

# Automatic identification of landmarks by shape recognition

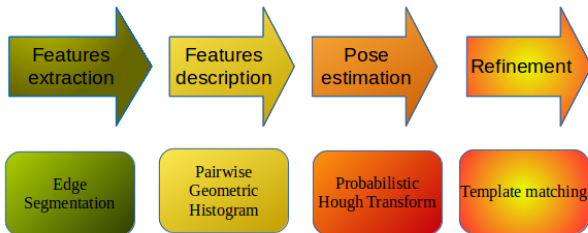
November 11, 2015

# Contents

- 1 Introduction
- 2 Method
- 3 Result
- 4 References

# 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<sup>[2]</sup>:**

- 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

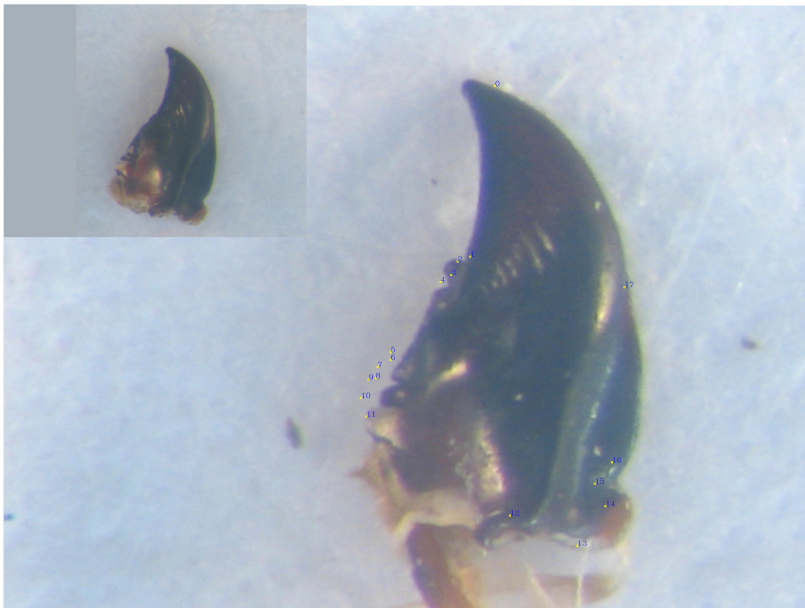
- Purpose:**
- Determine the presence and location of model image in scene image
  - Estimate the landmarks in the scene image
- Method:**
- Construct the reference table
  - Find the pair scene lines have the best “vote”
  - Estimate the “reference point” in scene image
  - Estimate the landmarks
-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



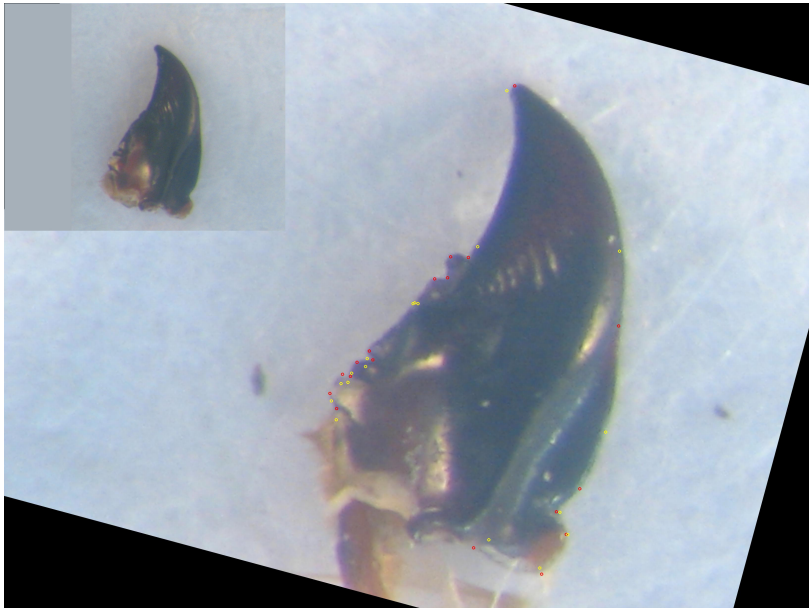
# Method - Template matching

**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 !