8 Exercises

Exercise 1: Write a program to count the number rice grains in a picture.

> **Hint:** OpenCv provides
> - *contours = cv2.findContours(bw, cv2.RETR_EXTERNAL, cv2.CHAIN_APPROX_SIMPLE)[1]*
> - *(x,y,w,h) = cv2.boundingRect(cnt)*

Exercise 2: Write a program to calculate the total of values of coins in this picture.

Algorithm 2 TolCoins

1: **procedure** TS–ALG(I is the input image)
2:      $I_{bw} \leftarrow$ Convert image to binary image.
3:      $I_{fh} \leftarrow$ Fill image regions and holes on I_{bw}
4:      $I_{lb}, k \leftarrow$ Label and count connected components on I_{bw}
5:      $A, C \leftarrow$ Measure properties of image regions as area, centroid on I_{lb}
6:      $m \leftarrow 0$
7:      Counting money based on the area of coin.
8:      **for** $a_i \in A$ **do**
9:          **if** $a_i > 2000$ **then**
10:             $m \leftarrow 5$ cents
11:          **else**
12:             $m \leftarrow 10$ cents
13:          **end if**
14:      **end for**
15: **end procedure**

> **Hint:** OpenCV provides
> - *cv2.connectedComponents(bw)*
> - *cv2.contourArea(cnt)*
> - *cv2.minAreaRect(cnt)*

Exercise 3: Perform the morphological operations to find out the topological skeleton of object in characters image.

> **Hint:** OpenCV provides *cv2.countNonZero(bw)*

Algorithm 3 Topological Skeleton algorithm

1: **procedure** TS–ALG(I is the input image)
2:     $I_{skel} \leftarrow$ The zero matrix has the same size w, h with the input image.
3:     $I_{bw} \leftarrow$ The binary image of the input image.
4:     **for** each $i \leftarrow 0$ to $N - 1$ **do**
5:         Find $I_e \leftarrow I_{bw} \oplus B$ (Erosion)
6:         Find $I_d \leftarrow I_e \ominus B$ (Dilation)
7:         Compute $I_s \leftarrow I_{bw} - I_d$ (Difference)
8:         $I_t \leftarrow \mathrm{OR}(I_{skel}, I_s)$
9:         $I_{bw} \leftarrow I_e$
10:        $j \leftarrow w \times h - C_0$. where C_0 is the number of non-zero values in I_{bw}
11:        **if** $j == w \times h$ **then**
12:            *break*
13:        **end if**
14:    **end for**
15: **end procedure**

Exercise 4: Write a program to detect how many type of species are in the picture.

Exercise 5: Write a program to detect and count how many type of shape in a input picture.

9   References

1. R. C. Gonzalez, R. E. Woods. Digital Image Processing. New Jersey, Prentice Hall, 2002.

2. T. Acharya. Image Processing Principles and Applications. New York, Wiley & Son, 2005

3. I.T. Young, J.J. Gerbrands, L.J. van Vliet. Fundamentals of Image Processing, Delft University of Technology, 1998.