Department of Computer Science
Faculty of Science, Kasetsart University

Lab 8 Object Detection
Asst.Prof. Dr. Pakaket Wattuya

# Let's Find STARBUCKS!

**PREPROCESSING :** Convert RGB input images to grayscale images. `I = rgb2gray(im_rgb);`

## STEP 1: Feature Detection

Each image is searched for locations that are likely to match well in other images.

| MATLAB functions | Description |
|---|---|
| `points = detectHarrisFeatures(I)` | Harris-Stephens algorithm to find corner points. |
| `points = detectSURFFeatures(I)` | Speeded-Up Robust Features (SURF) algorithm to find blob features. |
| `points = detectMSERFeatures(I)` | Maximally Stable Extremal Regions (MSER) algorithm to find regions. |

A reference image:
(reference_sm.jpg)

An input image:


## STEP 2: Feature Description

Each region around detected keypoint locations is converted into a more compact and stable (invariant) descriptor that can be matched against other descriptors.

| MATLAB functions | Description |
|---|---|
| `[features, validPoints] = extractFeatures(I,points)` | Extracted feature vectors (aka. descriptors), and their corresponding locations, from a binary or intensity image. |

## STEP 3: Feature Matching

Find candidate matches between features

3.1 Find matching features using two matching methods: Nearest Neighbor Ratio method (default) and Threshold method.

| MATLAB functions | Input Arguments | Input Argument Value |
|---|---|---|
| `indexPairs = matchFeatures(features_ref,features,Name,Value)` | `'Method'` | **Matching method:** NearestNeighborRatio (default)\| Threshold |
| | `'MatchThreshold'` | Percent value in the range (0, 100), increase this value to return more matches. |

Example

```
indexPairs = matchFeatures(feature_ref,features,'Method','Threshold','MatchThreshold',20.0);
indexPairs = matchFeatures(feature_ref,features,'Method','NearestNeighborRatio',...
                           'MatchThreshold', 4, 'MaxRatio', 0.6);
```

Find matched points

```
matchedPoints1 = validPoints_ref (indexPairs(:, 1));
matchedPoints2 = validPoints (indexPairs(:, 2));
```

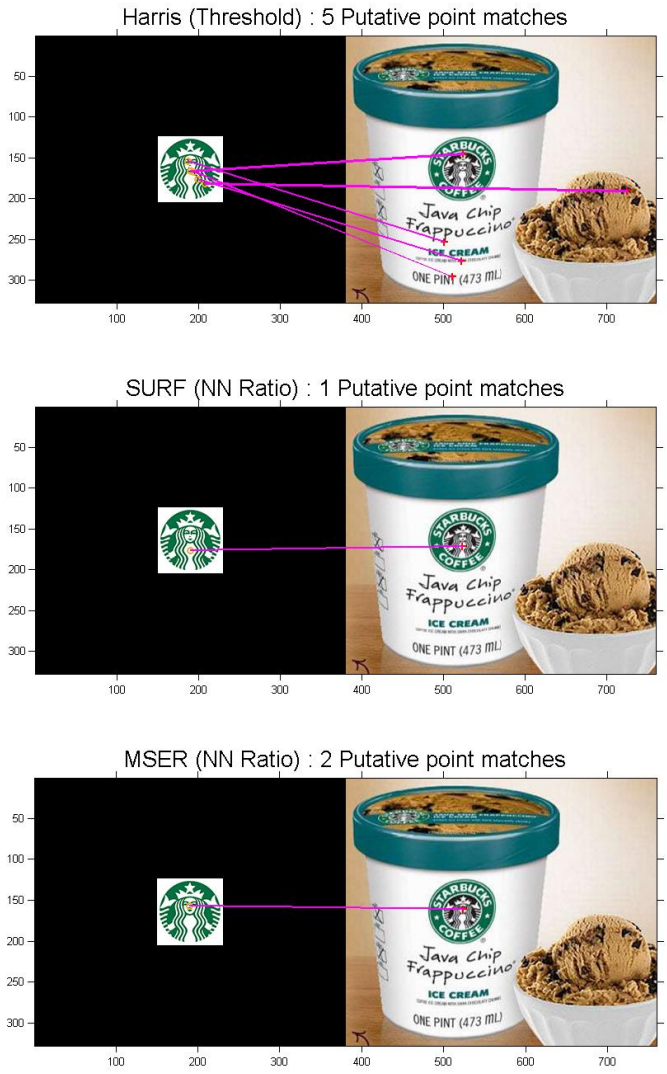
### 3.2 Display corresponding feature points

| MATLAB functions | Input Arguments | Input Argument Value |
|---|---|---|
| **showMatchedFeatures**(I_ref,I,matchedPoints1,matchedPoints2,method) | 'method' | Display methods:<br>falsecolor (default) \| blend \| montage |

Example

```
showMatchedFeatures(I_ref,I, matchedPoints1, matchedPoints2,'montage');
```

## Example Results:

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Reference

[1] Harris, C., and M. Stephens, "A Combined Corner and Edge Detector," Proceedings of the 4th Alvey Vision Conference, August 1988, pp. 147-151.

[2] Herbert, B., A. Ess, T. Tuytelaars, and L. Van Gool, SURF: "Speeded Up Robust Features", Computer Vision and Image Understanding (CVIU), Vol. 110, No. 3, pp. 346--359, 2008.

[3] Matas, J., O. Chum, M. Urba, and T. Pajdla. "Robust wide baseline stereo from maximally stable extremal regions." Proceedings of British Machine Vision Conference, pages 384-396, 2002.