Due on 9 May 2022

M.Sc. Data Science

Computer vision - Assignment 7

Use images from this folder.

1. Reading assignment: Read the paper "Deep learning vs. traditional computer vision" - especially sections 2.3 and later. Recent developments in deep learning seem to make traditional computer vision techniques obsolete, but this paper makes a case for the traditional CV to be used in conjunction with deep learning to improve the performance of the latter. It also highlights problems which are not suitable for a deep learning approach (Sections 3.5, 3.6 and 3.7).

2. Practice with morphological operations and segmentation techniques: apply the following techniques to improve the appearance of the said images (remove noise, enhance edges, bring clarity to features thus preparing them for further processing)

   (a) Erosion and dilation: for images 'fingerprint3' and 'fingerprint4' process to get binary image with thin ridges (skeleton) and no noise.

   (b) Opening and closing: for the image 'fingerprint5' apply opening and closing on the image as well as its complement. Experiment with $3x3$ box and round structuring elements.

   (c) K-means clustering: apply to images 'market' and 'Pisa'. Start with a small bin value K and experiment with increasing the number of bins. Does increasing the bins make the segmentation better? Is the resulting image getting closer to the original one?

   (d) Superpixels: apply the superpixel algorithm to the images 'panda' and 'Pisa'. What is the lowest number of superpixels you can get by with before you start to lose the interpretation of the image?

   (e) Watershed algorithm: apply the watershed algorithm to get segmentation on the images 'market' and 'Colors'.

3. Example of applying SIFT: apply the SIFT functions from OpenCV to find the matching keypoints in the images 'hawamahal1' and 'hawamahal2' uploaded in the folder. Mark at lest 50 matchings. You may make use of this tutorial.

4. (2% Extra Assignment Credit - you are allowed to submit this problem till May 18.) There are 3 crop images in this folder. The objective is to count the number of crops in the images. Here is a rough pipeline with possible internal variations, and you are free to produce your own if you like:

   - Convert image to grayscale (or extract the R,G,B channels and work with the one that seems to contain more information about the stem centers)
   - threshold the image by finding a suitable threshold
   - eliminate noise - get all the connected components and remove those that are smaller than a specified radius; another option would be to apply Gaussian blur in the beginning; yet another option would be to use erosion to eliminate small components.
   - count the number of blobs and report them as the number of detected plants.

   Here we suggested using thresholding as a segmentation technique. You can also experiment with other segmentation techniques such as watershed or clustering. (You can try DBSCAN if you feel enthusiastic.)