中国科学院软件研究所学术年会’2018
暨计算机科学国家重点实验室开放周

学术论文

面向视频内容的多尺度表示与交互

Visualizing and Analyzing Video Content With Interactive Scalable Maps

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IEEE Transactions on Multimedia, vol. 18, No. 11, November 2016.

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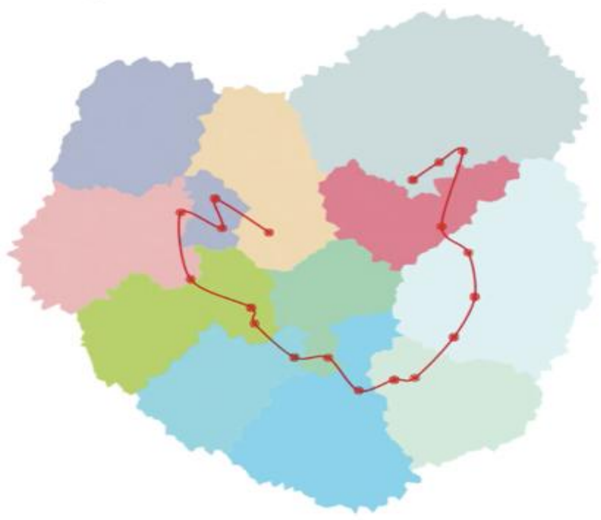
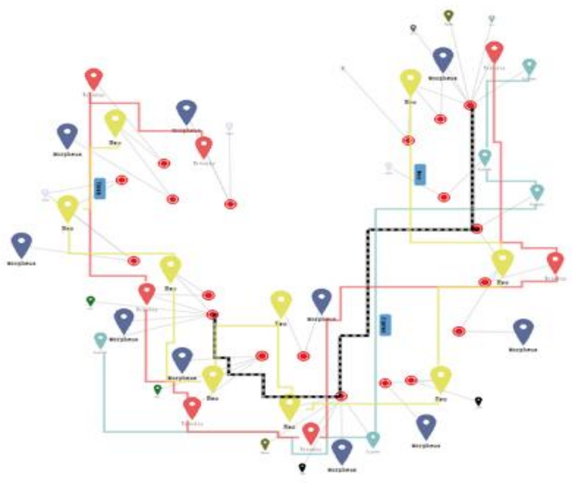
ABSTRACT

Visualizing and communicating insights through maps offers an intuitive and familiar way to explore large-scale dynamic relational data. In this paper, we present VideoMap, which is a novel approach for presenting and interacting with relational video content by taking advantage of the map metaphor. VideoMap employs a metaphor to visualize video content by elements of a map with the aim of enabling exploration of video content as if reading a map.



Video map in coarser-grained level



Path in the videomap

Video map in fined-grained level

VIDEOMAP VISUALIZATION AND ANALYSIS

Structured representation of video data. Simlarity measure methods for characters, events and scene in the movie.

1) Importance of Characters:

TABLE I
KATZ CENTRALITY VALUES OF MAIN CHARACTERS

Characters	value
Neo	0.55
Morpheus	0.50
Trinity	0.43
Cypher	0.31
Dozer	0.2
Apoc	0.17
Smith	0.15
Tank	0.14
Switch	0.12
Mouse	0.12
Oracle	0.03

2) Similarity between events:

$$t_i = \frac{t_i - t_{\min}}{t_{\max} - t_{\min}}$$

$$\text{score}\ (c_i) = \frac{\text{score}(c_i) - \min\{\text{score}(c)\}}{\max\{\text{score}(c)\} - \min\{\text{score}(c)\}}$$

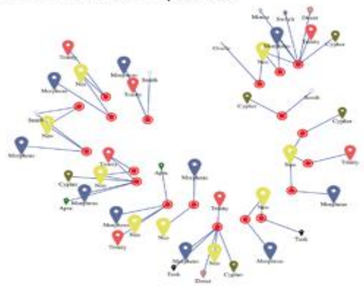
$$\text{sift}\ (i,j) = \frac{\text{sift}(i,j) - \min\limits_{m \neq n}\{\text{sift}(m,n)\}}{\max\limits_{m \neq n}\{\text{sift}(m,n)\} - \min\limits_{m \neq n}\{\text{sift}(m,n)\}}$$

$$\begin{aligned}&\text{Sim}(\text{Event}_i, \text{Event}_j)\\ &\quad = (w_1|t_j - t_i|^2 + w_2|\text{score}(c_j) - \text{score}(c_i)|^2\\ &\qquad + w_3|1 - \text{sift}(i,j)|^2)^{-1/2}.\end{aligned}$$

3) Layout and Scene block:

The canvas is tessellated by a Voronoi diagram of a large number of random points.

Voronoi cells belonging to the same scene are painted in the same color.



Events - Characters layout

Characters shared in two events

Visual Analysis and interaction. Here we define two types of relations: Relationships between different characters and relationships between different events.

1) Find bridges connecting characters

Find path with minimal crossover points of path.

2) Sketch gestures interaction: characters and events

Specific event tracking.

Three characters' tracking instances.

3) Sketch gestures interaction: scene blocks include characters

Characters selected by drawing a line between them using sketches.

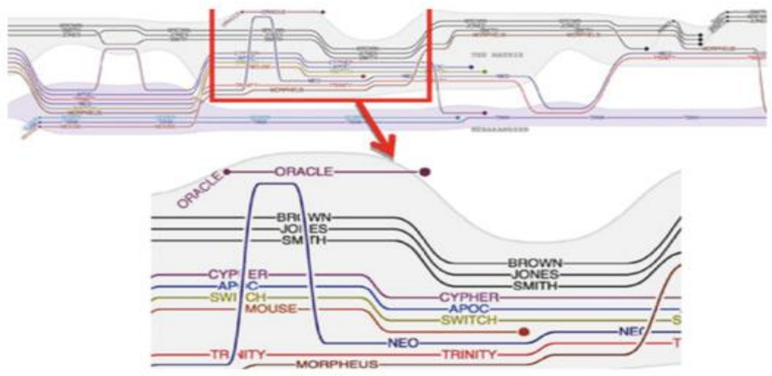
EVALUATION

1) Symposium Evaluation: TV directors & graphic designers.

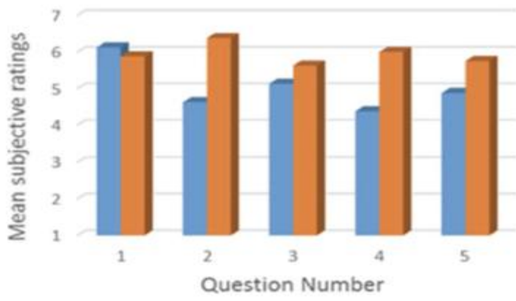
2) Time Evaluation on Familiarization With VideoMap.

3) Evaluation of Multiscale Operations for Scaling With Complex Data in VideoMap.

4) Comparison Between VideoMap and Storyline.



Storyline used in the experiment.



CONCLUSION

In this paper, we present VideoMap, a novel and narrative technique based on the map metaphor for visualizing video data with hierarchical structures.

A limitation of VideoMap is that it does not work well on non-chronological storylines because the relationships be--tween different characters in VideoMap rely on this temporal information.