

COC202 Computer Vision

Lab 10 – Texture – Solutions

1.

```
function hist = lbphist(image)

% calculate LBP histogram of image

weight_matrix = [16 8 4; 32 0 2; 64 128 1];

image_lbp = zeros(size(image,1)-2, size(image,2)-2);
for i=2:size(image,1)-1
    for j=2:size(image,2)-1
        block = image(i-1:i+1,j-1:j+1); % our 3x3 block
        ind = find(block>=block(2,2)); % threshold by centre
        pixel and identify 1s
        lbpcode = sum(weight_matrix(ind)); % turn bitpattern into byte
        (histogram bin)
        image_lbp(i-1,j-1) = lbpcode;
    end
end

hist = imhist(uint8(image_lbp), 256); % calculate the LBP histogram
hist = hist / sum(hist); % normalise histogram
```

2.

```
% QBE with LBP histograms

imds = imageDatastore('*.tif'); % create image datastore
imgs = readall(imds); % read in all images

for i=1:length(imgs)
    disp(sprintf('%2d - %s', i, imds.Files{i}));
    allhists(i,:) = lbphist(imgs{i});
end
sel = input('Select query image by number: ');

qhists = allhists(sel,:,:,:);
for i=1:length(imgs)
    mhist = allhists(i,:,:,:);
    sim(i) = histint(qhists, mhist);
end

[d, ind] = sort(sim, 'descend');
figure
for i=1:length(ind)
    subplot(10,10,i);
    imshow(imgs{ind(i)});
end
```

3.

```
function lbp2rilbp

% table for mapping LBP to rotation invariant LBP

for i=0:255
    mappings = [];
    mappings(8) = i;
    i_fi = fi(i, 0, 8, 0); % create fi object for current code
    for j=1:7
        mappings(j) = int(bitror(i_fi, j)); % circular bitshift
    end
    table(i+1) = min(mappings);
end
table_unique = unique(table);
for i=1:256
    lbp_lookuptable(i) = find(table_unique==table(i))-1;
end

% LBP codes start with 0 but matlab indices start with 1
lbp_lookuptable = lbp_lookuptable + 1;

save('lbp_lookuptable','lbp_lookuptable');
```

```
function hist = rilbphist(image)

% calculate rotation invariant LBP
% first calculate normal LBP, than map to rotation invariant

load lbp_lookuptable;

lhist = lbphist(image);

hist = zeros(max(lbp_lookuptable),1);
for i=1:length(lbp_lookuptable)
    hist(lbp_lookuptable(i)) = hist(lbp_lookuptable(i)) + lhist(i);
end
```

4.

```
% QBE with rotation invariant LBP histograms

imds = imageDatastore('*.tif'); % create image datastore
imgs = readall(imds); % read in all images

for i=1:length(imgs)
    disp(sprintf('%2d - %s', i, imds.Files{i}));
    allhists(i,:) = rilbphist(imgs{i});
end
sel = input('Select query image by number: ');

qhists = allhists(sel,:,:,:);
for i=1:length(imgs)
    mhists = allhists(i,:,:,:);
    sim(i) = histint(qhists, mhists);
end

[d, ind] = sort(sim, 'descend');
figure
for i=1:length(ind)
    subplot(10,10,i);
    imshow(imgs{ind(i)});
end
```