INFORMATIK

2D Image Processing & Augmented Reality
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Survey on Face Tracking with Deep Learning

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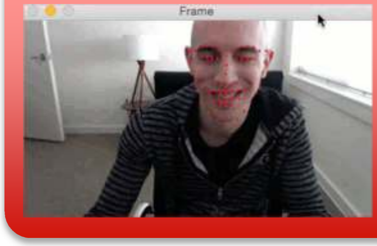
Outline



Face tracking is a computer vision task that involves tracking a specific number of landmarks on the face detected across all frames of a video.

Applications include Face analysis, Person identification, Activity recognition, Expression analysis, Face modeling etc.

It is a challenging problem as the videos can be captured in unconstrained conditions which may include illumination variations, large head poses, occlusions, etc.

Outline

- **Image-based methods use models trained on still images in each frame.**
- **Video-based methods make use of temporal information to predict facial landmarks in each frame.**
- **Various approaches –**
  - Regression-based methods
  - Video-based face alignment
  - Encoder-Decoder Networks

Recurrent Encoder-Decoder Network for Video-based Face Alignment

- **Temporal-variant features such as pose and expression are separated from Temporal-invariant features such as facial identity.**
- **Employs recurrent learning at both spatial and temporal dimensions.**
- **The network consists of 4 modules - Encoder-Decoder, Spatial recurrent learning, Temporal recurrent learning and Supervised identity disentangling.**

Dynamic Facial Analysis: From Bayesian Filtering to Recurrent Neural Network

- Improvises on previous approaches for dynamic facial analysis that use Kalman/Particle filters.
- Bayesian filters require problem-specific design and tuning.
- This RNN based method avoids tracker engineering by learning from data (large data).
- CNN layers followed by recurrent layers as dense layers.
- Uses FC-RNN to exploit generalization from a pre-trained CNN.

Dual-Agent Deep Reinforcement Learning for Deformable Face Tracking

- Exploits the fact that bounding box tracking and landmark detection tasks are dependent. The accuracy of the latter depends on how good the former is.
- The two tasks are modeled in a probabilistic manner by following a Bayesian model.
- The architecture consists of a *Tracking agent, Alignment agent* and *Communication channels* between the agents.

Two-stream Transformer Networks for Video-based Face Alignment

- **Two stream deep learning method to capture spatial as well as temporal information.**
- **Spatial stream captures information on still frames.**
- **Temporal stream captures temporal consistency information across successive frames. It is followed by a RNN to model the sequential information over consecutive frames.**
- **Finally, facial landmarks are determined by a weighted fusion of spatial and temporal streams.**

Face Alignment Recurrent Neural Network

- Recurrent regression based approach
- Uses LSTM to exploit both spatial and temporal information.
- Spatial – The predicted landmark location is used as basis for estimation in the next stage.
- Temporal – The predicted landmark location is used as basis for estimation in the next frame.

Comparison metrics

- **Following are some of the metrics that will be used to compare the various methods in this survey :–**
  - Dataset used for training (In the wild vs constrained)
  - Evaluation metrics
  - Number of landmarks tracked
  - Kind of landmarks retrieved (2D or 3D)
  - Robustness to large pose variations, illumination changes

Thank You