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16720F13 Computer Vision

Assignment3

BRIEF Feature Descriptors

**Section 1: Keypoint Detector**

* + 1. DoG Pyramid

I implemented the DoGPyramid by taking the input, GaussianPyramid, and subtracting subsequent layers to find the difference between the Gaussians (because we can approximate Laplacians using different of Gaussians, rather than manually computing the convolution). The input is RxCxL and the resulting output is RxCx(L-1) because there is one fewer difference of Gaussians than Gaussians.

1.1.2 Edge Suppression

In order to perform edge suppression, we need to select metrics for what is considered a distinctive keypoint. An edge removal method that we will use is to eliminate edge responses by thresholding on the principal curvature ratio in a local neighborhood of a point.

The 2x2 Hessian matrix describes the gradient of the DoG pyramid in the x and y orientations at the keypoint of interest. In the computation of the principal curvatures, we can avoid explicitly calculating the eigenvalues of H by using a trick borrowed from the Harris feature detector algorithm – that only the ratio of the eigenvalues matters, and fortunately the products and sums of the min and max eigenvalues can be computed using the trace and determinant of the Hessian.

1.1.3 Detecting Extrema

1.2 Assembling the DoG Detector

**Section 2: BRIEF Descriptor**

2.1 Creating a Set of BRIEF Tests

2.2 Computing the BRIEF Descriptor

2.3 Assembling the BRIEF Descriptor

2.4 Descriptor Matching

2.5 BRIEF and Rotations

**Section 3: Homographies**

3.1 RANSAC

3.2 Assembling the RANSAC Algorithm

3.3 Theory

Suppose you wished to recover the pose of the camera from the homography matrix. Assume there is a plane with a known equation in 3D space.

3.3.1 Relationship between Pi and the imaged points in our target image.

3.3.2 Expression for the columns of a matrix A such that H = K\*A.

3.3.3 Recovering R and t from H given K and the plane equation.