WEEK 1 & 2
COUNTING IN DENSE CROWDS USING DEEP LEARNING

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WEEK 1

- Matlab Review
- Computer Vision Lectures
- Guest Speakers
- Topics: SIFT, Adaboost, Bag of Features
WEEK 2: SELECTION OF PROJECT

Counting in Dense Crowds using Deep Learning
EXAMPLES

• Concerts
• Political Speeches

• Rallies
• Stadiums
REAL WORLD APPLICATIONS

- Crowd Management
- Safety
- Surveillance
- Design Analysis for Buildings
DIFFICULTIES

- Occlusion
- Clutter
- Low resolution
- Foreshortening
- Irregular Arrangement
RESEARCH GOALS

- Perform deep learning via Convolutional Neural Networks (CNNs) to obtain counts of people in images
- Train the network and replace softmax loss function (used for classification task) with Mean Squared Error (MSE)
- Extract dense SIFT descriptors from the images and encode these descriptors using fisher vectors and then train a support vector machine.
RESEARCH GOALS (CONT.)

- Also, extract features from the network and train a support vector machine afterward.
- Possibly explore other options to improve the performance of the counting algorithm (i.e. horizontal line estimation, using size of humans to infer density)
RESOURCES TO READ


MULTI-SOURCE MULTI-SCALE COUNTING IN EXTREMELY DENSE CROWD IMAGES
Code

• Downloaded MatConvNet – Matlab toolbox implementing CNNs and worked with pre-trained models

```matlab
% setup MtConvNet in MATLAB
run matlab/vl_setupmn

% download a pre-trained CNN from the web
urlwrite('http://www.vlfeat.org/sandbox-matconvnet'
'imagenet-vgg-f.mat');
net = load('imagenet-vgg-f.mat');

% obtain and preprocess an image
im = imread('peppers.png');
im_ = single(im); % note: 255 range
im_ = imresize(im_, net.normalization.imageSize(1)
im_ = im_ - net.normalization.averageImage;

% run the CNN
res = vl_simplenn(net, im_);

% show the classification result
scores = squeeze(gather(res(end).x));
[bestScore, best] = max(scores);
figure(1); clf; imagesc(im);
title(sprintf('%s (%d), score %.3f', ...
net.classes.description{best}, best, bestScore))
```
CNN

VGG Convolutional Neural Networks Practical

% Read an example image
x = imread('peppers.png');

% Convert to single format
x = im2single(x);

% Visualize the input x
figure(1); clf; imagesc(x)

% Create a bank of linear filters
w = randn(5,5,3,10,'single');

% Apply the convolution operator
y = vl_nnconv(x, w, []);
DATASET

- 50 crowd images with counts ranging from 94 to 4543
- Will have to annotate the images in the future
NEXT STEPS

• Finish reviewing relevant papers

• Test code from the ‘Multi Source Multi Counting in Dense Crowds’ paper

• Learn more information about encoding via Fisher Vectors