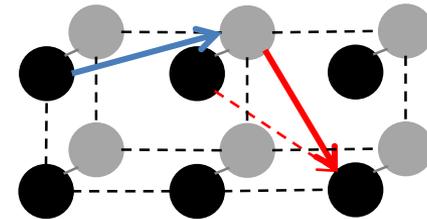
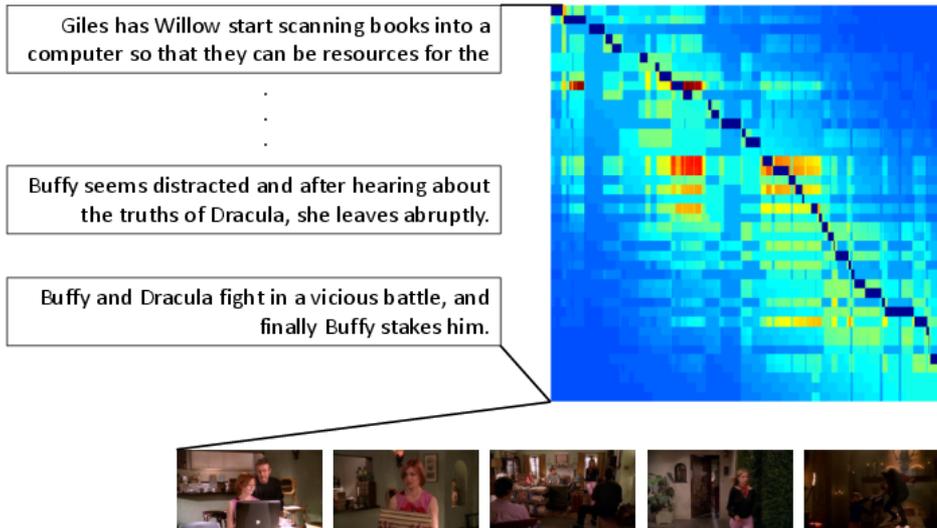


Story-based Video Retrieval in TV series using Plot Synopses

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Karlsruhe Institute of Technology, Germany

03 April, ACM ICMR 2014

Computer Vision for Human-Computer Interaction Lab



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Story



Gandalf falls to a
Balrog of Moria

0:00:00

2:58:00

Obi-Wan cuts Darth
Maul in two with
his light saber



0:00:00

2:16:00

[Search](#)[How it works](#)[About](#)[Contact](#)

Goal

Story-based Video Retrieval

Buffy the Vampire Slayer: Season 05

 Sign out

Sample queries: Buffy kills Dracula, Willow attacks Glory with magic, Buffy sacrifices herself, ...



Idea



- Main page
- Contents
- Featured content
- Current events
- Random article
- Donate to Wikipedia

- Interaction
- Help
- About Wikipedia
- Community portal
- Recent changes
- Contact Wikipedia

- Toolbox
- Print/export

- Languages
- Español
- Français
- Türkçe

Article [Talk](#)

Read [Edit](#) [View history](#) Search

Buffy vs. Dracula

From Wikipedia, the free encyclopedia



This article **needs additional citations for verification**. Please help [improve this article](#) by adding citations to [reliable sources](#). Unsourced material may be [challenged](#) and [removed](#). *(May 2011)*

"**Buffy vs. Dracula**" is the fifth season premiere of the television series *Buffy the Vampire Slayer*. Buffy faces the infamous [Count Dracula](#), who has come to [Sunnydale](#) to make her one of his concubines. In the process, he turns [Xander](#) into a [Renfield](#) of sorts, and [Giles](#) becomes enthralled with the three sisters, much like [Jonathan Harker](#) in the novel. However, after a brief spell during which Buffy is mesmerized by the Count, she regains her usual composure and defeats him.

Contents [hide]

- 1 Plot
- 2 Continuity
- 3 Production
- 4 References
- 5 External links

Plot

[[edit](#)]

Unable to sleep, [Buffy](#) goes out to [patrol](#) the [cemetery](#) and after staking a vampire, [she](#) returns to [bed](#) with [Riley](#). The next day, [Buffy](#) and [Riley](#) [play](#) around at the beach, until [Willow](#) magically [ignites](#) the [barbecue](#), and a sudden storm forces them all to seek shelter from the rain.

Elsewhere, two men [deliver](#) a large [crate](#) to a [residence](#), but when they drop it, a clawed hand [breaks](#) through the wood and attacks one of the men.

[Giles](#) has [Willow](#) start scanning [books](#) into a [computer](#) so that they can be resources for the gang to use. [He](#) then [tells](#) her that he's going back to England because it seems he's no longer needed by Buffy or the Scoobies.

While patrolling, Buffy is confronted by a vampire who [condenses](#) from mist: he introduces himself as [Count Dracula](#). When she tries to stake the legendary vampire, he disappears. [Xander](#) and [Willow](#) arrive to see Dracula before he turns into a [bat](#) and flies away. The women [discuss](#) how amazing Dracula is, and Riley and Xander both [express](#) their jealousy towards the infamous Dark Prince. Willow makes a lame attempt to attract attention to Giles and his usefulness, but the gang seems oblivious.

As Xander is walking [home](#) alone, he encounters Dracula. Using his mysterious charms, the vampire [persuades](#) Xander to be his aide and lure the [Slayer](#) to him. Riley [asks](#) [Spike](#) about Dracula, but the former commando is warned that Dracula is too dangerous for him to take on alone. Buffy awakens to find

"Buffy vs. Dracula"

Buffy the Vampire Slayer episode



Buffy stakes Dracula again after he comes back from dust

Episode no. [Season 5 Episode 1](#)

Directed by [David Solomon](#)

Written by [Marti Noxon](#)

Production code 5ABB01

Original air date September 26, 2000

Guest actors

- [Rudolf Martin](#) as [Dracula](#)
- [Amber Benson](#) as [Tara Maclay](#)
- [Michelle Trachtenberg](#) as [Dawn Summers](#)
- [Kristine Sutherland](#) as [Joyce Summers](#)
- [E.J. Gage](#) as [Mover #1](#)

Names

Places

Talking Verbs

Action Verbs

Objects

Crowd-sourcing



Freiburg *et al.* 2011
Concert concepts with user feedback



Wang *et al.* 2013
Joint latent space
for images and text

Text (transcripts) to video



Everingham *et al.* 2006
Person Identification



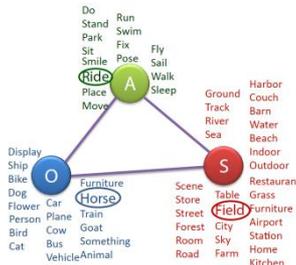
Laptev *et al.* 2008
Action Recognition



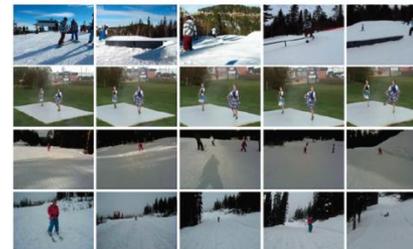
Event: Free throw
Player: Rasheed Wallace
Team: Detroit Piston

Xu *et al.* 2008
Event detection in sports

Describing images and videos



Farhadi *et al.* 2010
<object, action, scene>
Triplets to describe images



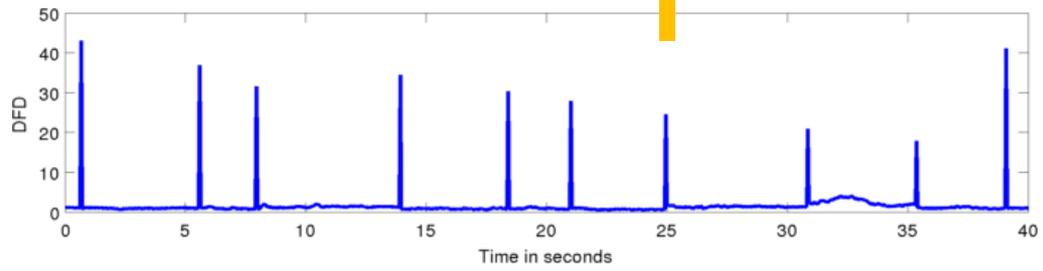
Habibian *et al.* 2013
Video2Sentence
Sentence2Video

Text – Video Alignment

- ❖ Pre-processing
- ❖ Character identification
- ❖ Alignment

Pre-processing

Shot boundary detection



Original sentence

Buffy awakens to find Dracula in her bedroom. She is helpless against his powers and unable to stop him from biting her. When she wakes the next morning ...

Part-of-speech tagging

Names

Places

Buffy/NNP awakens/VBZ to/TO
find/VBP Dracula/NNP in/IN
her/PRP bedroom/NN ./.
She/PRP is/VBZ helpless/JJ
against/IN his/PRP powers/NNS ...

Coreference resolution

Buffy awakens to find **Dracula** in
her bedroom. **She** is helpless
against **his** powers and unable to
stop **him** from biting **her**. When
she wakes the next morning ...

Weak character labels

align (fan) **transcripts** to **subtitles**

who speaks what?

↔ what is spoken **when**?

Buffy: So I won't be taking drama with you.

00:10:01,933 --> 00:10:04,447

So I won't be taking drama with you.

Willow: What? You have to, you promised!

00:10:04,533 --> 00:10:08,811

- What? You have to. You promised!

Buffy: Well, I know, but Giles said that it just was-

- I know, but Giles said that it was

Willow: The hell with Giles.

00:10:08,893 --> 00:10:11,407

- The hell with Giles.

Giles: I can hear you, Willow.

- I can hear you, Willow.

Weakly Labeled Data



Person id in video

Weakly Labeled Data



Train classifiers

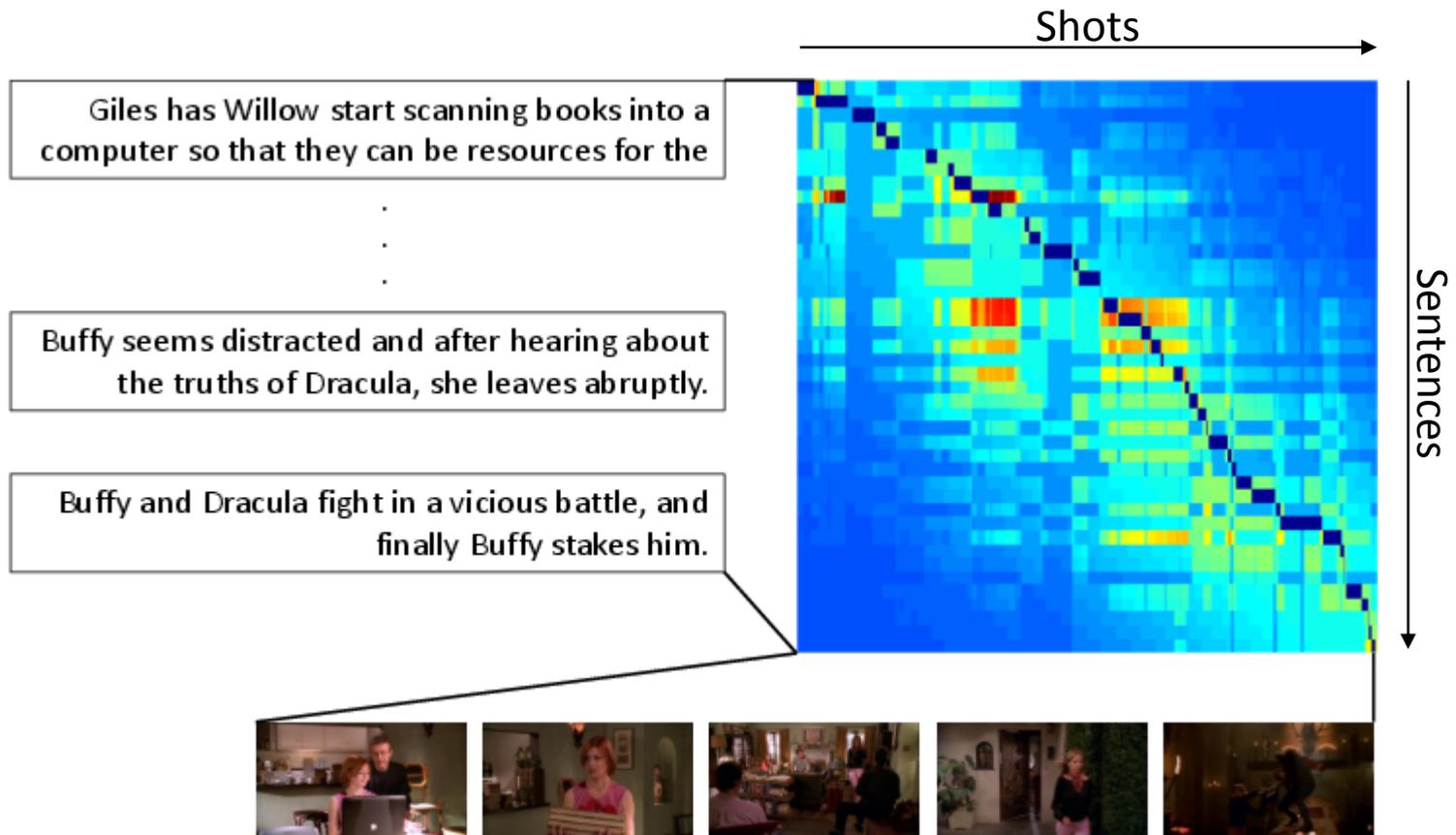


Automatically identify all tracks



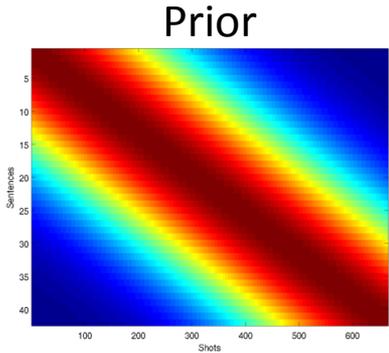
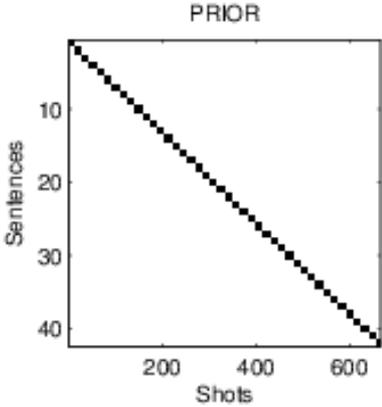
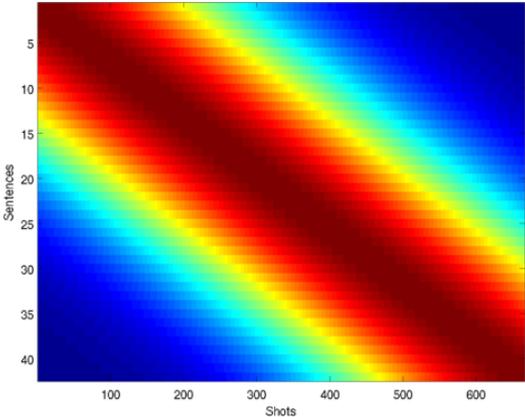
Alignment

- Compute the similarity matrix
- Find the alignment which maximizes similarity*

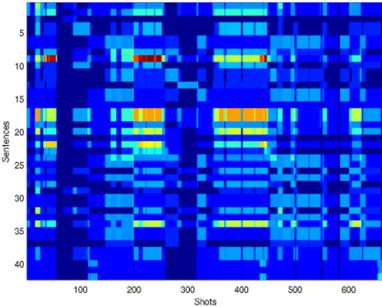


A simple prior

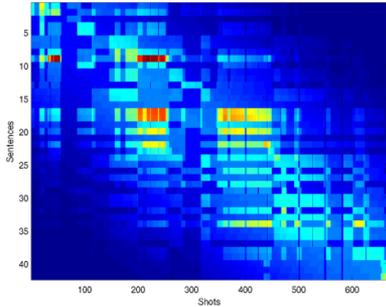
Distribute shots equally to sentences



Similarity



Similarity



Similarity – Identities



Riley asks Spike about Dracula, but the former commando is warned.

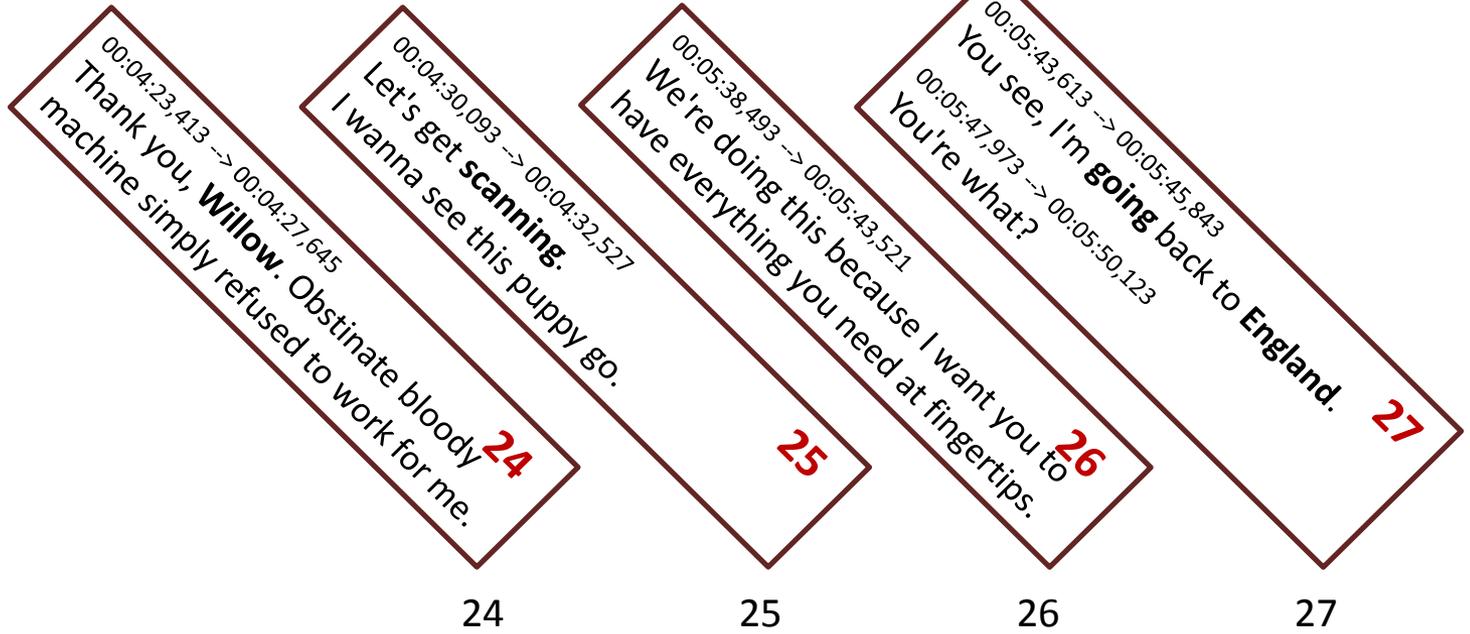
Buffy awakens to find Dracula in her bedroom.

	130	131	132	133	134
130	$+w_{Riley}$ $+w_{Spike}$	$+w_{Riley}$	$+w_{Spike}$	$+w_{Dracula}$	0
131	0	0	0	$+w_{Dracula}$	$+w_{Buffy}$
132	0	0	0	$+w_{Dracula}$	$+w_{Buffy}$
133	0	0	0	$+w_{Dracula}$	$+w_{Buffy}$
134	0	0	0	$+w_{Dracula}$	$+w_{Buffy}$

Matrix of similarity scores

Note: w_A represents IDF or importance of A in the episode.

Similarity – Subtitles



Giles has **Willow** start **scanning** books into a computer so there can be resources for the gang to use

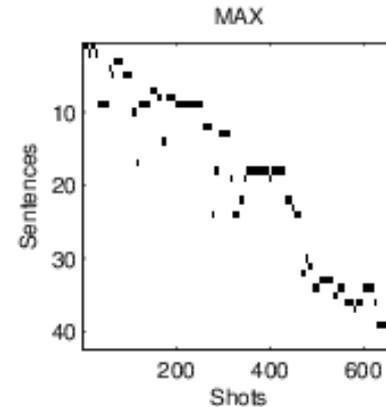
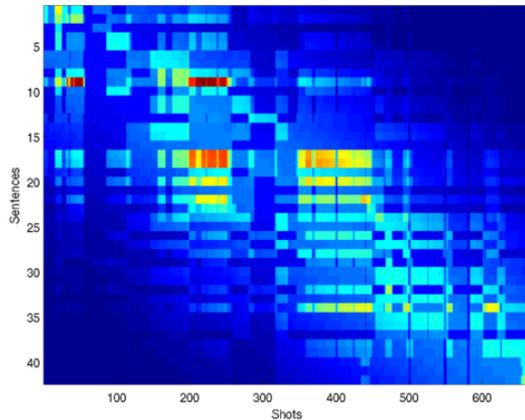
He then tells her that he's **going** to **England** because it seems he's no longer needed by Buffy or the Scoobies

	24	25	26	27
24		+1	0	0
25	+1		0	0
26	0	0		0
27	0	0	0	

Matrix of similarity scores

Max Similarity

*Maximize joint similarity over all shot-sentence assignments
such that each shot is assigned to ONE sentence*



Properties

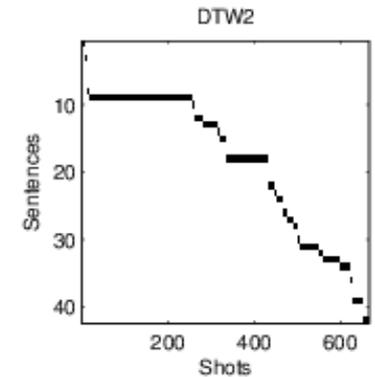
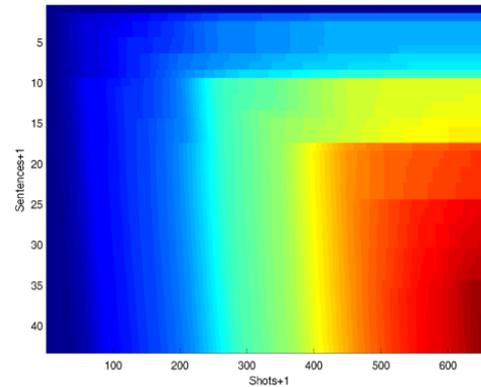
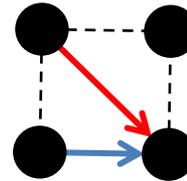
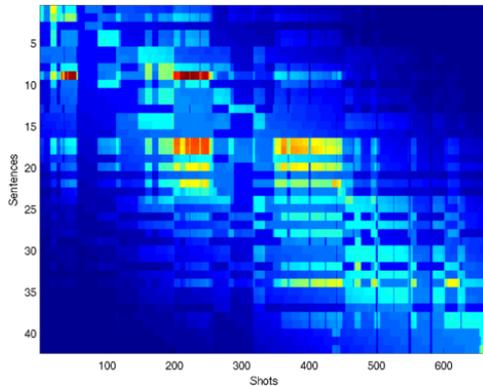
- ✓ maximizes similarity
- ❖ breaks structure causes *jumpiness*

maximize similarity

+ each shot to ONE sentence

DTW2

Consecutive shots are likely to be assigned to same (or next) sentence



Properties

- ✓ maximizes similarity with temporal consistency
- ✓ efficient computation
- ❖ can assign too many shots to one sentence
- ❖ unable to handle plot-nonlinearity

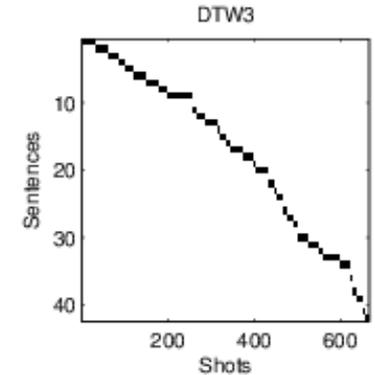
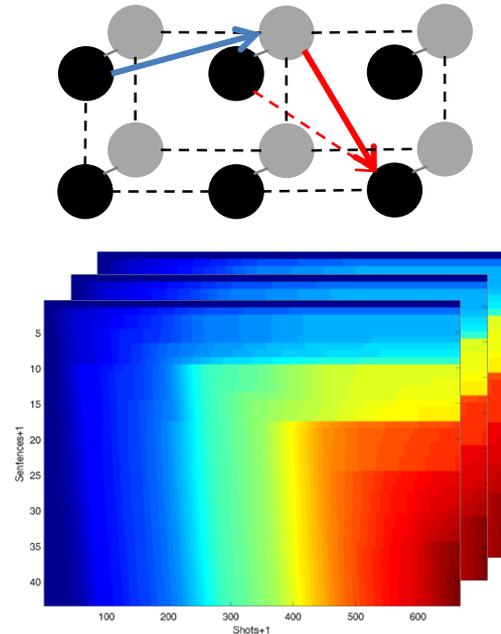
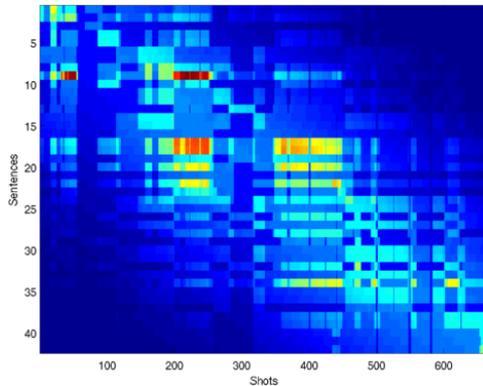
maximize similarity

+ each shot to ONE sentence

+ temporal consistency

DTW3

Regularize number of shots being assigned to one sentence



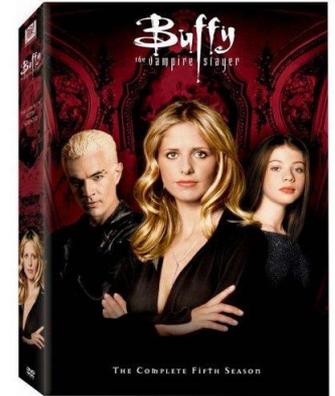
Properties

- ✓ maximizes similarity with temporal consistency
- ✓ automatically controls the number of shots assigned to a sentence
- ✓ efficient computation
- ❖ unable to handle plot non-linearity

Evaluation

- ❖ Data set
- ❖ Quantitative results
- ❖ Qualitative results

- Buffy the Vampire Slayer (season 5)
- Plot synopsis from Wikipedia
 - 22 episodes, 15+ hours of video
 - 15700 shots
 - 800 sentences
 - 21000 face tracks
- Per episode,
 - #shots: 540 – 940; avg. ~720
 - #sentences: 22 – 54; avg. ~36



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Alignment accuracy

$$\text{Accuracy} = \frac{\text{correctly assigned shots}}{\text{total number of shots}} \%$$

Method		Buffy E01	Buffy E02	Buffy E03	Buffy E04	Average E01 - E22
Human		81.5	86.4	77.5	72.8	–
Prior		2.9	23.8	27.9	8.8	10.11
Character ID	MAX	11.6	30.9	23.6	19.1	–
Character ID	DTW2	9.4	35.0	18.8	28.4	–
Character ID	DTW3	42.2	43.8	40.4	40.3	41.17
Subtitles	DTW3	20.4	48.4	35.3	30.1	37.00
Char-ID+Subt.	DTW3	40.8	51.3	41.4	47.6	49.16

Alignment result

BF-1:27. Dracula talks to Buffy of all the things he will do for her while she struggles to regain control of herself.

BF-1:28. Xander tries to stop Riley from going after Dracula, but Riley knocks him out with one punch.

BF-1:29. Giles finds himself victim to the Three Sisters who effectively keep him distracted.



Application

- ❖ Story-based Retrieval
- ❖ Demo

Retrieval

Text Query



Plot Synopsis Retrieval



Alignment



Results
Play Video

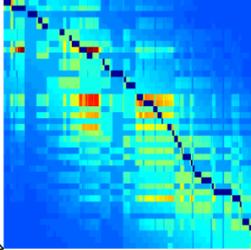


Giles has Willow start scanning books into a computer so that they can be resources for the

⋮

Buffy seems distracted and after hearing about the truths of Dracula, she leaves abruptly.

Buffy and Dracula fight in a vicious battle, and finally Buffy stakes him.



Retrieval performance

62 queries;

Query	Ground Truth <i>Time and Sentence</i>	top 5?	Time
Buffy fights Dracula	E01: m35-36 (33) Buffy and Dracula fight in a vicious battle	✓	Overlap
Toth's spell splits Xander into two personalities	E03: m11-12 (7) The demon hits Xander with light from a rod ... (8) ... but then we see another Xander	✗	
Willow teleports Glory away	E13: m39 (34) ... before Willow and Tara perform a spell to teleport Glory somewhere else	✓	Overlap
Glory sucks Tara's mind	E19: m24-27 (15) Protecting Dawn, Tara refuses, and Glory drains Tara's mind of sanity.	✓	Overlap
Xander proposes Anya	E22: m24-27 (6) Xander proposes Anya	✓	2m44s

Conclusion

- ❖ Story-based retrieval in TV series
- ❖ Alignment of human-written descriptions to shots in video
- ❖ Dynamic programming based efficient solution
- ❖ 15+ hours of annotated video data

The screenshot shows a web application interface for "Story-based Video Retrieval". At the top, there is a dark navigation bar with a home icon and links for "Search", "How it works", "About", and "Contact". Below the navigation bar, the title "Story-based Video Retrieval" is displayed in a large font, followed by the subtitle "Buffy the Vampire Slayer: Season 05". A "Sign out" link with a user icon is positioned below the subtitle. The main content area features a search input field with the placeholder text "Enter your search query" and a blue "Search!" button. Below the search field, a light blue box contains sample queries: "Sample queries: Buffy kills Dracula, Willow attacks Glory with magic, Buffy sacrifices herself, ...". A mouse cursor is visible near the bottom right of the sample queries box.

Thank you!

**Story-based Video Retrieval in TV series
using Plot Synopses**

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<https://cvhci.anthropomatik.kit.edu/~mtapaswi>

Downloads: <https://cvhci.anthropomatik.kit.edu/projects/mma>