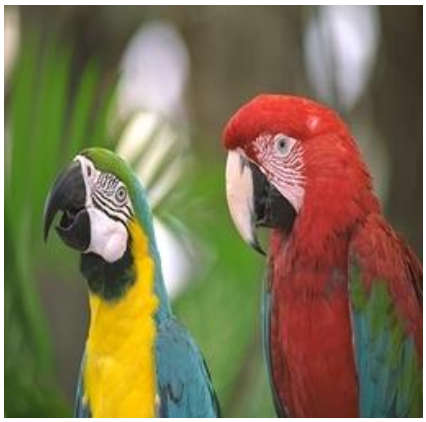
MATLAB RGB CODE

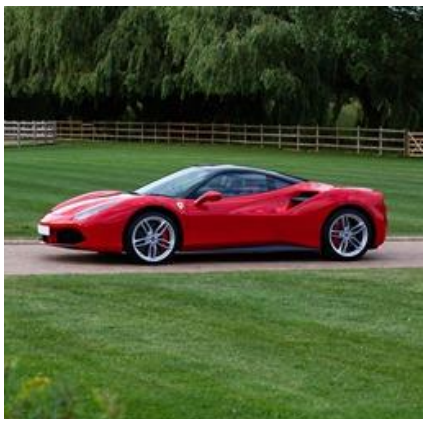
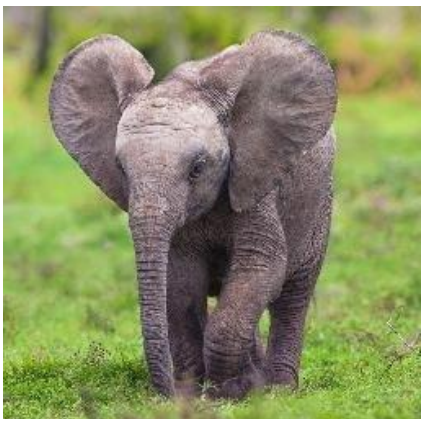
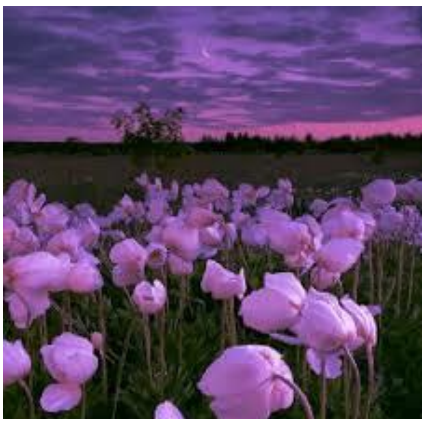
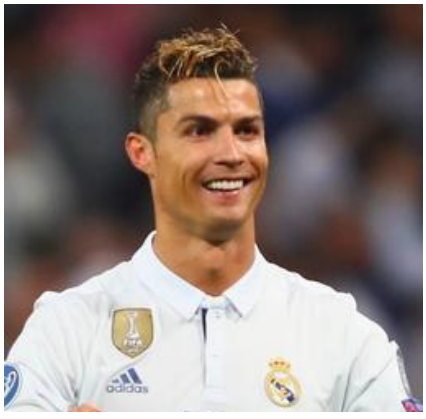
```
%% Raw image datastore path
imds = imageDatastore("E:\pics for image");
%% Creatng denoising image data set
inmds = denoisingImageDatastore(imds, 'patchSize', 50);
%% Specifying the training options
options = trainingOptions('sgdm',...
  'Momentum' , 0.9,...
  'InitialLearnRate', 1e − 3,...
  'LearnRateDropFactor' , 0.2000,...
  'LearnRateDropPeriod', 5,...
  'L2Regularization',      1.0000e − 04,...
  'GradientThresholdMethod', 'l2norm',...
  'GradientThreshold', Inf,...
  'MaxEpochs', 3,...
  'MiniBatchSize', 64,...
  'Shuffle' , 'every − epoch',...
  'Plots' , 'training − progress');
%% Specifying the network architecture
layers = dnCNNLayers('NetworkDepth', 5);
%% Training Our network
net = trainNetwork(inmds, layers, options);
%% Illustrating the raw input and the noisy input
pristineRGB = imread("lighthouse. png");
pristineRGB = im2double(pristineRGB);
pristineRGB = imresize(pristineRGB, [512 512]);
noisyRGB = imnoise(pristineRGB, "gaussian", 0,0.01);
[noisyR, noisyG, noisyB] = imsplit(noisyRGB);
figure
imshowpair(pristineRGB, noisyRGB, 'montage');
title('Original Image (left) and Noisy Image (right)')
%% Splitting the RGB image into three seperate channels then concatenating the results
denoisedR = denoiseImage(noisyR, net);
denoisedG = denoiseImage(noisyG, net);
denoisedB = denoiseImage(noisyB, net);
denoisedRGB = cat(3, denoisedR, denoisedG, denoisedB);
%% Illustrating the output results
figure
subplot(1,3,1);
imshow(I);
subplot(1,3,2);
imshow(denoisedRGB);
subplot(1,3,3);
imshow(denoisedI);
noisyPSNR = psnr(noisyRGB, pristineRGB);
fprintf("\n The PSNR value of the noisy image is %0.4f. ", noisyPSNR);
denoisedPSNR = psnr(denoisedRGB, pristineRGB);
fprintf("\n The PSNR value of the denoised image is %0.4f. ", denoisedPSNR);
noisySSIM = ssim(noisyRGB, pristineRGB);
fprintf("\n The SSIM value of the noisy image is %0.4f. ", noisySSIM);
denoisedSSIM = ssim(denoisedRGB, pristineRGB);
fprintf("\n The SSIM value of the denoised image is %0.4f. ", denoisedSSIM);
```

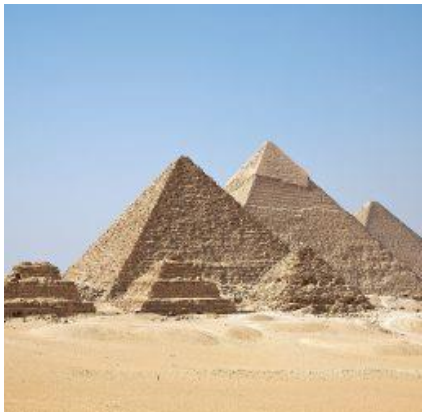
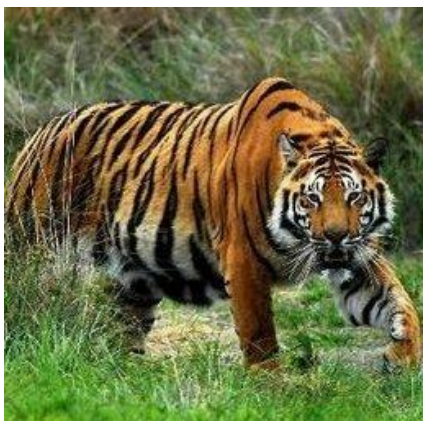
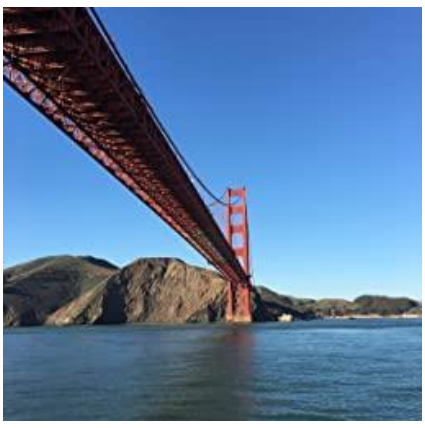
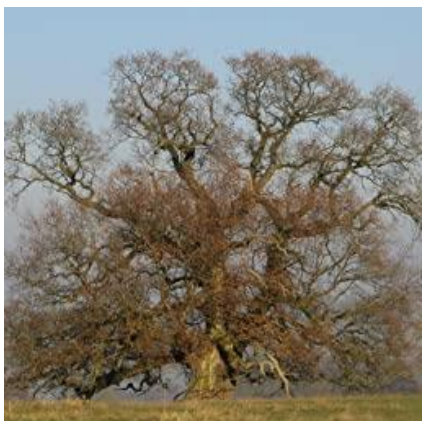
MATLAB GRAYSCALE CODE

```
%% Raw image datastore path
imds = imageDatastore("E:\pics for image");

%% Creatng denoising image data set

inmds = denoisingImageDatastore(imds,'patchSize',50);

%% Specifying the training options

options = trainingOptions('sgdm',...
  'Momentum',0.9,...
  'InitialLearnRate',1e-3,...
  'LearnRateDropFactor',0.2000,...
  'LearnRateDropPeriod',5,...
  'L2Regularization',      1.0000e-04,...
  'GradientThresholdMethod','l2norm',...
  'GradientThreshold',Inf,...
  'MaxEpochs',3,...
  'MiniBatchSize',64,...
  'Shuffle','every-epoch',...
  'Plots','training-progress');
%% Specifying the network architecture

layers = dnCNNLayers('NetworkDepth',5);
%% Training Our network
net = trainNetwork(inmds,layers,options);

%% Illustrating the raw input and the noisy input

I = imread('cameraman.tif');
I = imresize(I,[512 512]);
noisyI = imnoise(I,'gaussian',0,0.01);
figure
imshowpair(I,noisyI,'montage');
title('Original Image (left) and Noisy Image (right)')

%% Denoising the input
denoisedI = denoiseImage(noisyI,net);
%% Illustrating the output results
figure
subplot(1,3,1);
imshow(I);
subplot(1,3,2);
imshow(noisyI);
subplot(1,3,3);
imshow(denoisedI);
noisyPSNR = psnr(noisyI,I);
fprintf("\n The PSNR value of the noisy image is %0.4f.",noisyPSNR);
denoisedPSNR = psnr(denoisedI,I);
fprintf("\n The PSNR value of the denoised image is %0.4f.",denoisedPSNR);
noisySSIM = ssim(noisyI,I);
fprintf("\n The SSIM value of the noisy image is %0.4f.",noisySSIM);
denoisedSSIM = ssim(denoisedI,I);
fprintf("\n The SSIM value of the denoised image is %0.4f.",denoisedSSIM);
```

RGB Training DATA SET



GRAYSCALE TRAINING DATA SET