Combining Content-based Analysis and Crowdsourcing to Improve User Interaction in Zoomable Video

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ABSTRACT

- Zoomable video allows users to zoom and pan in streamed video
- A dynamic scene with moving objects motivates users to frequently interact with the video
  - Frequent interaction can be irritating to the users
  - Users may not be fast enough to follow objects of interest in a rapidly changing scene
  - Frequent user interaction can be supported only if the end-to-end system has a low reaction time
- Content-based analysis of the video scene can be used to identify interesting regions in the video
  - Users are presented with automatically generated viewports at different zoom levels
  - The user interface automatically zooms and pans within the scene when a user clicks on a recommended viewport
- The user interface allows for overriding suggested viewports
- Users’ viewport selection is combined with machine generated viewports to refine the interesting region

OVERVIEW OF THE SYSTEM

- Video frame
- Frame features
- Suggest Viewports
- Log users’ choice
- Gaussians of users’ choice is a new feature
- Refine viewport suggestion

CUTS AND VIEWPORT GENERATION

- Importance Map
- A Bad Cut
- A Good Cut

- Cluster points in the importance map based on proximity
- Use exhaustive search to find viewports based on the “cut” metric
- Limit number of viewports to three per zoom level

TUBING AND PANNING

- For all pairs of paths between viewports in two consecutive key frames
  - Find a path that minimizes a “tubing metric”
  - The tubing metrics are “cluster cuts”, “heat”, “regularity” and “coherence”
  - Repeat for each zoom level

RESULTS

- User’s selections
- Gaussians representing users’ selections

- Distribution of Recommended Viewport Selection

- User Selection of Viewports
  - Content Analysis 18% Coffee Lounge 45%
  - +Feedback 40% 55%

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