Automatic Keypoint Detection on 3D Faces Using a Dictionary of Local Shapes

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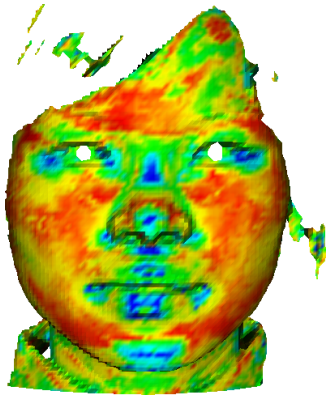
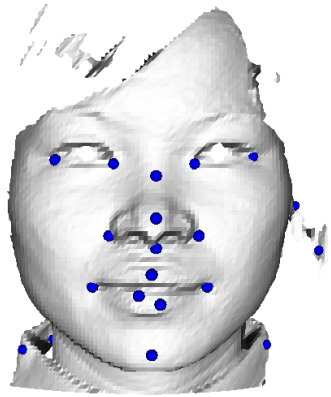
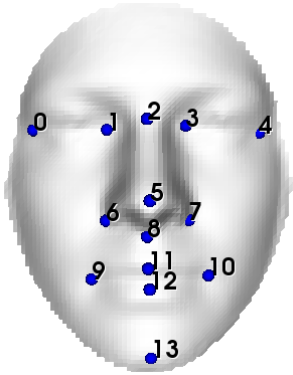
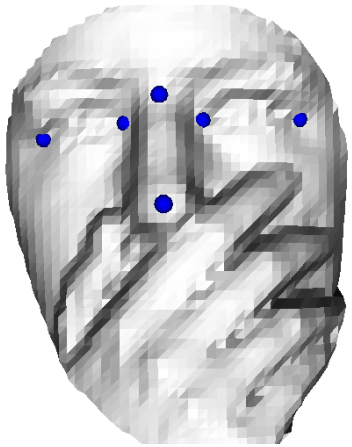
Aim

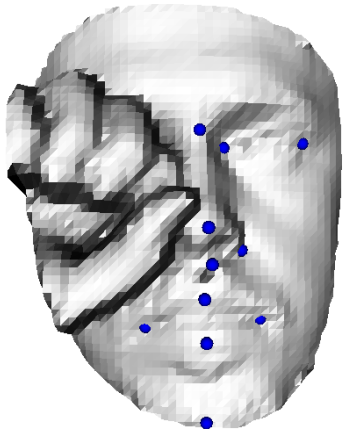




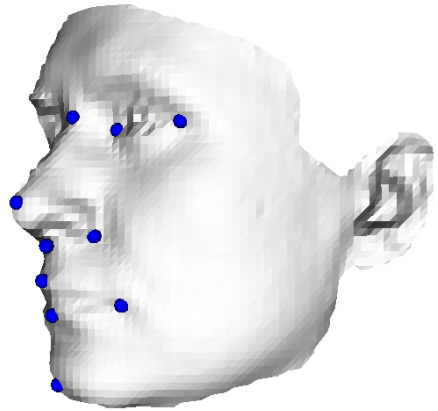
- Keypoints detection (NOT LANDMARKS)
- Similar to any of 14 learnt features (Dictionary of local shapes)



Part of a bigger project

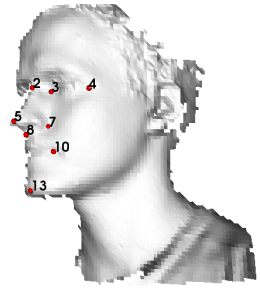






Positions + Labels

Landmarking



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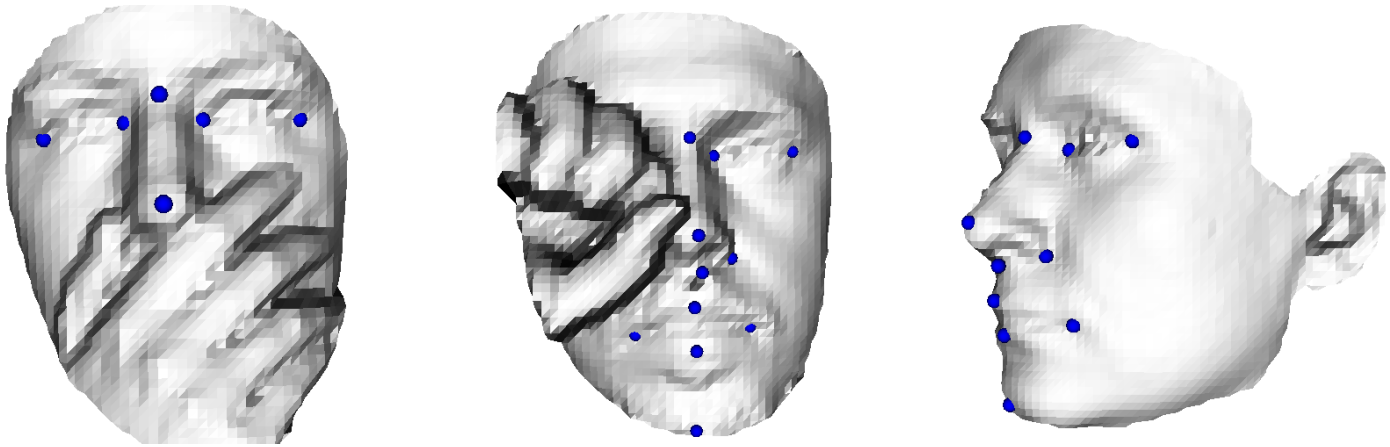
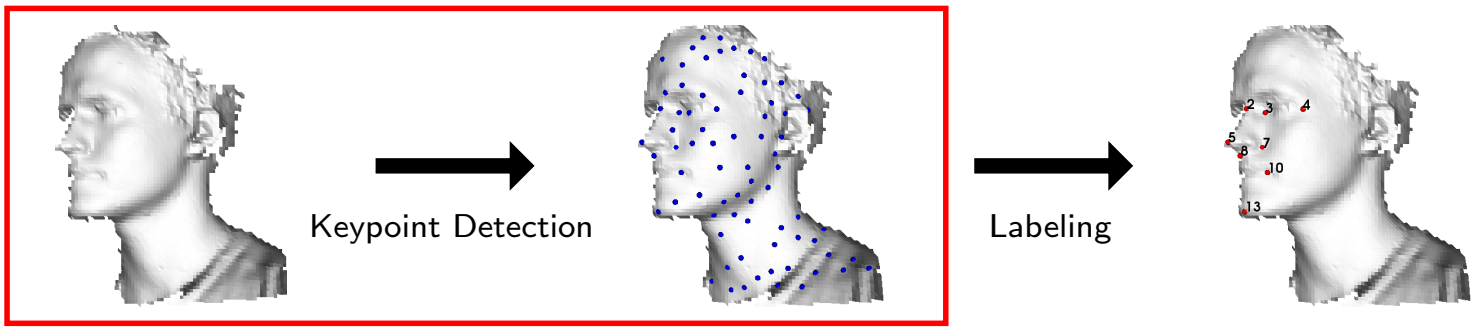


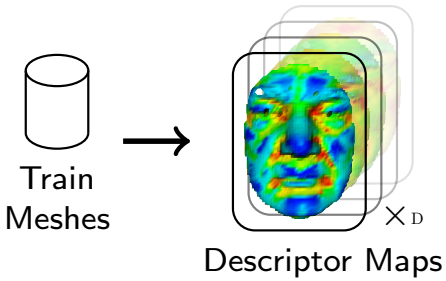


Gap in Research

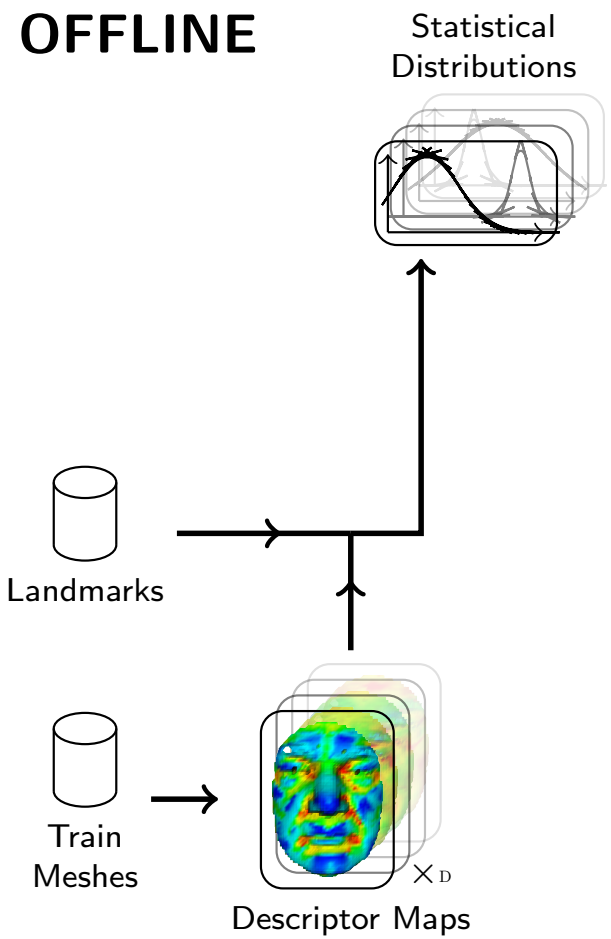
Most literature:

- 3 points max or single-point-of-failure design
- Weak features often discarded
- Almost no work on combining more than 2 descriptors
- Little literature that examine multiple descriptors over multiple scales
- Most people focused on landmarking, without giving the intermediate results on candidate detection (keypoints)

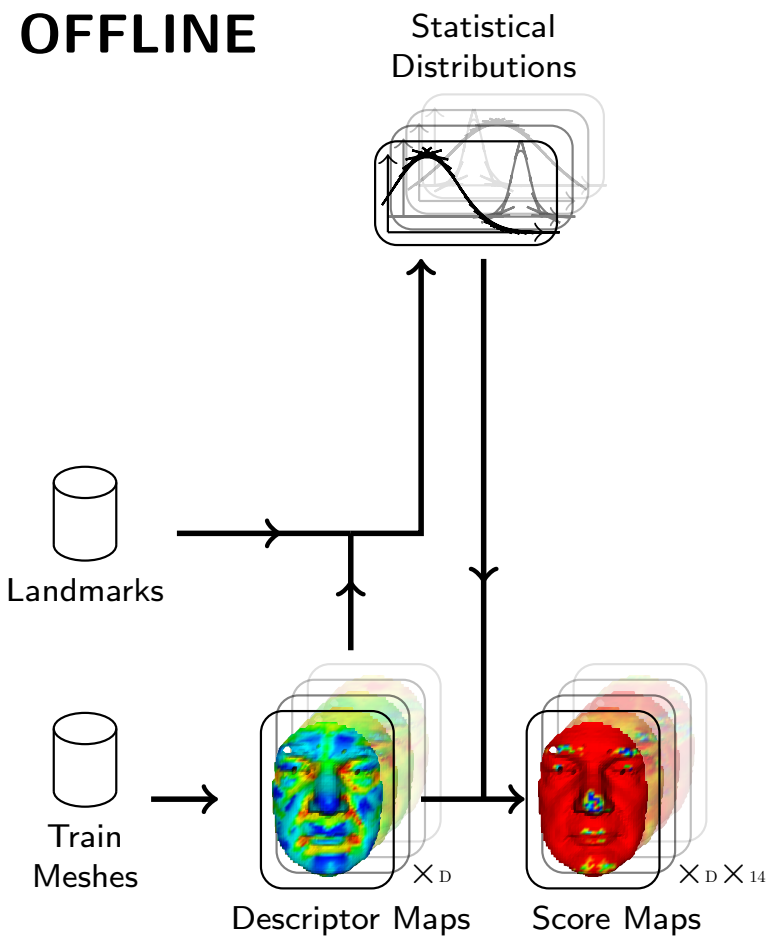
OFFLINE



Workflow



Workflow



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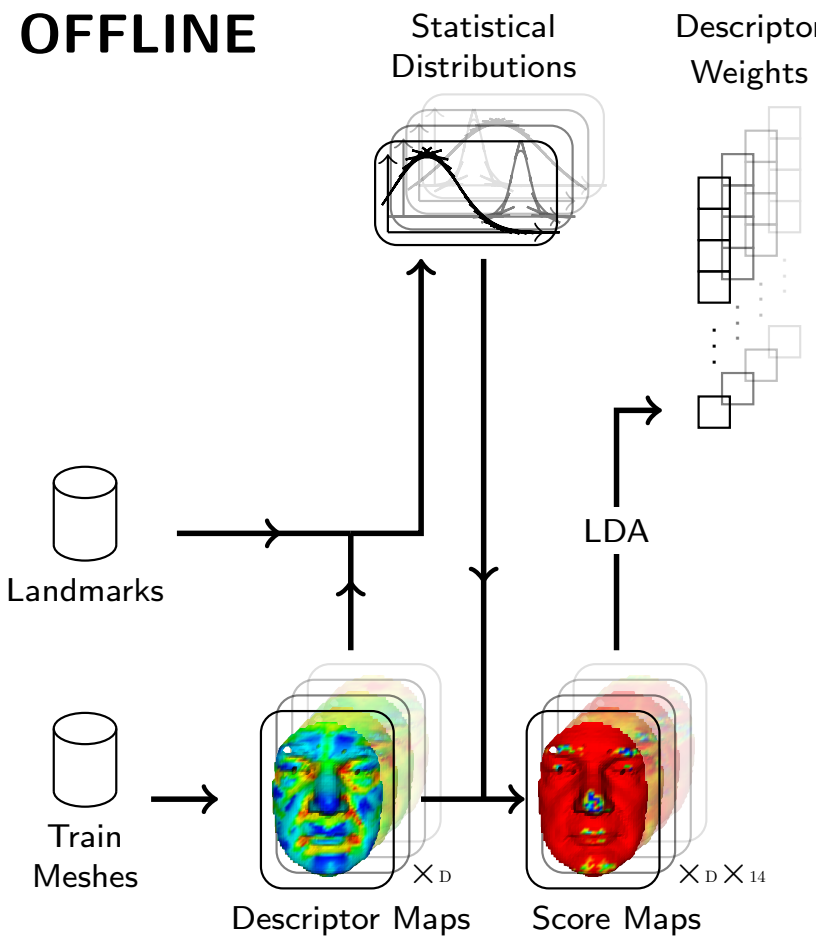

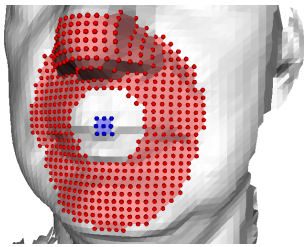

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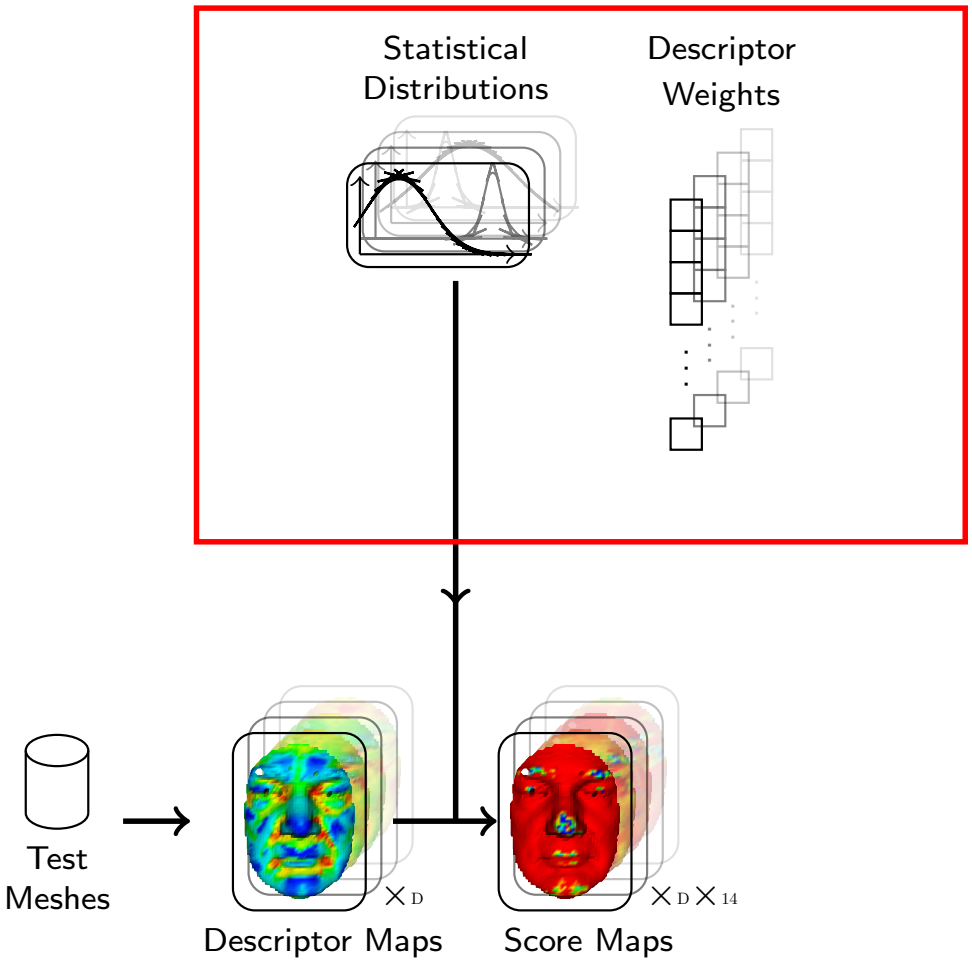
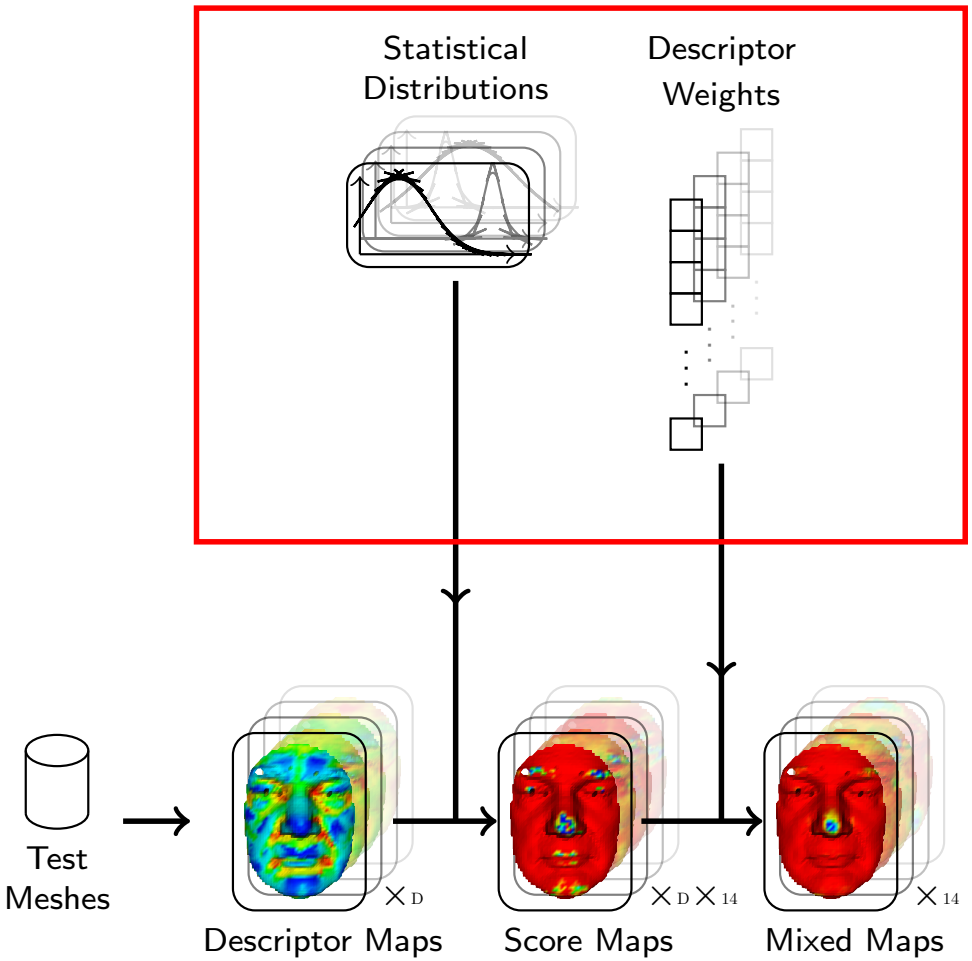


ONLINE

Dictionary of local shapes

Workflow



ONLINE

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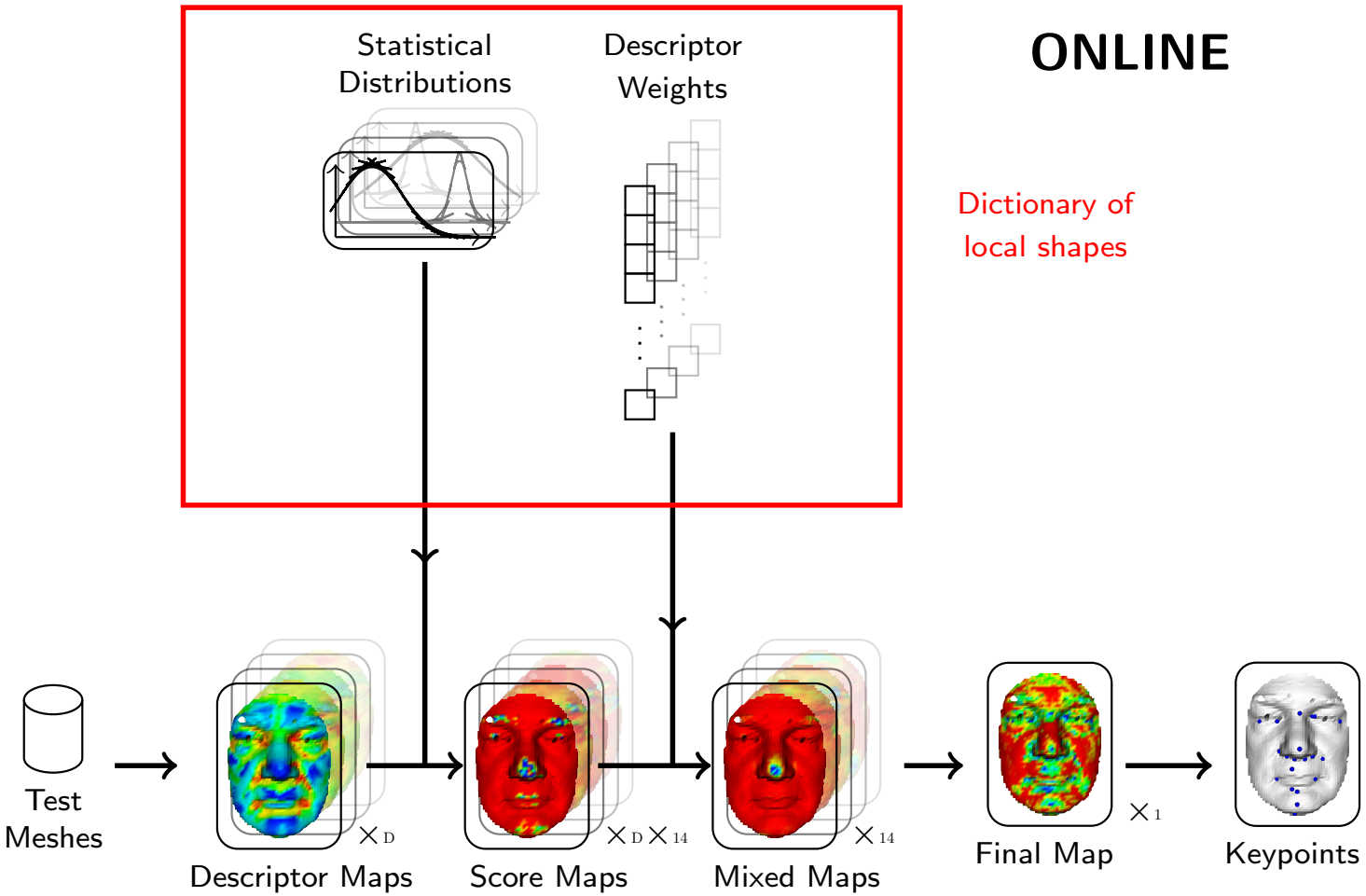
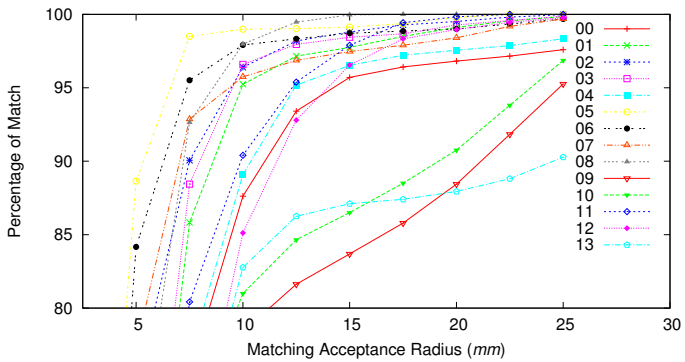
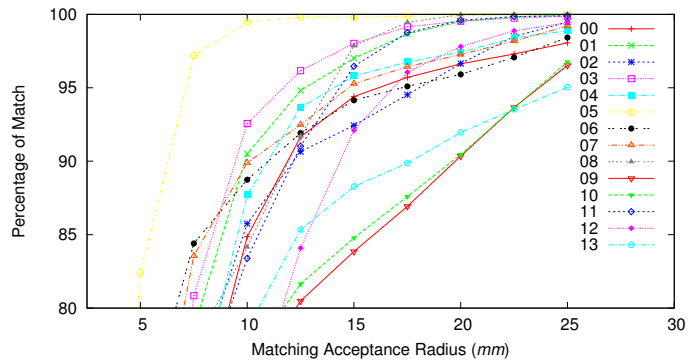


Results

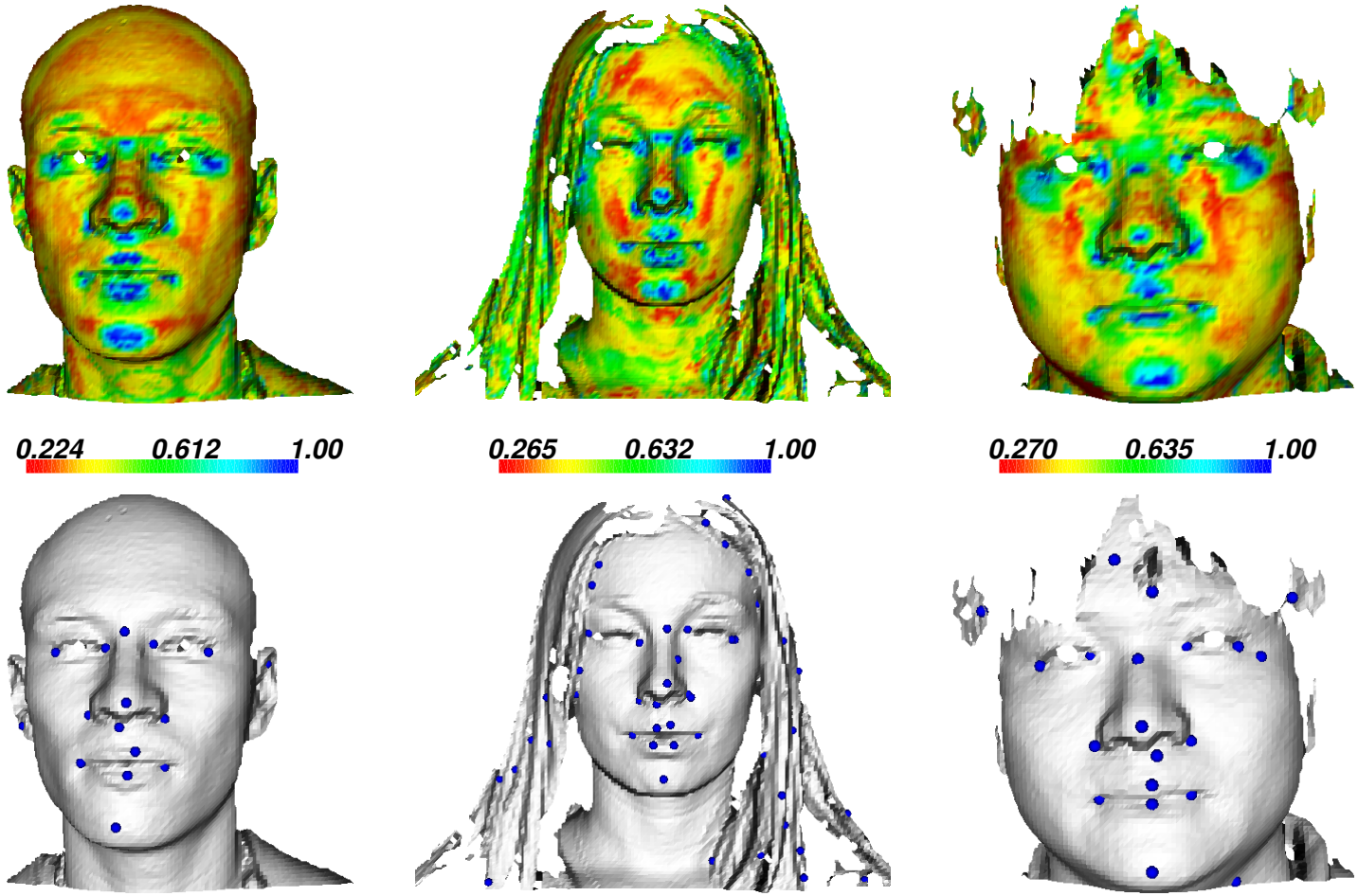
- Sparse selection (max 1%)
- Reapeatable (same subject registration)
  - ∼75% (at 10 mm)
- Close to human hand-placed landmarks
  - average All: ∼85% (at 10 mm)
  - average Nose: ∼99% (at 10 mm)
  - average Eyes: ∼90% (at 10 mm)
- High proportion of the local shapes retreived
  - ∼11.88/14 (at 10 mm)



Configuration 1



Configuration 2



Conclusion

- Good points:
  - Detects "weak" features
  - No single-point-of-failure design
- Limitations:
  - Can be time consuming
    article: 7s, now: 0.5s (8 desc.)
  - Linear combination of scores
- Future Work:
  - Non linear methods (boosting, kernel methods)
  - Structural matching to deduce correspondences
  - Comparison with a new clustering technique for keypoint detection

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Thank You For Listening!

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