

Relevant Video Matching Using Frame-Level Segmentation

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Abstract: - *The exponential growth of online videos, along with increasing user involvement in video-related activities, has been observed as a constant phenomenon during the last decade. The massive publishing and sharing of videos has given rise to the existence of an already large amount of near-duplicate content. A frame-level video matching algorithm, which achieves dense frame matching between near-duplicate videos, is proposed in this work by using a ternary frame descriptor for the near duplicate video matching. Proposed system also formulate the frame-level matching problem as the minimization of a cost function, which consists of matching costs and adaptive unmatching costs. We develop an iterative refinement scheme that converges to a local minimum of the cost function. This eliminates the need for exhaustive key frame-pair comparisons, which significantly accelerates the matching speed. The set of key frame-pairs found by our algorithm provides our proposal on the list of candidate key frame-pairs for near-duplicate detection using local interest points. This eliminates the need for exhaustive key frame-pair comparisons, which significantly accelerates the matching speed. Experimental results show the effectiveness of our approach for both web-based near-duplicate video and unbalanced video datasets. The near-duplicate alignment capacity of IMark is also shown to be effective.*

Keywords: *Near-duplicate video detection, frame-level video matching, ternary frame descriptor, and iterative refinement*

I. INTRODUCTION

Emerging online video-related services such as video sharing, video broadcasting, video recommendation and so on, increasingly bring user interests and participation to video related activities like editing, publishing, searching, streaming, and viewing. According to a report by comScore.com, a leading company in measuring the digital world, 76.8% of the total U.S. Internet audience viewed online videos and these users viewed 14.8 billion online videos in January 2009 alone, with an average view count of 101 videos and an average view time of 356 minutes per user. It also shows an evident rising demand for online videos, supported by the facts that the view count of January 2009 increased by 4% and average view time up by 15% compared to November 2008. Enlightened by the observation that corresponding key frames of two near-duplicate videos usually exhibit regular alignment patterns, the alignment distortion is novelly proposed to measure the temporal arrangement of the key frames. The idea of distortion was previously used in the shape matching problem. In this paper, we present a novel frame descriptor for efficient near-duplicate video matching, called the ternary frame descriptor. As a patch-based descriptor, the proposed descriptor represents the order relations of patch intensities in ternary digits. To compute the similarity of the ternary descriptors of two frames in a fast manner, we transform the ternary digits into bits and employ the Hamming distance. Moreover, we propose a frame-level matching algorithm to obtain dense frame matching between near-duplicate videos. We first formulate a cost function for the matching, which consists of matching costs and adaptive unmatching costs. Then, we develop an iterative refinement scheme, which is guaranteed to converge to a local minimum of the cost function. Experimental results confirm that the proposed algorithm achieves effective frame description and efficient frame matching of near-duplicate videos.

A. Motivation

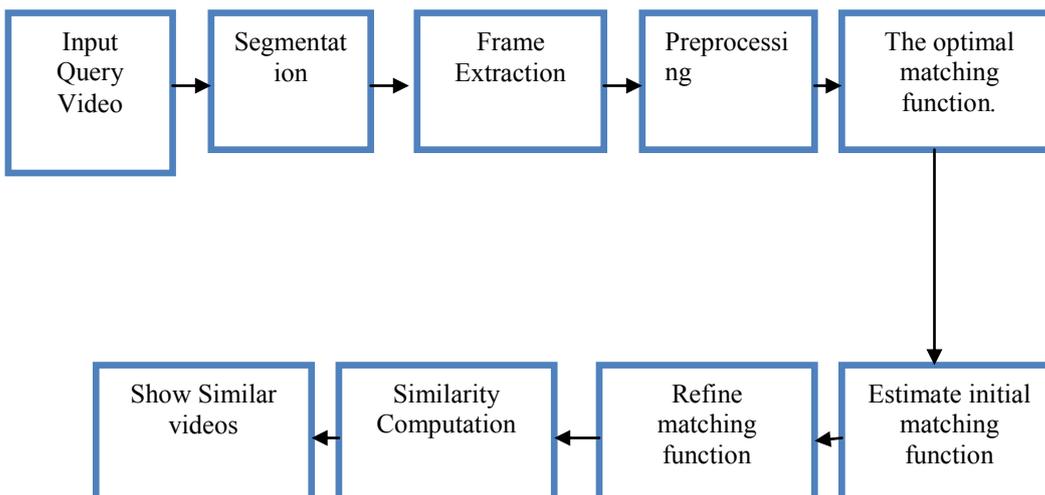
With the popularization of video-sharing sites, such as YouTube and Vimeo, an enormous amount of videos are available on the Internet. A typical video database contains near-duplicate videos, which have the same contents but different modifications, e.g. subtitle insertion, contrast enhancement, and cropping. Near-duplicate videos induce redundancy and inefficiency in video retrieval and database management.

II. LITERATURE SURVEY

Novelty/redundancy detection has been explored in text information retrieval from the event level to the document/sentence level [3, 39]. It is closely related to the New Event Detection (NED) or First Story Detection (FSD) in Topic Detection and Tracking (TDT) that investigates several aspects for the automatic organization of news stories in text area. The NED task is to detect the first story that discusses a previously unknown event. A common solution to NED is to compare news stories to clusters of stories from previously identified events. The novelty detection approaches for documents and sentences mainly focus on vector space models and statistical language models to measure the degree of novelty expressed in words. The idea of novelty detection has also been applied to web search to improve the search results. Query relevance and information novelty have been combined to re-rank the documents/pages by using Maximal Marginal Relevance, Affinity Graph and language models. However, these approaches are mainly based on textual information. Recently, multimedia based novelty/redundancy detection has also been applied to cross-lingual news video similarity measure and video re-ranking by utilizing both textual and visual modalities. Hsu used an information bottleneck method to rerank video search results. For web videos, the textual information is usually limited and inaccurate. Therefore, applying text analysis to web videos makes little sense. To the best of our knowledge, there is little research on near-duplicate video detection and re-ranking for large scale web video search. Enlightened by the observation that corresponding keyframes of two near-duplicate videos usually exhibit regular alignment patterns, the alignment distortion is novelly proposed to measure the temporal arrangement of the key frames. The idea of distortion was previously used in the shape matching problem. In this paper, the quality of correspondences between key frames is jointly measured by two factors: visual similarity and alignment distortion. Visual similarity considers the visual quality in terms of visual keywords, while the alignment distortion measures the temporal arrangement of the similar keyframes. The correspondence problem is then cast as an integer quadratic programming problem. As such, dissimilar keyframe pairs are effectively filtered out by the correspondence matching and near-duplicate keyframe detection need to be performed only within the matched pairs.

III. RELATED WORK

Architecture Diagram



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CONCLUSION AND FUTURE WORK

We proposed the ternary frame descriptor for near-duplicate video matching. Specifically, we partitioned a frame into patches and described the order relations of patch intensities with ternary digits, which were converted into bits for fast similarity measurement using the Hamming distance. Moreover, we developed an efficient and precise frame-level matching algorithm. We first formulated a cost function for the matching, composed of matching costs and adaptive unmatching costs. Then, we roughly determined initial matchings and refined those matchings iteratively to reduce the cost function monotonically.

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