Spectators' synchronization detection based on manifold representation of physiological signals: application to movie highlights detection

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Objectives
- Determining highlight moments in a movie on the basis of physiological reactions of several spectators:
  - interactions among a group of spectators during the projection of a movie in a movie theatre (data recorded in an ecological situation);
  - detection of movie highlights based on a level of the proposed synchronization measure of spectators’ physiological signals.

![Fig. 1 Aesthetic highlight types](image)

Comparison of our methodology with baseline methods

![Fig. 4 Overview of the proposed approach to highlights detection](image)

Our methodology
- Synchronization measure is based on a local shape similarity of reconstructed trajectories:
  - Kolmogorov-Smirnov distance between local shape cumulative distributions of pairwise distances.
  - A certain value of the synchronization measure (threshold) is set to determine the particular type of highlights.
- To reconstruct a trajectory of each dynamical system (a representation of each viewer) from a time series, we use:
  - time-delay embedding of a recorded GSR signal;
  - manifold learning (diffusion maps).

We propose a methodology that is invariant to scale and topological changes of signals by investigating their intrinsic structure:
- Our methodology obtains significantly higher performance for detection of highlights H1, H2, H4, H5 (Bradley test, α=0.05) compared to other baseline methods;
- Mutual information achieves higher performance for detection of highlights H3 (Bradley test, α=0.05) compared to the rest. This result can be explained by a lack of strong physiological reactions to character development scenes that take place in the movie;
- Spectacular highlights (H1) are identified better than other types: our methodology is capable of extracting the similarity of skin conductance peaks (strong reaction).