**Assignment 4**

1. Technical Overview
2. SIFT feature matching

The Scale-Invariant Feature Transform(SIFT) is an excellent feature extracting methodology that gives consideration to both performance and computation efficiency. To summarize, it generally extracts features based on the below 4 steps.

1) It uses the idea of Laplacian of Gaussian filter, and applies LoG of different onto the original image, which forms an octave, to smooth out clutters for scale invariance. The difference of adjacent images in the octave is saved into Difference of Gaussian(DoG). And the process is looped over by further sampling less pixels into a smaller octave and DoG, so finally we would get a downsampling pyramid, or a scale space.

2) To get the points of interest, every pixel is compared with its neighboring pixels amidst its adjacent scales, and would be selected if its local extrema.

3) Some optimizations are applied on the selected interest points, which include discarding low contrast points based on threshold, and inspecting the ratio between the highest and lowest eigenvalues of the 22 Hessian matrix. Larger ratio indicates an imbalanced edge detection on two directions and thus prone to be outliers.

4) Calculate the gradient magnitude and orientation for each pixel, and abstract every region into a 44 subregion, with each one being a 8-bin orientation histogram(parameters can be tuned). The output would be a feature descriptor that denotes the feature in an appended array.

5) Match the feature points between two images using nearest neighbors based on a ratio threshold for rejecting false matches. The point match could serve for further applications such as image stitching.

1. SIFT feature matching