

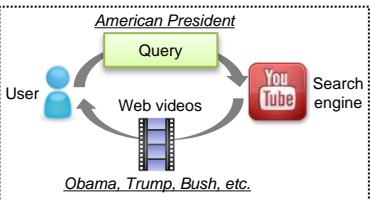
# (UCD-P1.5) TRACKING HIERARCHICAL STRUCTURE OF WEB VIDEO GROUPS BASED ON SALIENT KEYWORD MATCHING INCLUDING SEMANTIC BROADNESS ESTIMATION

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## 1. Introduction

### Background of Web video retrieval



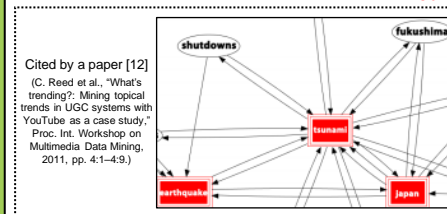
Time stamps including desired topics are different depending on each user.

**Ex.** Given a topic "American president", some users desire Web videos about "Donald Trump" and some desire "Barack Obama".

**Problem** Existing search engines cannot provide retrieval results considering trends of topics over time.

## 2. Related Work

### Conventional studies to track Web video groups over time for Web video retrieval [8-12]



Cited by a paper [12] (C. Reed et al., "What's trending?: Mining topical trends in UGC systems with YouTube as a case study," Proc. Int. Workshop on Multimedia Data Mining, 2011, pp. 4-1-4-9.)

Realize retrieval by providing Web video groups obtained via flat clustering considering time information

**Merit** Can retrieve desired Web videos by grasping trends of topics over time  
**Problem** Cannot accurately track Web video groups since their semantic broadness is ignored

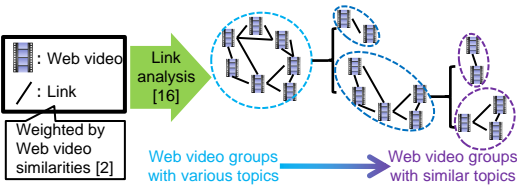
**Ex.** Cannot distinguish Web video groups with different semantic broadness (e.g. "iPhone" and "Electronic device")

## 3. Proposed Method

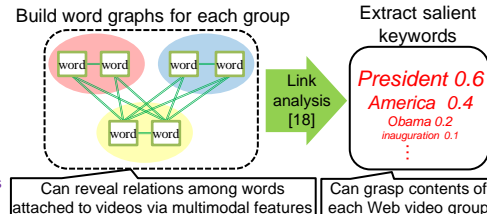
### Novel method to track Web video groups considering semantic broadness for Web video retrieval

#### Phase I: Extraction of the hierarchical structure of Web video groups

##### (i) Extraction of the hierarchical structure

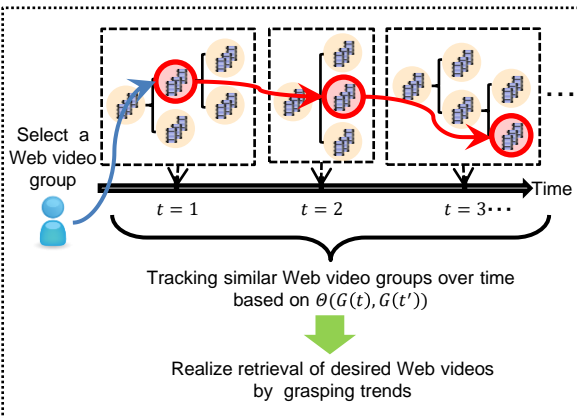


##### (ii) Estimation of salient keywords



#### Phase II: Tracking the hierarchical structure of Web video groups over time

**Main contribution**



**Novelty** Similarity definition between Web video groups at different time stamps

$$\theta(G(t), G(t')) = S_k(G(t), G(t')) \times S_b(G(t), G(t'))$$

$$\textcircled{1} \text{ Similarity based on salient keyword distribution}$$

$$S_k(G(t), G(t')) = \frac{\sum_u \sum_{u'} a(u, G(t)) a(u', G(t')) \delta_{uu'}}{\sqrt{\sum_u a(u, G(t))^2} \sqrt{\sum_{u'} a(u', G(t'))^2}}$$

$a(u, G(t))$ : attribution degree of a salient keyword  $u$  to a Web video group  $G(t)$

$\delta_{uu'}$ : 1 if  $u$  and  $u'$  are the same and 0 otherwise

Can track Web video groups with similar topics via multimodal features

$\textcircled{2}$  Similarity based on semantic broadness

$$S_b(G(t), G(t')) = \exp\left(-\frac{\|H(G(t)) - H(G(t'))\|^2}{2\sigma^2}\right)$$

$H(G(t))$ : entropy [19] of salient keywords of  $G(t)$

$\sigma$ : predefined threshold

Can reduce over-tracking if many salient keywords are the same although semantic broadness is different from each other

## 4. Experimental Results

### I. Purpose

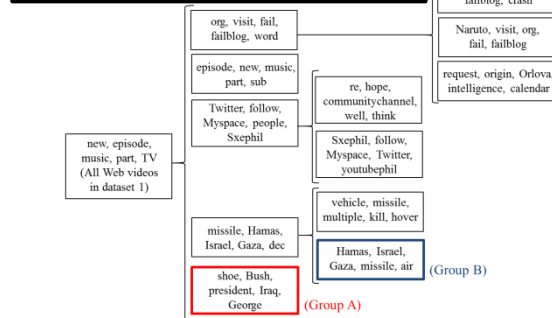
Verify the effectiveness of our new similarity  $\theta(G(t), G(t'))$  that consists of salient keyword distribution (novelty  $\textcircled{1}$ ) and semantic broadness (novelty  $\textcircled{2}$ )

### II. Datasets

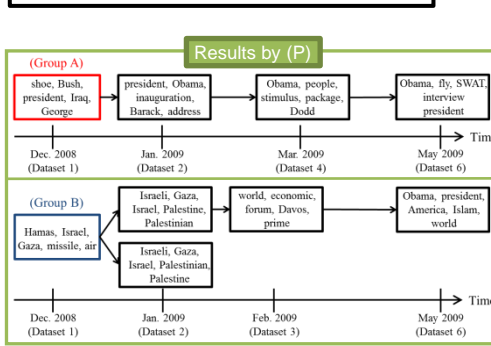
Public datasets MCG-WEBV 1.0 [20] containing "Most Viewed" YouTube videos of each month

	Crawling time stamp	Num. of Web videos
Dataset 1	December 2008	1315
Dataset 2	January 2009	1204
Dataset 3	February 2009	1141
Dataset 4	March 2009	1333
Dataset 5	April 2009	1439
Dataset 6	May 2009	1382

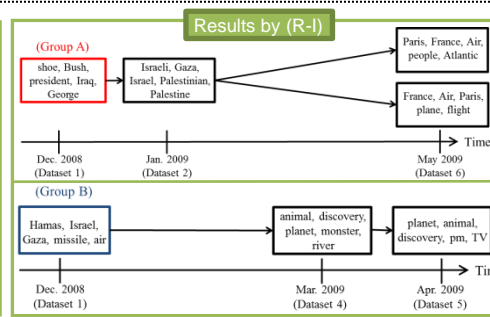
### III. Hierarchical structure for dataset 1



### IV. Tracking results for groups A and B



(P): Proposed method  
 (R-I): Method that calculates  $S_k(G(t), G(t'))$  by Doc2Vec [24] features  
 (R-II): Method that ignores semantic broadness  $S_b(G(t), G(t'))$



(P) ... Can accurately grasp changes of topics and people attention over time **Confirm novelty  $\textcircled{1}$**   
 (R-I) ... Cause mistracking since importance of each word cannot be considered **Confirm novelty  $\textcircled{2}$**   
 (R-II) ... Cause more than 100 unsuitable results including some common salient keywords in any hierarchies