Annotated Facial Landmarks in the Wild

A Large-scale, Real-world Database for Facial Landmark Localization

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Motivation

• Facial Landmarks useful for many face related vision tasks
  – MV Face Detection
  – Face Alignment
  – Face Pose Estimation
  – Face Recognition
Agenda

• Motivation

• **Related Databases**

• Annotated Facial Landmarks in the Wild (AFLW) database

• Intended Uses
  – Multi-View Face Detection
  – Face Pose Estimation
  – Facial Landmark Localization

• Data and Tools
Related Databases

• Huge interest in automatic face analysis

• Many face databases exist
  – Only a subset provides additional annotations
  – Large-scale databases often provide only a little number of landmarks

[Angelova et al., 2005]
## Related Databases

<table>
<thead>
<tr>
<th>Database</th>
<th># landmarked imgs.</th>
<th># landmarks</th>
<th># subjects</th>
<th>image size</th>
<th>image color</th>
<th>Ref.</th>
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</thead>
<tbody>
<tr>
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<td>10,524</td>
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<td>-</td>
<td>-</td>
<td>color</td>
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<td>6</td>
<td>-</td>
<td>-</td>
<td>grayscale</td>
<td>[26]</td>
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<td>CMU / VASC Profile</td>
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<td>6 to 9</td>
<td>-</td>
<td>-</td>
<td>grayscale</td>
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<td>100</td>
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<td>AFLW</td>
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<td>-</td>
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<td>color</td>
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</table>
Annotated Facial Landmarks in the Wild

- 25,993 faces in 21,997 real-world images
  - 66% non-frontal faces
  - 56% female, 44% male

- 389,473 annotations
  - 21 point markup scheme

- Comprehensive set of annotations
  - Landmarks
  - Face Rectangles
  - Face Ellipses
  - Coarse Face Pose

- Tools to manipulate annotations
  - Also importers to our database format for other databases such as e.g. BioID
Landmark Markup
Intended Uses

• Not only a benchmark database!

• Train and Test
  – Real-world MVFD
  – Facial feature localization
  – Head pose estimation
Facial Landmark Localization

• For alignment or pose estimation
• Influence of a Face Alignment Step ...
  – LFW / face verification task
  – Outcome: Better aligned faces give better recognition results
  – Needs rather elaborate annotations to train a detector
• AFLW provides loads of landmarks to train and evaluate ...

<table>
<thead>
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<th></th>
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</thead>
<tbody>
<tr>
<td>not aligned</td>
<td>60.85%</td>
<td>63.22%</td>
<td>65.53%</td>
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<tr>
<td>aligned</td>
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<td>65.68%</td>
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<tr>
<td>+</td>
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<td>2.47%</td>
<td>2.90%</td>
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</table>
Face Pose Estimation

• Database comes with approx. head pose  
  – Roll, pitch, yaw angles

• Pose automatically estimated from facial landmarks  
  – Least squares fit of 2D projections on the 3D model  
  – Postit algorithm  
    [DeMenthon and Davis, 1995]

• E.g. retrieve a pose specific subset of images
Multi-View Face Detection

- Frontal face detection
  - Solved
- **Multi-view face detection is still a challenge**
  - Needs a lot of data, e.g. [Huang et al., 2005] used 75k faces
  - Head pose is beneficial
    - Pose specific detectors
    - AFLW provides it
- **AFLW ready to use with FDDDB protocol** [Jain and Learned-Miller, 2010]
  - Annotation based on ellipse
Data and Tools

• Backend supports different face data collections...

• **SQLite Database** to collect the annotations
  – SQL query needs by far less effort than writing traditional code, e.g. to select faces with a specific pose range
  – Database scheme supports multiple face databases
  – C++ and Matlab Wrapper¹

• **Label GUI**
  – Display and manipulate annotations

• **Programming Tools**
  – Display annotations
  – Calculation of pose angles, face ellipses etc.
  – Export to FDDB ground truth file

• Tested under Windows / Linux

¹ http://mksqlite.berlios.de/
Conclusion

• **Annotated Facial Landmarks in the Wild db provides**
  – a large-scale, real-world collection of face images
  – Not limited to frontal poses
  – Comprehensive set of annotations and tools

• **Suited to train and test algorithms, not only benchmark db!**
  – Ready to use with **FDDB** protocol

• **Future work:**
  – Attributes

• **Thanks to ...**
  – Interns
  – Colleagues of the Documentation Center of the National Defense Academy of Austria

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