Learning to Rank Authenticity from Facial Activity Descriptors

Otto von Guericke University, Magdeburg - Germany

Frerk Saxen, Philipp Werner, Ayoub Al-Hamadi
The Task – Real or Fake?

Dataset statistics

• Training set
  – 40 Subjects
  – 6 Emotions
  – 480 Videos

• Validation set
  – 5 Subjects
  – 6 Emotions
  – 60 Videos

• Test set
  – 5 Subjects
  – 6 Emotions
  – 60 videos

• One real and one fake video per emotion and subject
The Task – Real or Fake?

We changed the rules:

• Which one is more real than the other?
Our Approach

1. Face Detection
2. Face Recognition
3. Landmark detection
4. Action Unit Intensity Estimation
5. Facial Activity Descriptor
6. Rank SVM Ensemble
Our Approach

1. **Face Detection**
   - CNN resnet with dlib [1]

2. **Face Recognition**
   - CNN resnet with dlib [2]

3. **Landmark detection**
   - Ensemble of regression trees with dlib [3]

4. Action Unit Intensity Estimation
5. Facial Activity Descriptor
6. Rank SVM Ensemble

Our Approach

1. Face Detection
2. Face Recognition
3. Landmark detection

4. Action Unit Intensity Estimation
   - Using previous work [4]
   - Affine face transform
   - LPB + shape features
   - Ensemble of SVR (Support Vector Regression)

5. Facial Activity Descriptor
6. Rank SVM Ensemble


Our Approach

1. Face Detection
2. Face Recognition
3. Landmark detection
4. Action Unit Intensity Estimation
5. Facial Activity Descriptor
   - Based on previous work [5] with some additional statistics
   - Noise reduction with Butterworth filter
   - Filtered signal + derivative
   - Signal statistics (max, mean, ... )
6. Rank SVM Ensemble

Our Approach

1. Face Detection
2. Face Recognition
3. Landmark detection
4. Action Unit Intensity Estimation
5. Facial Activity Descriptor
6. Rank SVM Ensemble
   - Learn the difference between two facial activity descriptors with libSVM [6]
   - Create an Ensemble of 75 Rank SVMs
   - Aggregate by counting the votes.

Training:

\[
\begin{align*}
\text{feature} & \rightarrow \text{label} \\
x_R - x_F & \rightarrow 1 \\
x_F - x_R & \rightarrow 0
\end{align*}
\]

Test:

\[
\begin{align*}
N_0 &= \sum_{i} \text{pred}_i (x_0 - x_1) = 1 \\
N_1 &= \sum_{i} \text{pred}_i (x_1 - x_0) = 1 \\
y_0 \text{ more authentic} & \leftarrow N_0 > N_1 \\
y_1 \text{ more authentic} & \leftarrow N_1 > N_0
\end{align*}
\]

Results

- Validation set performance (5 subjects, 60 videos)
- Human performance conducted with 22 subjects
Results

- Test set performance (5 subjects, 60 videos)
Final Remarks

- Professional organization team with quick and friendly response. Thank you!
- Challenge introduced us to a new research field.
- Validation and test set provided only 60 samples.
- Data acquisition is questionable:
  - Some humans reported that all videos look fake
  - Fake vs. Fake?
Final Remarks
Contact

- **Frerk Saxen**
  Tel.: +49 391 67 51671
  E-Mail: frerk.saxen@ovgu.de

- **Philipp Werner**
  Tel.: +49 391 67 51491
  E-Mail: frerk.saxen@ovgu.de

- **Prof. Ayoub Al-Hamadi**
  Tel.: +49 391 67 58709
  E-Mail: ayoub.al-hamadi@ovgu.de

**Address:** Otto-von-Guericke Universität
Institut für Informations- und Kommunikationstechnik (IIKT)
Universitätsplatz 2
30106 Magdeburg