

AN EFFECTIVE VIDEO RETRIEVAL SYSTEM BY COMBINING VISUAL AND TEXTUAL MINING TECHNIQUES

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Outline

- Introduction
- System Architecture
- Experimental Evaluations
- Conclusions
- Future Work



Introduction (1)

□ Previous work on video retrieval

□ Textual search

- Rely on the video metadata heavily by exactly matching
- High cost by manual annotation

□ Visual search

- The traditional content-based video search is limited in the compound and complex visual contents in terms of effectiveness and efficiency.

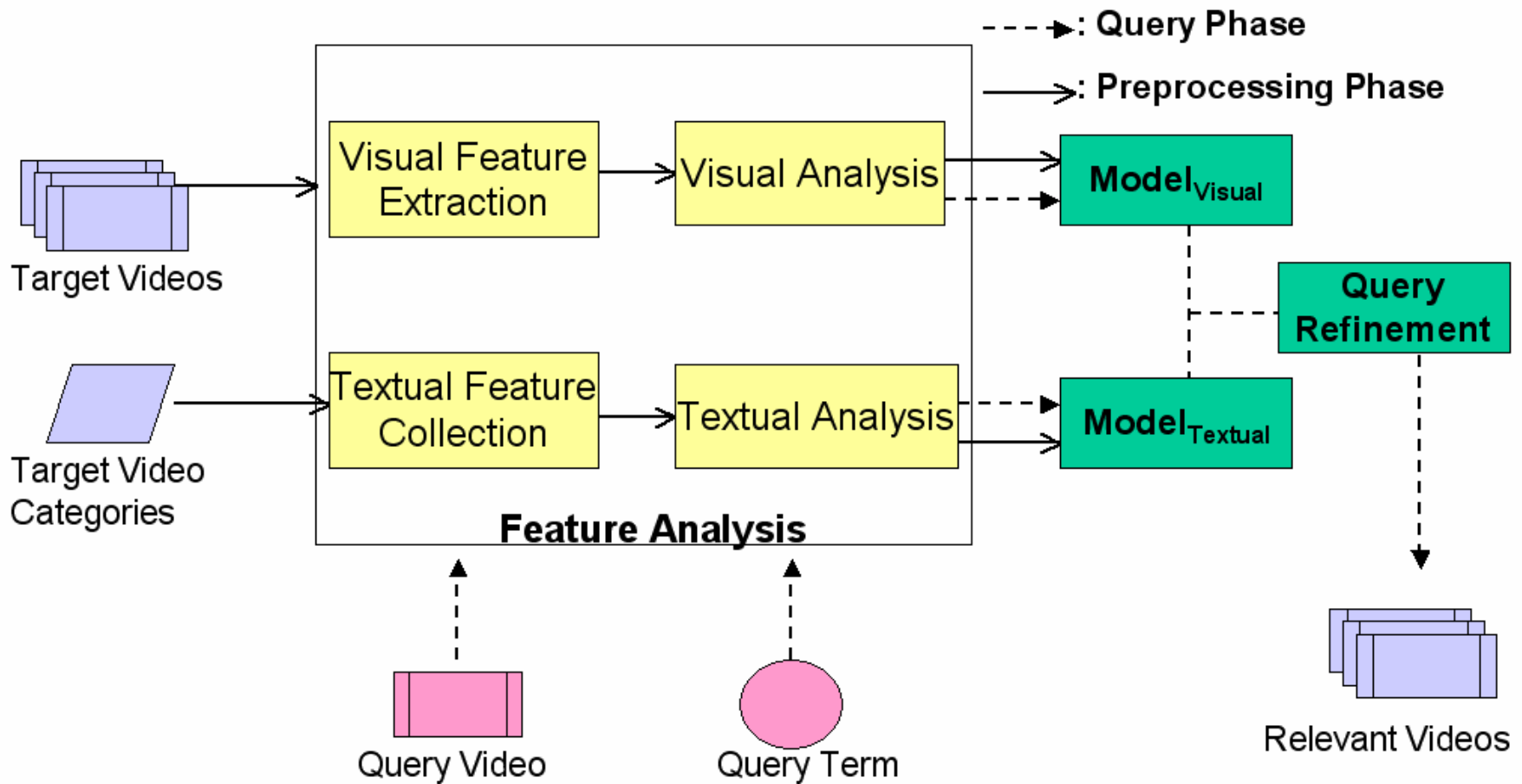


Introduction (2)

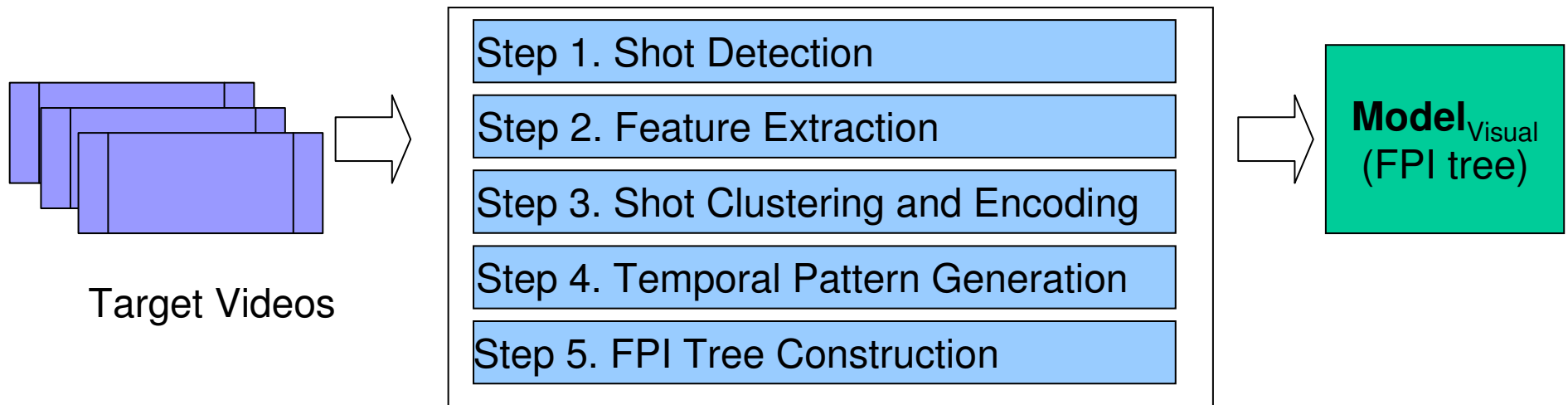
- To retrieve users' desired videos by combining textual- and visual-based mining
 - Our advantages on solving previous problems
 1. For textual-based search, without annotating videos, the videos can be retrieved by the automated metadata we propose.
 2. Reduce semantic gap between video concepts and query terms
 3. The proposed approach can achieve high performance of visual-based search.



System Architecture

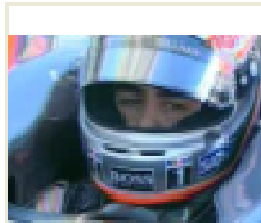


Visual Processing

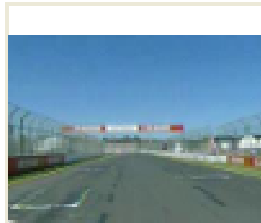


Visual Processing

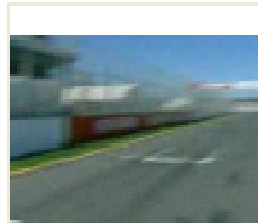
–Shot Clustering and Encoding



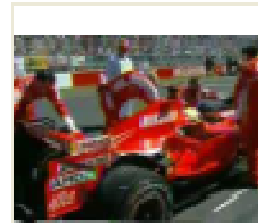
D



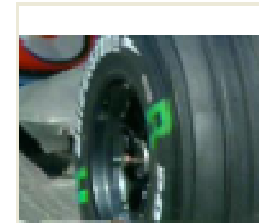
A



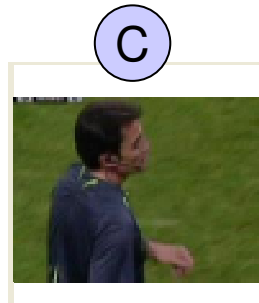
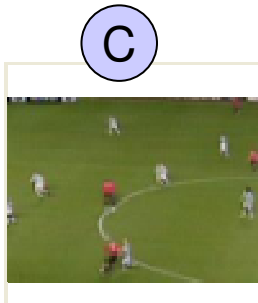
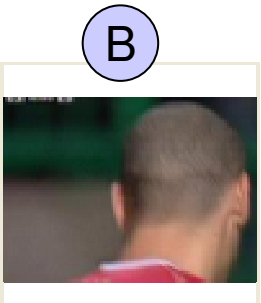
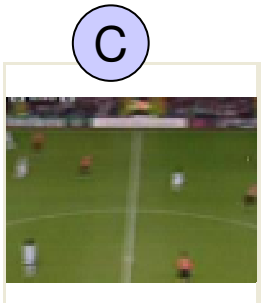
A



D



D

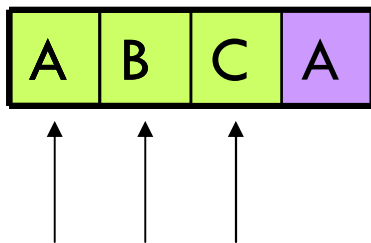


Visual Processing

– Temporal-Pattern Generation

Clip-id	Shot/Key-Frame Pattern
Clip 1	A, B, C, A
Clip 2	C, B, B, A, E, F
Clip 3	F, F, E, E, A, B, D, B, C, A, B
Clip 4	B, C, G, C, A, D, B

For Clip1



	Two shot-patterns
A	A→B, A→C, A→A
B	B→C, B→A
C	C→A

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Start Point
 winsize=3



Visual Processing

– Fast-Pattern-Index Tree Construction

	Two shot-patterns
Clip 1	A→B, A→C, A→A, B→C, B→A, C→A

	A	B	C	D	E	F	G
A	1	1	1				
B	1						
C	1	1					
D							
E							
F							
G							

Fast Pattern Index Tree



Visual Processing

– Fast-Pattern-Index Tree Construction

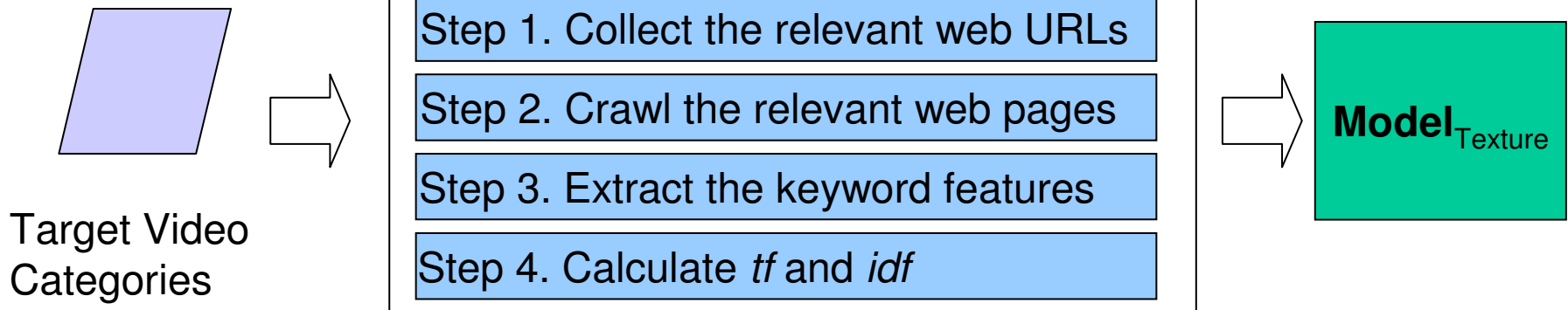
	Two shot-patterns
Clip1	A→B, A→C, A→A, B→C, B→A, C→A
Clip2	C→B, C→A, B→B, B→A, B→E, B→F, A→E, A→F, E→F
Clip3	F→F, F→E, F→A, E→E, E→A, E→B, E→D, A→B, A→D, B→D, B→B, B→C, D→B, D→C, D→A, B→A, C→A, C→B
Clip4	B→C, B→G, C→G, C→C, C→A, G→C, G→A, G→D, C→D, C→B, A→D, A→B, D→B

	A	B	C	D	E	F	G
A	1	1,2,3	1,2,3,4	3	3	3	4
B	1,3,4	2,3	2,3,4	3,4	3		
C	1	1,3,4	4	3			4
D	3,4	3	4		3		4
E	2	2			3	3	
F	2	2			2	3	
G		4	4				

Fast Pattern Index Tree

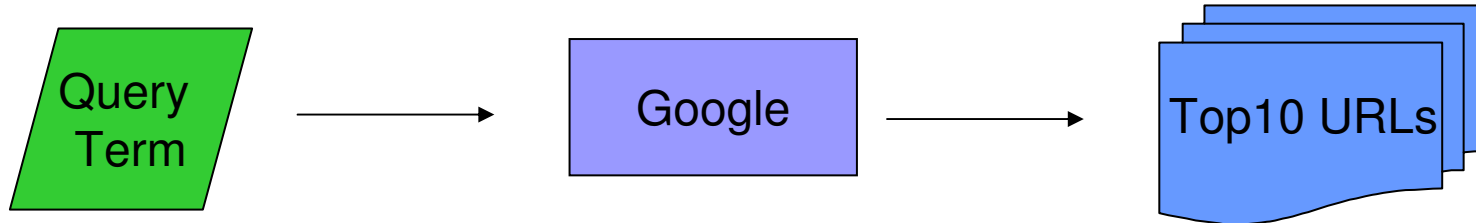


Textual Processing



Textual Processing

– Collect and Crawl The Relevant Web Pages



[Hayley Westenra - Wikipedia, the free encyclopedia](#)

Hayley Dee Westenra (born 10 April 1987 in Christchurch, New Zealand) [1] [2] is a New Zealand soprano. Her first internationally released album, *Pure*, ...

en.wikipedia.org/wiki/Hayley_Westenra - 148k - [Cached](#) - [Similar pages](#) -

HAYLEY WESTENRA: OFFICIAL SITE WWW.HAYLEYWESTENRA.COM - 18 Mar 2009 ... Official site News, music mailing list.

www.hayleywestenra.com/ - 12k - [Ca](#)

Hayley Westenra - Wikipedia, th

Hayley Dee Westenra (born 10 April ' soprano. Her first internationally releas en.wikipedia.org/wiki/Hayley_Westen

Hayley Westenra - Listen free a
Listen free to Hayley Westenra (Dark

April 1987 in Christchurch, New Zealan www.last.fm/music/Hayley+Westenra

Crawl the link content

Hayley Westenra

From Wikipedia, the free encyclopedia

Hayley Dee Westenra (born 10 April 1987 in Christchurch, New Zealand)^{[1][2]} is a New Zealand soprano. Her first internationally released album, *Pure*, reached No 1 on the UK classical charts in 2003 and has sold more than two million copies worldwide. Westenra has received numerous awards for her contributions to music, both in New Zealand and elsewhere. In November 2008 she was named "classical performer of the year" at the Variety Club's annual awards in London.^[3]

Pure is the fastest-selling international debut classical album to date, and Westenra became an international star, aged 16, when the first of her international albums was released. In August 2006, Westenra joined the Irish group *Celtic Woman*, was featured on their *Celtic Woman: A New Journey* CD and DVD, toured with them on their 2007 Spring Tour, and also was featured on their latest CD and DVD, *The Greatest Journey: Essential Collection*, released in 2008.

Westenra has performed for dignitaries around the world. She is the youngest UNICEF Ambassador to date and has contributed to charities around the world.

Contents [hide]

- 1 Biography
 - 1.1 Early life
 - 1.2 International success
 - 1.3 Beyond her initial success
- 2 Philanthropy and charity
- 3 Discography
 - 3.1 Albums
 - 3.1.1 Regional albums
 - 3.1.2 International albums
 - 3.2 Singles
 - 3.3 Featured
- 4 Notable tours and concerts
- 5 References
- 6 Further reading
- 7 External links

Hayley Westenra



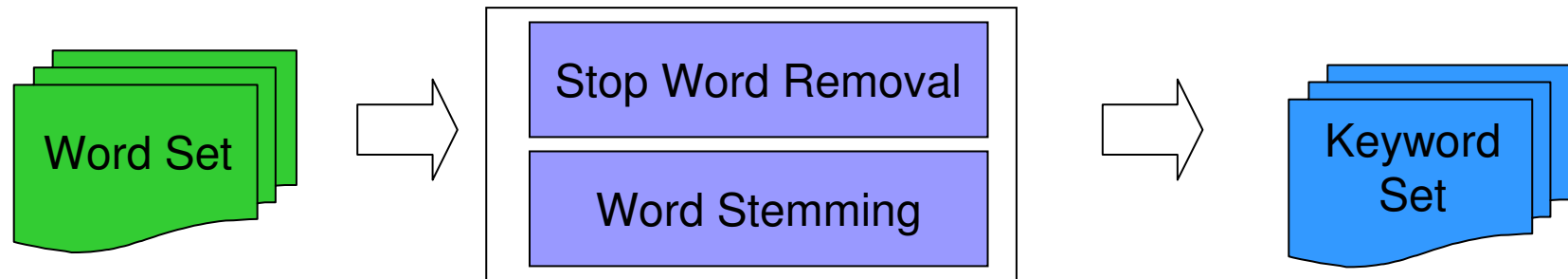
Background information

Born	10 April 1987 (age 22)
Origin	Christchurch, New Zealand
Genre(s)	Classical, Pop, Celtic, Operatic pop
Occupation(s)	Singer
Instrument(s)	Vocals, Piano, Guitar
Voice type(s)	Soprano
Years active	2000 - Present
Label(s)	Universal New Zealand Decca Records
Associated acts	Celtic Woman
Website	HayleyWestenra.com#



Textual Processing

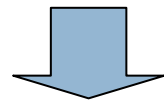
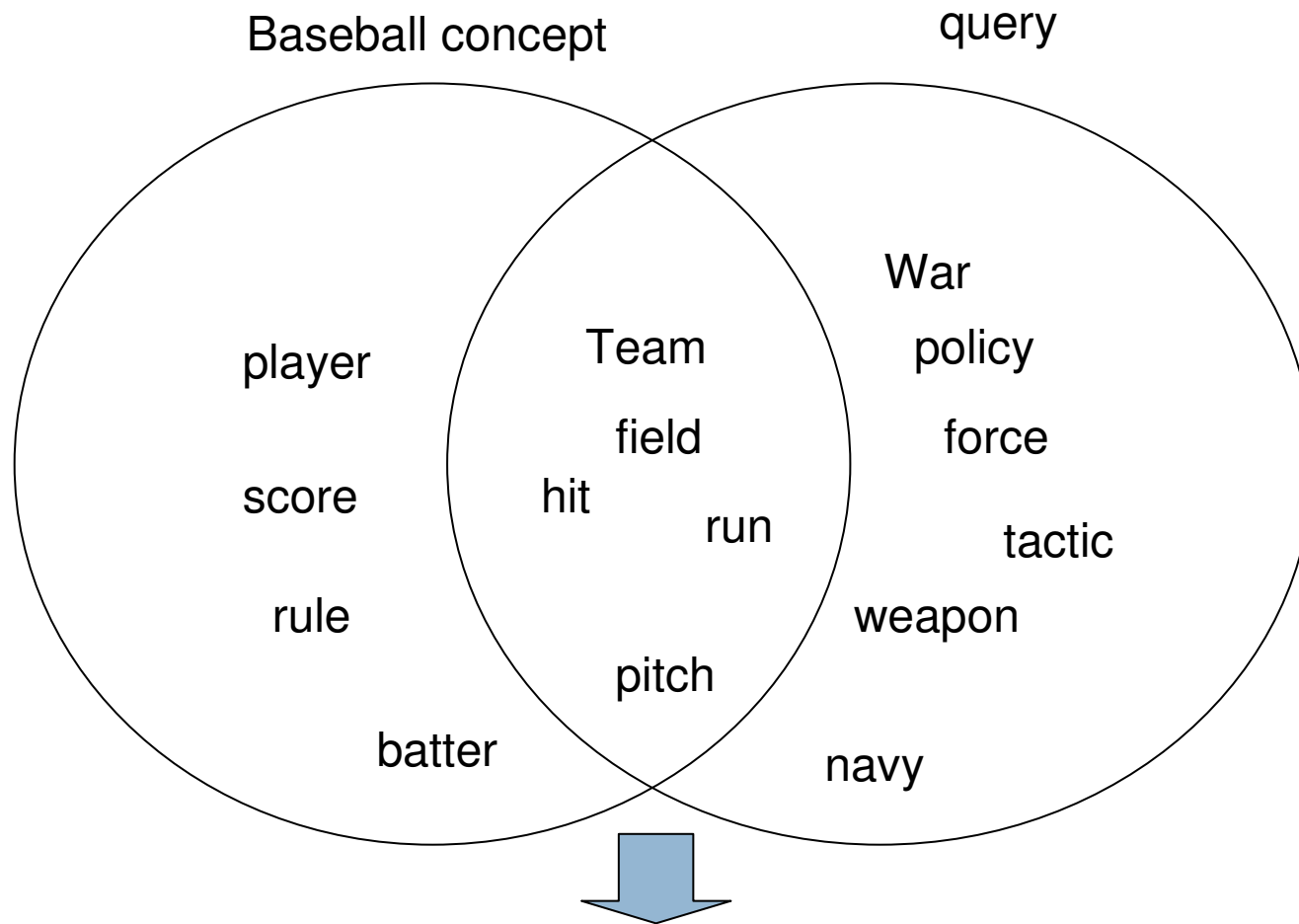
– Extract The Feature-Keywords



Hayley Dee Westenra is a New Zealand soprano. Her first internationally **release** album, Pure, reached **No 1** on the **UK classical charts** in 2003 and has **sold more** than **two million copies** worldwide.

Textual Processing

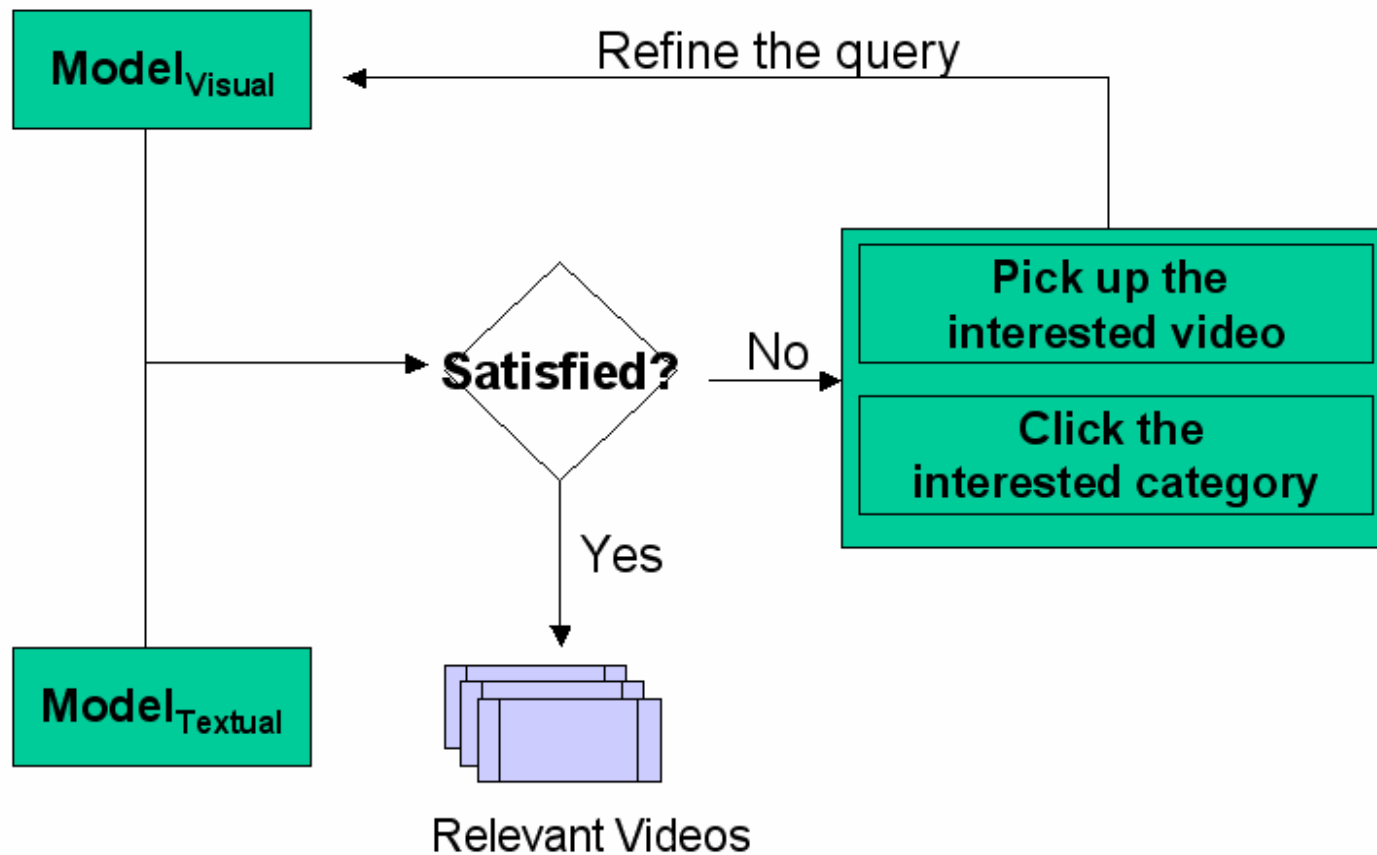
– Match by Feature-Keywords



TFIDF



Query Refinement



Experiments

□ Dataset

□ Visual dataset

- 13 video concepts
 - 258 video clips with 10464 shots
 - Totally, the duration of video data is about 20 hours
 - From each concept, 33% of visual videos are randomly selected as the testing data

□ Textual dataset

- For each concept, top 2000 keywords that came from top 10 search results by Google are selected as feature keywords.
- For each concept, we collect top 10 keywords from wikipedia as testing query.



Experiments

— Measurement

□ Visual search evaluation

	Returned	Non-returned
Relevant	Correct	Incorrect
Non-relevant	Incorrect	Incorrect

□ Example

- For 10 returned videos, the concepts of five clips are the same as that of query video. Also, there are 20 ground-truth videos.
 - precision = $5 / 10 * 100\% = 50\%$
 - Recall = $5 / 20 * 100\% = 25\%$

$$precision = \frac{|Correct|}{|Returned|} * 100\%$$

$$recall = \frac{|Correct|}{|Relevant|} * 100\%$$



Experiments

– Measurement

- Textual search evaluation

- “Hit” represents the coverage for the correctly returned categories over the resulting ones

$$Hit = \begin{cases} 100\%, & \text{if the returned } k \text{ results contain the query term} \\ 0, & \text{otherwise} \end{cases}$$

- For example

- If now we have a query term, “homerun,” and 3 concepts (baseball, basketball, racing-car) are returned from our system. Then “homerun” **hits** the “baseball” concept.

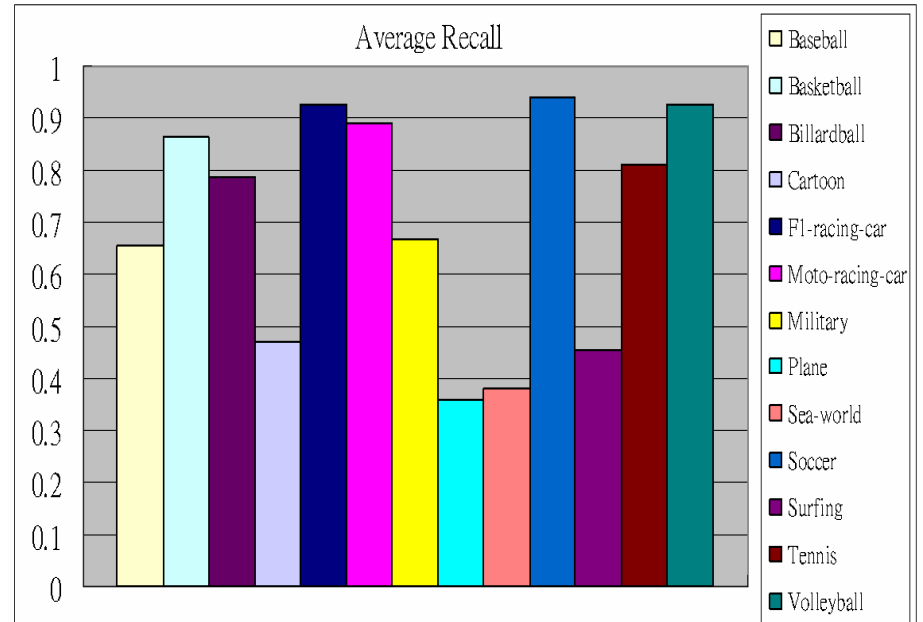
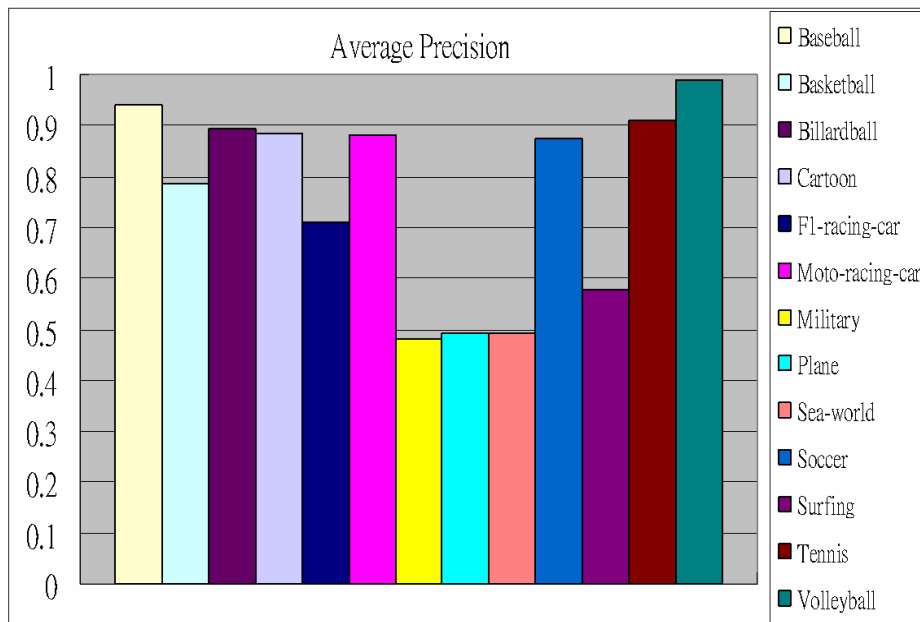


Experiment (1)

– Visual Search

□ Precision

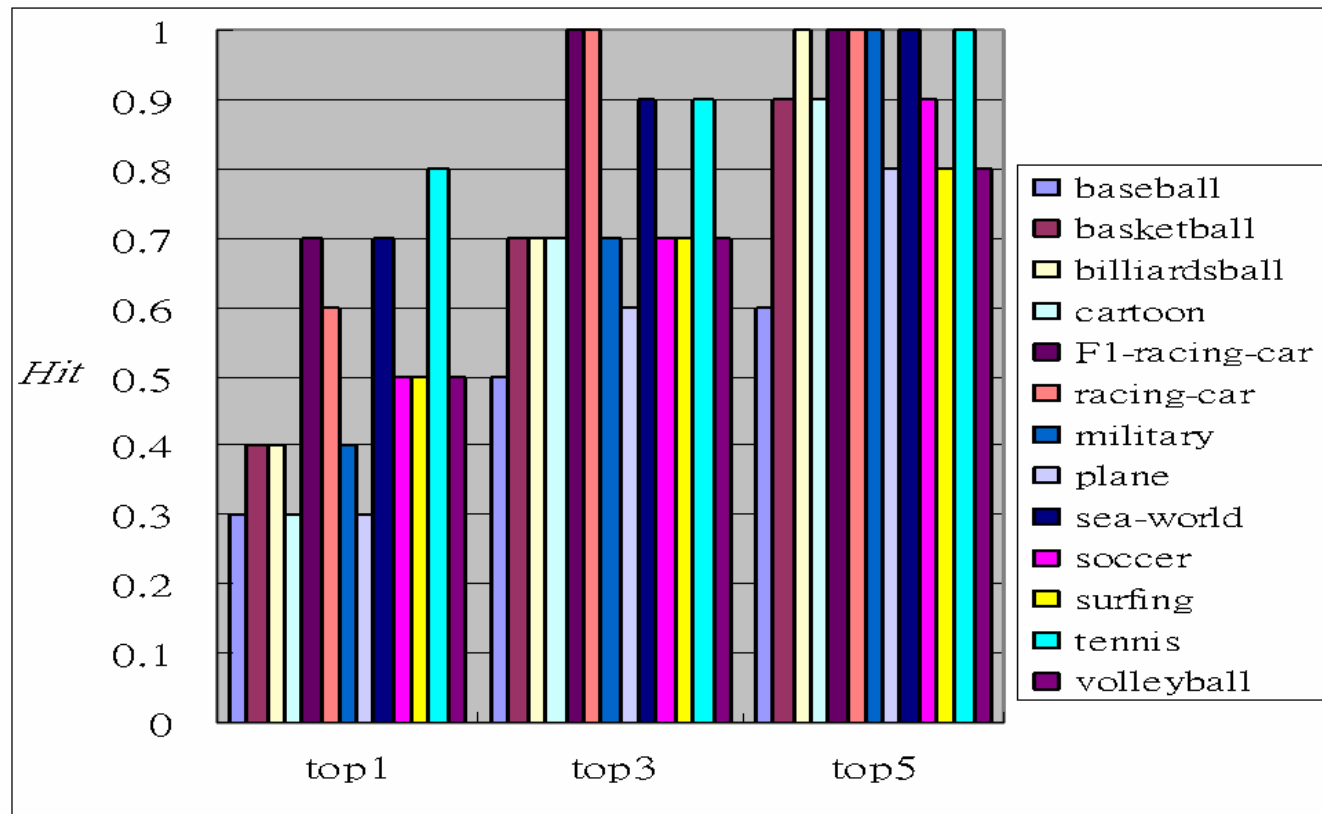
□ Recall



Experiment (2)

– Textual Search

Ratio of hit



System Prototype

— Example

Concept Oriented Content-based Video Retrieval System

Keyword
 Video

Concept	Similarity
racing-car	1.15
F1-racing-car	0.84
volleyball	0.70
sea-world	0.66
soccer	0.62
High Level Concept	
sport	3.30
sea world	0.66

[racing-car](#)

[F1-racing-car](#)

[volleyball](#)

[sea-world](#)

[soccer](#)

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網際網路

Conclusions

- We propose a hybrid approach with textual- and visual-based mining strategies
 - Textual-based
 - Using Google as our backend mediator to find the web pages that are most relevant to the target query term
 - Associating the users' interests with the target concepts by feature-keyword matching
 - Visual-based
 - With the temporal properties, the proposed pattern-based index can accelerate the search.
 - By pattern-based matching, the user's desired videos can be found effectively.



Future Work

- Pattern-based index can substantially reduce high dimensional complexity
 - ▣ Apply this index structure to different types of multimedia applications
 - Example
 - Music Retrieval, Multimedia Recommendation



Thank you for your attention

