Uniwersytet Wrocławski | Instytut Informatyki

LAB 5: DESCRIPTORS AND MATCHING
DUE: 22 MAY.

Task 1 (20) Compute dominant orientation of features

Compute a histogram of orientations having 36 bins, where the result in each bin is the sum of the magnitudes of the gradient. You can use a patch size of 41x41 as SIFT uses.

The matched points in the data given do not provide scale, so for now, you can ignore it for now.

Ideally you would want to want to take the scale into account, you should scale the gradient by a gaussian weighted circular window around the point with a sigma 1.5 times that of the scale of the keypoint. Check SIFT paper, section 5 for details.

We will want to use that in the future when we use our keypoints from Lab 4.

Task 2 (50) Feature descriptors

Compute the SIFT-Like descriptor on greyscale images. To start with, you might want to simply use normalized patches as your local feature, which is very simple to implement, and you can compare the performance agains this baseline.

For full credit, you should implement something more SIFT-like. It should have a 4x4 grid of 8 bin direction histograms. The coordinates of the descriptor need to be rotated accordingly to the orientation computed in Task 1. Weight the contribution of the gradient directions with a gaussian window. The sigma here should be around $\sigma = 4$ for a 16x16 patch, according to the paper (half the size of the radius of the patch). The resulting 128 feature vector needs then to be normalized, clip to 0.2 and renormalized.

Image gradients   Keypoint descriptor
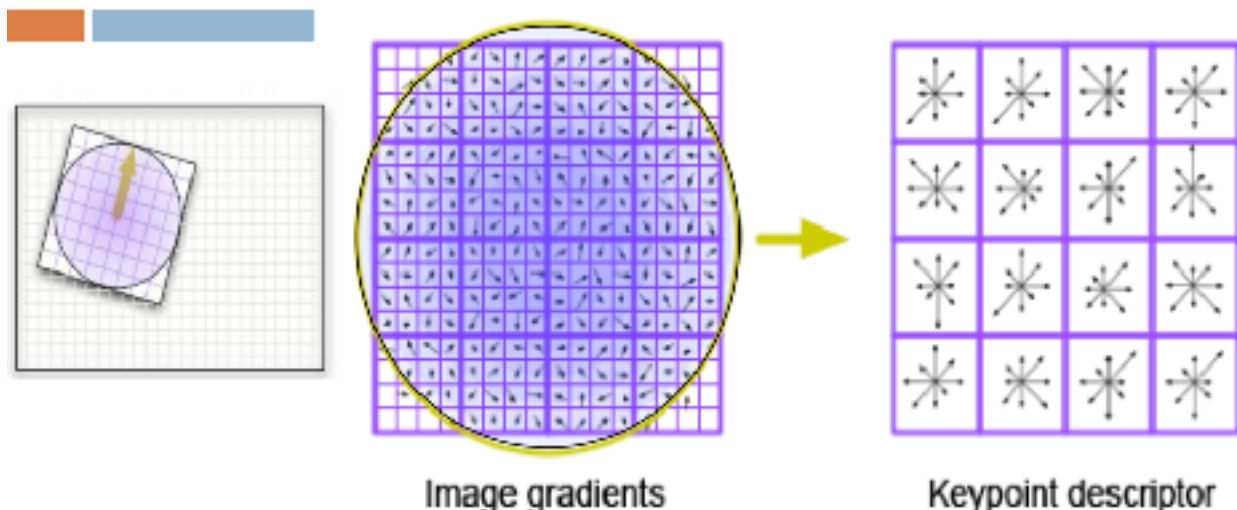
MORE MATERIALS
• Check the SIFT (section 6) paper and the materials below for more details.
• Szeliski 4.1.2
• http://www.vlfeat.org/api/sift.html
• http://mi.eng.cam.ac.uk/~cipolla/lectures/4F12/Slides/old/4F12-SIFT-extra-material.pdf
• https://web.eecs.umich.edu/~silvio/teaching/EECS598/lectures/lecture10_1.pdf

You do not need to perform the trilinear interpolation in which each gradient measurement contributes to multiple orientation bins in multiple cells As described in Szeliski, a single gradient measurement creates a weighted contribution to the 4 nearest cells and the 2 nearest orientation bins within each cell, for 8 total contributions. This type of interpolation probably will help, though.

Task 3 (30) Matching using NNDR

Use the Nearest Neighbor Distance Ratio to improve the matching, ordering your matches by confidence. Use the ground truth matches from the file to evaluate your descriptor and matching.

Task 3 (20) Statistics

Compare your matches with the ground-truth ones. Count precision and recall for your matching.