Introduction to Robotics CSCI/ARTI 4530/6530

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Agenda

o A quick recap

o For today

    o Computer Vision: Line Extraction

    o Introduction to Markov Localization

A quick recap

Harris corner detection:

1. Second-moment matrix M of partial derivatives Ix and Iy

2. Analyze Eigen values of M or use the cornerness function (and extract its local minima)

3. Invariant to rotation and intensity but sensitive to scaling
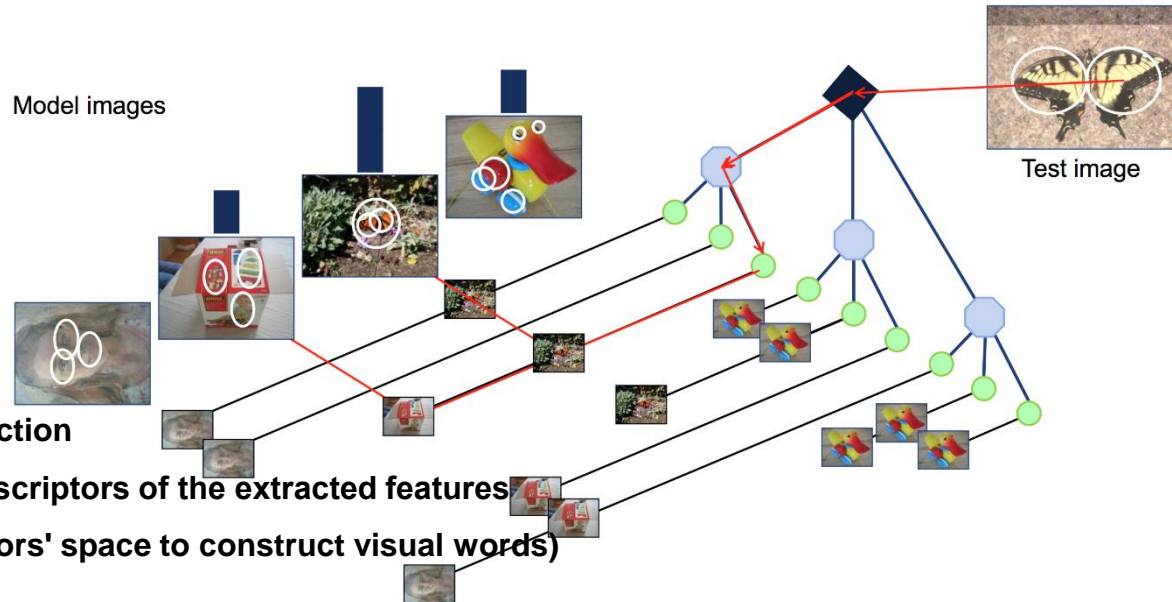
SIFT features:

1. Image array of Blurred and Scaled down image

2. Extract keypoints + scale (local extrema in the DoG pyramid)

3. Assign keypoint orientation (using the Gradient magnitude and orientation of keypoint neighborhood, and then taking the peak of the histogram of orientations)

4. Generate keypoint descriptors (4x4x8) – relative to keypoint orientation

FAST detector: see if a set of N contiguous pixels around an area centered at C is darker/brighter than C

BRIEF, **BRISK** descriptors, etc.

Place recognition

Model images

Test image

1. **Extract image features from the image collection**

2. **Populate the descriptor's space with the descriptors of the extracted features**

3. **Perform k-means clustering (in the descriptors' space to construct visual words)**

4. **Extract features from the Model images**

5. **Identify the visual word corresponding to an extracted feature**

6. **Link the visual word to the Model image it appears in**

7. **The Vocabulary Tree is ready**

8. **Extract features from the Test image**

9. **Identify the visual word corresponding to an extracted feature**

10. **Look-up the visual word in the inverted-file database**

11. **Increment the element of the voting array corresponding to the obtained visual word**

12. **Select most voted image as the best candidate matching the test image**

For today

See the attached EdX slides