

Automatic identification of landmarks by shape recognition

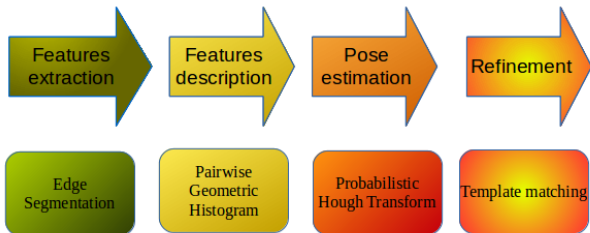
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Introduction

- The implementation based on "**Automatic identification of landmarks in digital images**", *Palaniswamy, Sasirekha, Neil A. Thacker, and Christian Peter Klingenberg*
- It includes four steps:



Method - Edge segmentation

Purpose:

- Extract the features (edge) from images
- Get the approximate lines

Method:

- Indicate the threshold value by analysis histogram of image
- Canny
- Break edge algorithm

Parameters:

- Threshold value: indicated by histogram analysis
- Canny ratio: 1:3 (lower:upper)
- Minimum distance to stop break edge: 3 pixels

Method - Edge segmentation



Method - Pairwise geometric histogram

Purpose: detecting the present of scene image in model image

Method^[2]:

- Construct the local PGH
- Construct the shape PGH
- Matching shape's PGH by Bhattacharyya metric

Parameters : to construct the PGH matrix (used to compute the metric)

- Angle accuracy: 90, 180, 360, 720
- Distance accuracy: 250, 500, 1000

Method - Pairwise geometric histogram

Local PGH and shape PGH

Local PGH : PGH for each feature (line)

Shape PGH : contains many **Local PGH**

PGH : a matrix two dimensions: angle axis and distance axis

PGH information : angle between two lines and perpendicular distance from two endpoints of scene line to reference line.

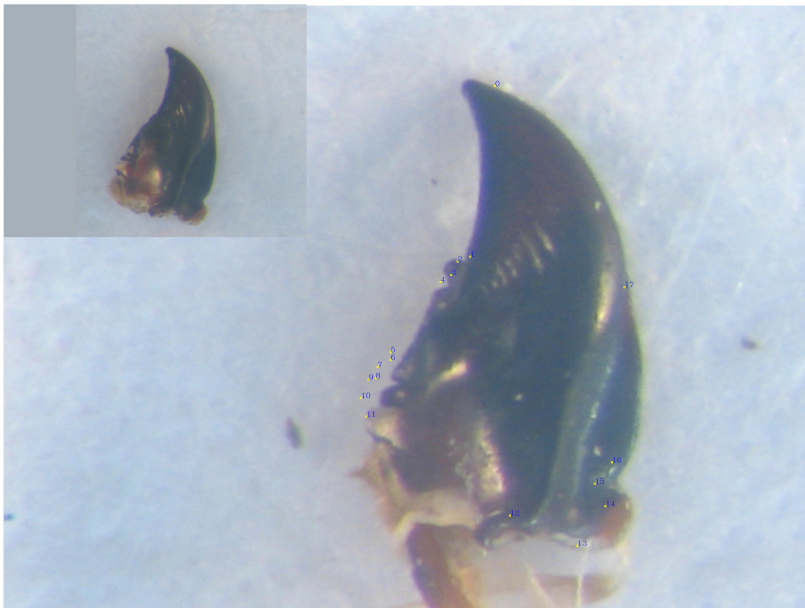
Method - Probabilistic Hough Transform

- Purpose:**
- Determine the presence and location of model image in scene image
 - Estimate the landmarks in the scene image
- Method:**
- Construct the reference table
 - Find the pair scene lines have the best “vote”
 - Estimate the “reference point” in scene image
 - Estimate the landmarks
- Result:** Estimated model landmarks on scene image

Method - PHT Parameters

- Closet lines
 - Minimum length of each line: 60 pixels
 - Minimum angle between two lines: 15 degrees
 - Distance from an endpoint of a line to another line: 5 pixels
- Similar pairs
 - Maximum difference angle: 1 degree
 - Maximum difference scale: 1 pixel
 - Maximum difference position: 2 pixels

Method - Probabilistic Hough Transform



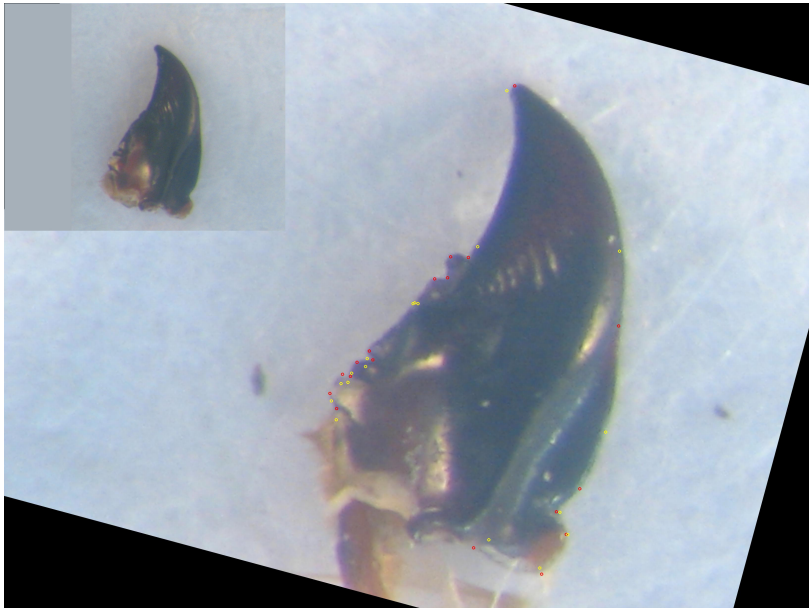
Method - Template matching

Purpose: Refine the estimated landmarks on the scene image

- Method:**
- On model image: For each landmark, create a bounding box with size " $t1$ " and *landmark* is center point of box
 - Rotate scene image to match with model
 - On scene image: For each estimated landmark, create a bounding box with size " $t2$ " and *landmark* is center point of box
 - Sliding $t1$ on $t2$ and find the the best match (cross-correlation)

- Parameters:**
- Template box size: 400px
 - Image box size: 1400px

Method - Template matching



Result

- Dataset: *Mandibule droite* and *mandibule gauche*
- Method includes 4 steps. The result of each step can effect to next step.
- This method can be used to identify the landmarks. But, in some cases, the estimated landmarks are not close with manual landmarks.

References I



Palaniswamy, Sasirekha, Neil A. Thacker, and Christian Peter Klingenberg

Automatic identification of landmarks in digital images

IET Computer Vision, 4.4 (2010): 247-260



Thacker, Neil A., P. A. Riocreux, and R. B. Yates.

"Assessing the completeness properties of pairwise geometric histograms."

Image and Vision Computing, 13.5 (1995): 423-429.

Thank you !