Eye Tracking of Dynamic Stimuli

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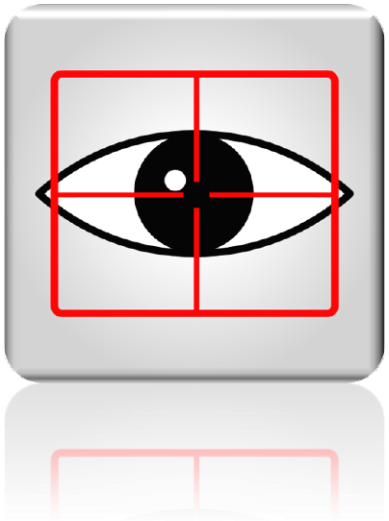

Motivation

Eye tracking of videos

- Analyzing viewing behavior of numerous viewers
  - Commercials
  - Movies
  - Animated visualizations

Goals

- New data visualizations
- Support quantitative evaluation of dynamic Areas of Interest (AOIs)

Overview

- Motivation
- **Challenges of Dynamic Stimuli**
  - Smooth Pursuit
  - Definition of AOIs
- **Common Visualization Techniques**
- **Beyond Standard Heat Maps and Gaze Replay**
  - Motion-Compensated Heat Maps
  - Space-Time Cube for Eye Tracking Videos
  - Examples
- **Conclusion & Future Work**

Challenges: Smooth Pursuit

- Common fixation filtering insufficient for videos
- Smooth pursuit of AOIs problematic

Challenges: Definition of AOIs

- Dynamic AOIs change position and size
  - AOI tracking
  - Overlaps
- Definition of AOIs
  - Computer vision approaches
  - Manual editing
  - Hybrid approaches

Common Visualization Techniques

Common Visualization Techniques

Bee Swarm

- Gaze points during video playback
  - Requires sequential analysis

Common Visualization Techniques

Gaze Replay

- Animated scan path with fixation durations
  - Difficult interpretation over time
  - Multiple users cause clutter

Common Visualization Techniques

Heat Maps (static)

- Aggregated data of numerous viewers
- Dynamic content hard to interpret

Heat Maps (dynamic)

- Dynamic adjustment of distribution of attention
- Sequential analysis still needed

Beyond Standard Heat Maps and Gaze Replay

Motion-Compensated Heat Maps

- Static heat map with motion compensation
- Optical flow information
- Gaze points move with the flow
- Hot spots remain on observed objects

Standard

Motion-compensated

Space-Time Cube for Eye Tracking Videos [1]

Gaze Point Visualization

- Color mapping based on density
- Filtering of sparse data reveals attentional synchrony

Clustering

- Spatiotemporal clustering of gaze points
- Information about the most important AOIs
- Mapping of AOIs to objects needed

Conclusion & Future Work

Presented Visualizations

- Motion-compensated heat maps
- STC for eye tracking data of videos

Future Work

- Analysis of individual users and groups
- Studying analysts‘ strategies
- Automatic conversion from clusters to object AOIs

More Information

- http://go.visus.uni-stuttgart.de/stva

References

- **[1]** K.Kurzhals, D. Weiskopf. **Space-Time Visual Analytics of Eye-Tracking Data for Dynamic Stimuli**. *IEEE Transactions on Visualization and Computer Graphics, 19 (12), to appear, 2013.*