

A QUICK SEARCH METHOD FOR MULTIMEDIA SIGNALS USING FEATURE COMPRESSION BASED ON PIECEWISE LINEAR MAPS

Akisato Kimura, Kunio Kashino, Takayuki Kurozumi and Hiroshi Murase
NTT Communication Science Laboratories, NTT Corporation

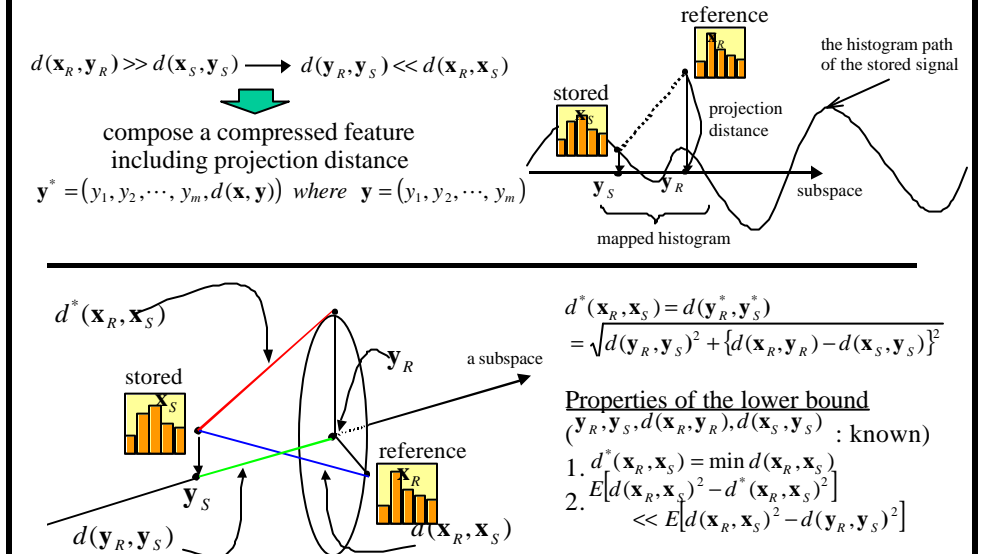
ABSTRACT

- Objective: Quick audio/video signal search (similarity-based search: usually very time-consuming)
- Approach (): Accelerate the search while guaranteeing the same search results
 - Dimension reduction based on piecewise linear maps
 - Distance bounding for efficient skips in the search
- Experiments: Approx. 2 times faster than TAS () (84 msec for 24-hour stored signal)

APPROACH

- Speeding up TAS
- Dimension reduction based on piecewise linear maps
- stored histogram sequence : continuous
- Compressed representation obtained by dividing the path and performing KL transformation.
- Distance bounding ()
 - calculate a lower bound of inter-histogram distance using mapped histograms and projection distances
- Note :
- Standard dimension reduction (ex. PCA, ICA)
 - compress the **whole** feature space using a common function : inefficient
 - Typical component extraction methods for each local area (ex. FastMap [Faloutsos 1995], projected clustering [Aggarwal 1999])
 - degrade accuracy or need computationally expensive post-processing

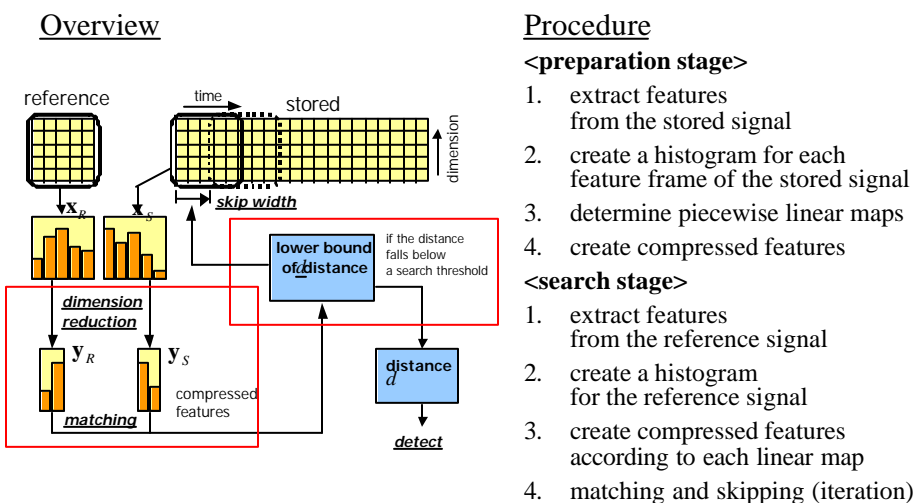
BOUNDING DETAILS



BACKGROUND

- Problem of similarity-based audio/video search
 - search speed (high dimensionality, quantitative accuracy requirements)
 - Time-series Active Search (TAS) [Kashino 1999]
 - omit unnecessary matches around the window based on the distance between feature histograms while mathematically guaranteeing the same search results
- Even faster methods are needed for Internet multi-channel broadcasting

METHOD



EXPERIMENTS

- Task
 - stored signal: a video recording of 24-hour TV broadcast
 - reference signals: ten 15-s segments randomly chosen from the stored signal
 - dimensions of histograms = 256
- Results
 - CPU times required after the reference signal was given

existing	SSDA	2092 msec
	TAS	165 msec
proposed		84 msec

Note: contribution rate = 97.5%, number of maps = 100
 SSDA: the Sequential Similarity Detection Algorithm was used for feature matching in the compressed feature space instead of performing skipping as the proposed method
 When the bounding technique was not employed in the proposed method, the search time was 95 msec.

References:

[Kashino 1999]
 Kashino et al.: "Time-series active search for quick retrieval of audio and video," Proc. of ICASSP99, Vol.6, pp.3697-3700, 1999

[Aggarwal 1999]
 Aggarwal et al.: "Fast algorithms for projected clustering," Proc. ACM SIGMOD, pp. 61-72, 1999

[Faloutsos 1995]
 Faloutsos et al.: "FastMap : A fast algorithm for indexing, data-mining and visualization of traditional and multimedia datasets," Proc. ACM SIGMOD, pp. 163-174, 1995

