CS 4722 – Computer Vision
Project Report

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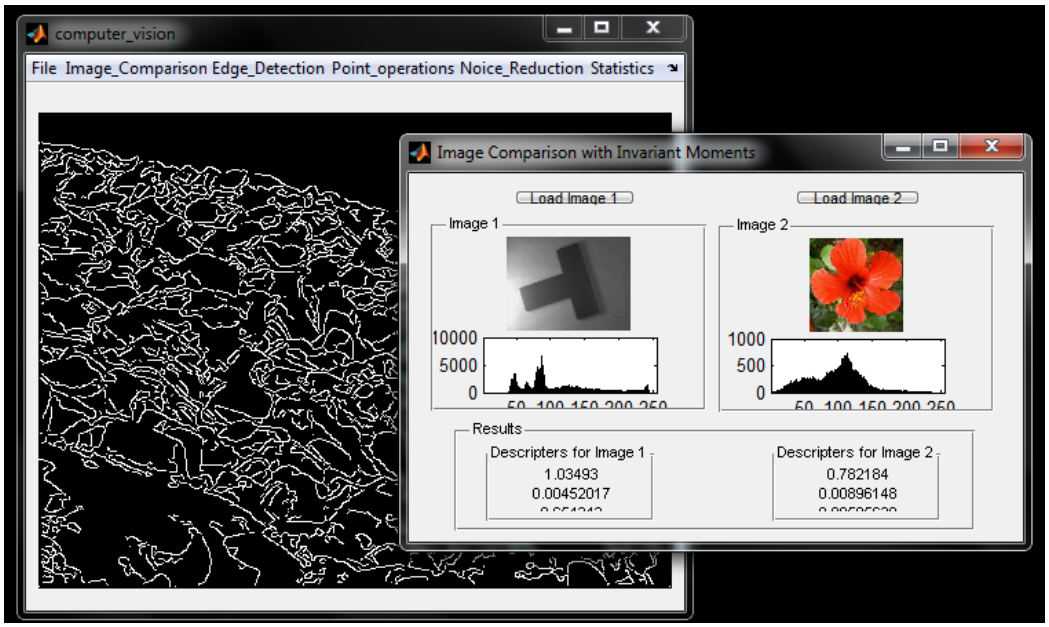
100476M

1. Functionalities of the application
    a. Image comparison with seven invariant moments
    b. Detecting edges of an image with canny edge detector
    c. Following point operations
        i. Transpose
        ii. Converting to gray scale
        iii. Vertical Flip
        iv. Rotations
        v. Cropping
        vi. Digital negative
        vii. Square root
        viii. Normalizing
    d. Following noise reduction operations
        i. Mean filter
        ii. Median filter
        iii. Mid-point filter
        iv. Min and max filters
        v. Alpha trimmed and modified trimmed filters
        vi. Adaptive filter MMSE
    e. Generating histograms
    f. Performing any combination of above operations and saving the image in the hard drive.

2. How to run the application



a. The application has been developed with Matlab 7.9.0.529(R2009b). The file "computer_vision.m" is the main m file of the application. Run the file "computer_vision.fig" to directly access the GUI of the application (assumed Matlab is installed).
b. After running the application, an image can be uploaded with **menu>File>Open**. Then any combination of operations including canny edge detection can be carried out with other menu items. Finally the image can be saved to hard drive with **menu>File>Save**.
c. Image comparison GUI can be opened with **menu>Image_Comparison>Invariant Moments**. Then use the two buttons **Load Image 1** and **Load image 2** to upload two images. The comparison results will be shown at the bottom of the GUI.

3. File structure and contents
    a. **computer_vision.m** : This file contains the code for main GUI handling, point operations, noise reduction operations.
    b. **computer_vision.fig** : This file represents the main GUI
    c. **descripters.m** : This file includes code for image comparison with descriptors (seven invariant moments).
    d. **descriptors.fig** : This file represents the 2nd GUI used for image comparison.
    e. **local_thresholding.m** : This file contains functions implemented for local thresholding.
    f. **seven_invariant_moments.m** : This file contains functions implemented for calculating seven invariant moments of an image.
    g. **canny.m** : This file contains an implementation of canny edge detector.

4. Comparing Images
    a. Segmentation
    There are many methods that can be used for segmenting an image. One method is to detect edges first and segmentation secondly. Another method is thresholding. Thresholding can be categorize into global which needs histogram analysis and local which considers only the properties of the neighbor pixels. Local thresholding performs well in both uniform and varying intensities. Finding a proper window size is a challenge in local thresholding. The window size is calculated dynamically according to the size of image in this application.
    b. Seven invariant moments
    The seven invariant moments are invariant under rotation, size and scale changes. There for they can be used to compare similarities between images.

5. References

    a. http://homepages.inf.ed.ac.uk/rbf/HIPR2/canny.htm
    b. http://homepages.inf.ed.ac.uk/rbf/HIPR2/adpthrsh.htm
    c. http://ro.ecu.edu.au/cgi/viewcontent.cgi?article=7351&context=ecuworks