Czestochowa University of Technology

Faculty of Mechanical Engineering and Computer Science

# Computer vision, pattern recognition and image retrieval

## Laboratory 7

**Topic:** *Pattern recognition*

**Teacher:** Joanna Kulawik, PhD

Technical support for Matlab is available on the website: http://www.mathworks.com/

In Laboratory 07, we will be using the key points that you learned about in Laboratory 06. The task will involve finding image fragments on the main image based on detected features and key points. Please perform the following exercises.

### Exercise 1

Please create a new "Lab06" application. The form should include 2 Button objects and 5 Axes objects. The first "Close" button should close the form. The second "Open" button should read a color image (in formats .jpg, .png, .bmp) from the selected file and display it in Axes (detailed instructions on how to do this can be found in Lab02).

### Exercise 2

Add another button of the "Pushbutton" type, named "Open Small". To program it, follow these steps.

First, you need to prepare a second (small) file with color images. It should be a fragment from the first loaded color image. You can accomplish this task by passing the original image. Then, after checking its size (e.g., using the size function), save only a portion of it (e.g., half of the image) to a new variable. Set this image to be of global type (this way, you will be able to use it in subsequent tasks). This will be our second (small) color image. The Small Image should be displayed in the second Axes object..

### Exercise 3

Add another object of the "Pushbutton" type, named "Compare SIFT". First, convert both introduced images to grayscale ("rgb2gray"). The task is to find key points on both images using the SIFT detector ("detect SIFTFeatures"). Then extract characteristic features for these points using the

"extractFeatures" algorithm. Finally, search for the object from the small image in the original image (using the "matchFeatures" function).

The program should display the original image with selected key points in the first Axes, a small image with marked key points in Axes2. To combine the image and key points, you can use the "insertMarker" function. The result of the search/comparison of both images should be displayed in Axes3 (you can use the "showMatchedFeatures" function).

**Required commands:**

detect SIFTFeatures – detects key points in an image using the SIFT algorithm
insertMarker – associates the image with key points
extractFeatures – extraction of features for given key points
matchFeatures – comparison of features between two images
showMatchedFeatures – displays images with matched points
figure – opens a new window for viewing

## Exercise 4

Add another object of the "Pushbutton" type, named "Compare FREAK". First, convert both introduced images to grayscale ("rgb2gray"). The task is to find key points on both images using the Harris detector ("detectHarrisFeatures"). Then extract characteristic features for these points using the "extractFeatures" method (used paramiter „Method="FREAK"). Finally, search for the object from the small image in the original image (using the "matchFeatures" function).

The program should display the original image with selected key points in the first Axes, a small image with marked key points in Axes2. To combine the image and key points, you can use the "insertMarker" function. The result of the search/comparison of both images should be displayed in Axes3 (you can use the "showMatchedFeatures" function).

**Required commands:**

detectHarrisFeatures – detects key points in an image using the Harris-Stephens algorithm
insertMarker – associates the image with key points
extractFeatures – extraction of features for given key points (used paramiter „Method="FREAK")
matchFeatures – comparison of features between two images
showMatchedFeatures – displays images with matched points
figure – opens a new window for viewing

## Exercise 5

Add another button object "Compare SURF". The exercise should be performed similarly to exercise 6. First, convert both input images to grayscale ("rgb2gray"). The task is to find key points in both images using the SURF detector ("detectSURFFeatures"). Then, extract characteristic features for these points using the "extractFeatures" method. Finally, search for an object from the small image in the original image (using the "matchFeatures" function).

The program should display the original image with selected key points in the first Axes, and a small image with marked key points in Axes2. To connect the image and key points, you can use the "insertMarker" function. The result of the search/comparison of both images should be displayed in Axes3 (you can use the "showMatchedFeatures" function)..

**Required commands:**

detectSURFFeatures – detects key points in an image using the Harris-Stephens algorithm
insertMarker – connects an image with key points
extractFeatures – extracts features for given key points
matchFeatures – compares features of two images
showMatchedFeatures – displays images with matching points
figure – opens a new window for browsing

## Exercise 6

Add another button object "Compare MSERF". The exercise should be performed similarly to exercise 6. First, convert both input images to grayscale ("rgb2gray"). The task is to find key points in both images using the MSERF detector ("detectMSERFeatures"). Next, extract characteristic features for these points using the "extractFeatures" method. Finally, search for the object from the small image in the original image (using the "matchFeatures" function).

The program should display the original image with selected key points in the first Axes, and a small image with marked key points in Axes2. To connect the image and key points, you can use the "insertMarker" function. The result of comparing both images should be displayed in Axes3 (you can use the "showMatchedFeatures" function).

**Required commands:**

detectMSERFeatures – detects key regions of the image using the MSERF algorithm
insertMarker – combines the image with key points
extractFeatures – extracts features for the given key points
matchFeatures – compares features of two images
showMatchedFeatures – displays images with matched points
figure – opens a new window for browsing

Please send only the „Lab07.mlapp” file to the moodle platform as an answer.