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Computer Vision

Dr. Cheng

Homework 4: Histogram of Oriented Gradients

```matlab
% DAVID MURRAY
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% HOG - PROJECT 4

oimg=imread('C:\Users\Dave\Desktop\Computer Vision\Project 4\gantrycrane.png');
imgheight=256;
img=imresize(oimg,[imgheight,imgheight/size(oimg,1)*size(oimg,2)]);
[x y]=ndgrid(22:2:132,32:4:256);   %max_height 300px -- need square list =
size(:,1)*dims
list=[x(:) y(:)];
tic;
%data = load('gantrycrane_hog.mat');
h = hog(img,list,16);
toc; % compute hog at the locations in the list
visualize_hog_list(h,list,img);

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%

function h=hog(I,list,nbins)
r = 11;                      % 23 x 23
nI=zeros(ceil(size(I)/r)*r);      % alloc space for nI with zeros
nI(1:size(I,1),1:size(I,2)) = I;  % set nI(1:#rows,1:#col) = [I] pad-matrix
hx = [1; 0; -1];
hy = hx';
dx = imfilter(nI,hx);             % sliding window thru x
dy = imfilter(nI,hy);             % sliding window thru y
angle = mod(atan2(dy,dx),2*pi);   % direction of gradient
rho = ((dy.^2)+(dx.^2)).^.5+0.02;      % magnitude of difference angle

negative_angles = angle<=0; % negative values
angle(negative_angles) = mod(angle(negative_angles)+2*pi,2*pi); % [0,2*pi]

binsize = (2*pi)/(nbins);   % set size of each theta-bin for angles, theta-->
binsize
theta = mod(angle+binsize/2,2*pi); % 128 x 171
tbin = ceil(theta/binsize);
theta(isnan(theta))=0;
rho(isnan(rho))=0;
%%%%% L2-normalization
rho=rho/sqrt(norm(rho)^2);
for z=1:length(rho)
  if rho(z)<0.4
   rho(z)=0.4;
  end
end
rhos = zeros([size(tbin) nbins]);
```

```matlab
    [I,J] = meshgrid(1:size(tbin,1), 1:size(tbin,2));
    K = sub2ind(size(tbin),I(:),J(:));
    size(rho)
    rhos(sub2ind(size(rhos),I(:),J(:),tbin(K))) = ...
    rho(sub2ind(size(rho),I(:),J(:)));   % 128 x 171 x 16


    [x,y] = meshgrid(-r:r,-r:r);     % x: 9x9: -4 to 4     y: 9x9: -4 to 4
    xi = reshape(kron(list(:,1),ones(numel(x),1)),[size(x),size(list,1)]); % 9 x 9 x
    100

    yi = reshape(kron(list(:,2),ones(numel(y),1)),[size(y),size(list,1)]); % 9 x 9 x
    100
    xi = xi+repmat(x,[1,1,size(list,1)]); % 9 x 9 x 100
    yi = yi+repmat(y,[1,1,size(list,1)]); % 9 x 9 x 100
    xi = reshape(xi,[numel(x),size(list,1)]);       % (r+1)^2  x  maxheight/nbins
                                            % numel(x) = prod(size(x)).  if
                                            % size(x) = 2 x 3 x 4, then prod(size(x))
    = 2*3*4 = 24
    yi = reshape(yi,[numel(x),size(list,1)]);
    hii = reshape(kron(1:nbins,ones(numel(xi),1)),[size(xi) nbins]);   % reshape to 81
    x 100 x 16
    xii = repmat(xi,[1,1,nbins]);      % 81 x 100 x 16
    yii = repmat(yi,[1,1,nbins]);      % 81 x 100 x 16
    save('hog_test');
    rhoss = rhos(sub2ind(size(rhos),xii,yii,hii));     % 81 x 100 x 16
    size(rhos)
    size(rhoss)
    h = rhoss(1:14:end,1:14:end,:);
    save('h_data');
    end
```