

Figure: Example of beetle mandibles from the studied data set with manual landmarks.

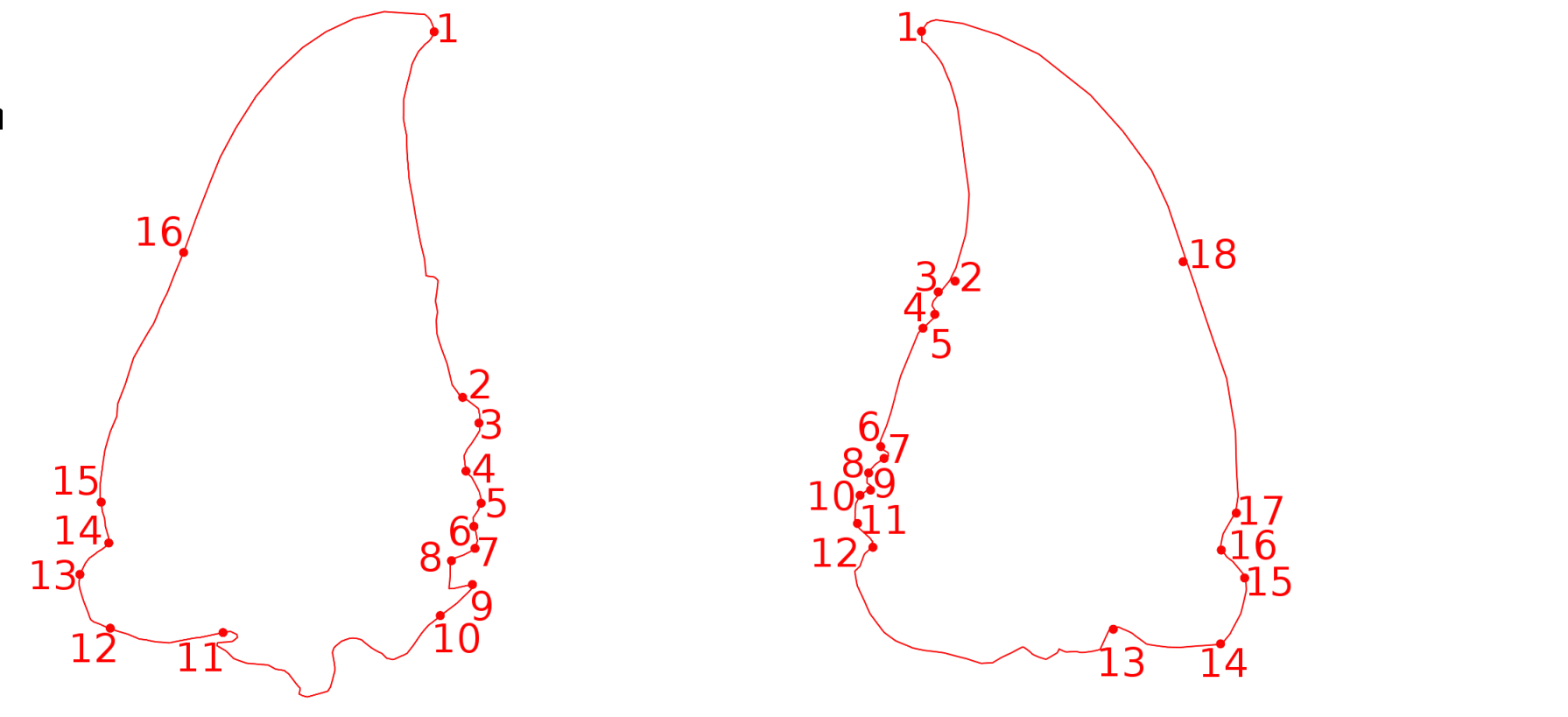
Context

Morphometry analysis is a way to characterize the shape variations of the organisms. Morphometric characteristics have been used to evaluate the evolution of an organism, by finding new or sharpening definition of old one. Morphometrics are also used to **classify** the objects in different groups.

Landmarks

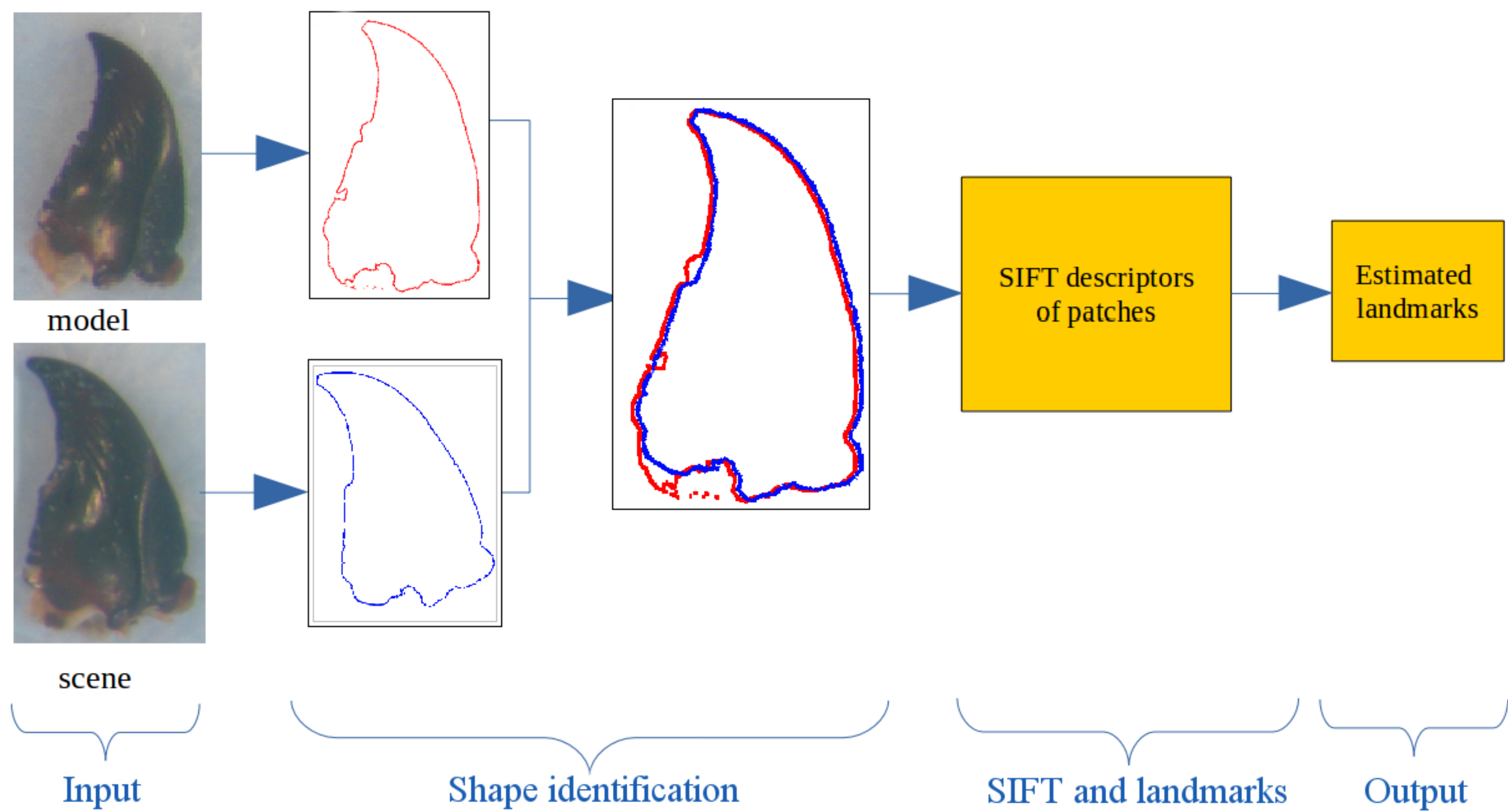
- Morphometric landmarks are points of interest in biological object,
- Landmarks characterize specificities through the shape most often linked to biological information
- They are usually **defined** by biologists **manually**,
- Images show manual landmarks in **beetle mandibles** belonging to our sample.

How to locate the landmarks automatically?



Proposed method

- **Input:**
 - Model image
 - Model manual landmarks
 - Scene image
- **Output:**
 - Landmarks of scene image
- **Steps:**
 - Shape identification: segmentation and registration
 - SIFT and landmarks



Segmentation

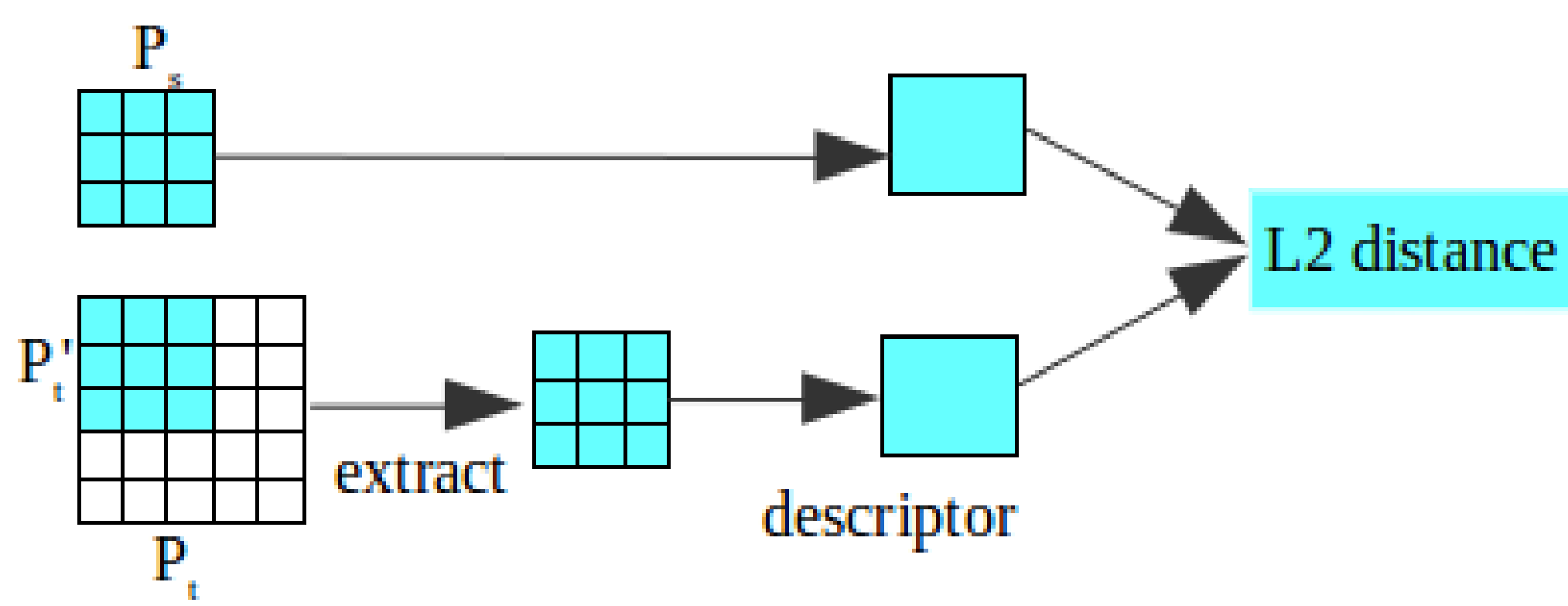
1. Converting the image to binary one by applying a threshold determined by histogram analysis
2. Contours points are extracted by Canny algorithm. The thresholds ratio in Canny: $T_{lower} = (1/3) \times T_{upper}$, in which T_{lower} equals to the threshold value in step 1.

Registration

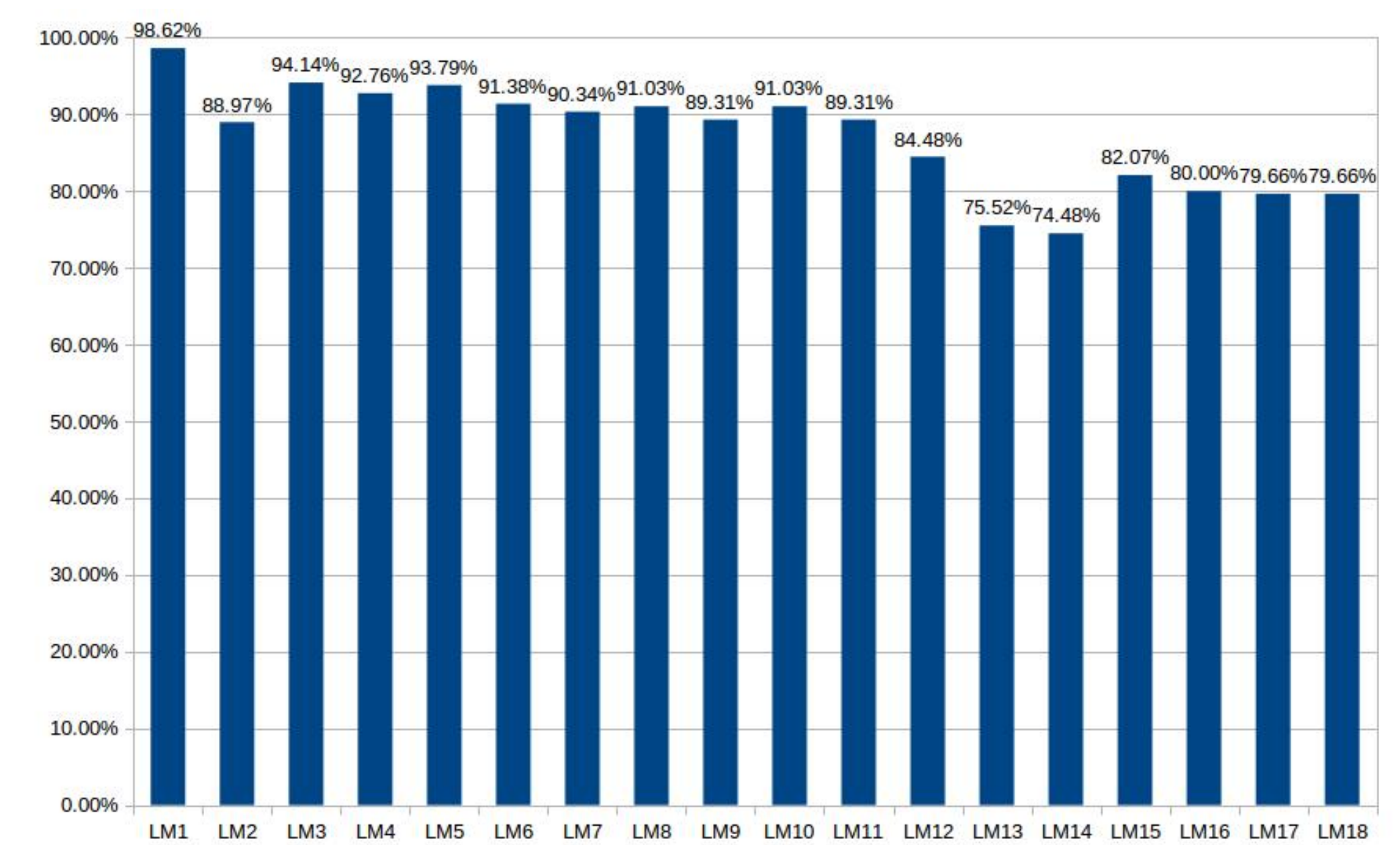
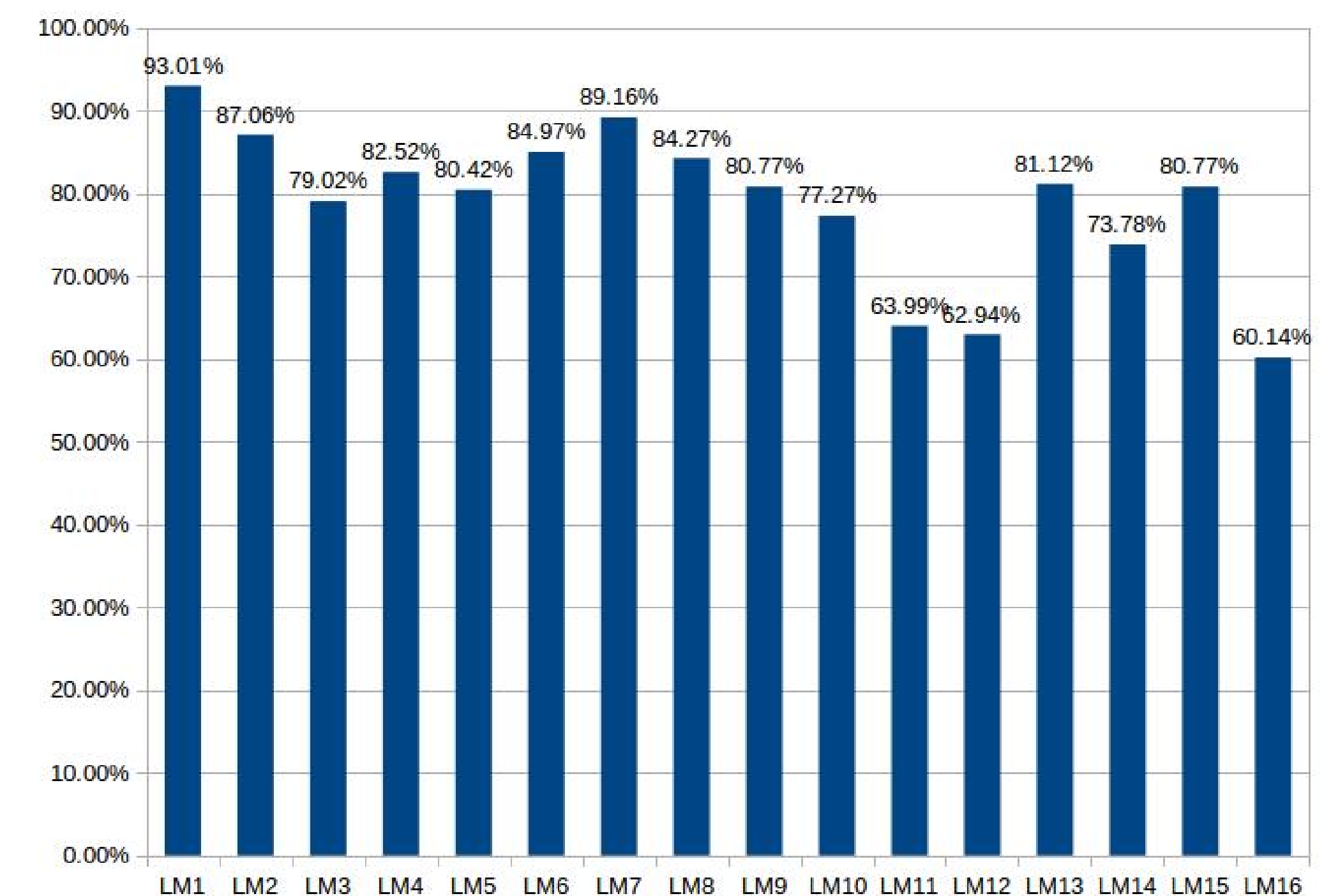
Model and scene images are segmented to extract the contours points. The contours points are registered by applying **Principal Component Analysis** Iteration (PCAI).

1. Compute the centroid point and principal axis of each list of contour points,
2. Compute the **translation** and **rotation** values between two lists of contour points,
3. **Register** the two lists of contour points,
4. Sort the contour points of scene image followed y-direction,
5. Select a subset of contour points of scene image and repeat step 1,
6. PCAI stop automatically when the **angle difference** between two lists of contour points is less than 1.5 **degree**.

SIFT and landmarks



1. A **patch** P_m is initialized at each manual landmark of model image (size of 9×9),
2. Calculating the SIFT descriptor for P_m ,
3. At the same position in the scene image, a patch P_s is created (size of 36×36),
4. For each pixel in P_s , a patch P'_s is extracted with the same size than P_m ,
5. Calculating the SIFT descriptor for all P'_s ,
6. Computing the distance between the descriptor of P_m and each P'_s ,
7. At the end, the pixel that has the **minimum distance** with P_m is kept.



Conclusion

Cependant un Faucon sur sa perche voyait – Notre Manceau qui s'enfuyait. – Les chapons ont en nous fort peu de confiance, – Soit instinct, soit expérience. Celui-ci, qui ne fut qu'avec peine attrapé, – Devait, le lendemain, être d'un grand souper, – Fort à l'aise en un plat, honneur dont la volaille – Se serait passée aisément.

References

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