

The background of the slide is a faded, light-colored image of the main facade of a large, ornate building, likely a church or university hall. It features a central gable with a cross on top, a large arched entrance, and a series of smaller arches along the ground level. The facade is decorated with intricate carvings and a large mural or fresco depicting several figures in a religious or historical scene.

# **Analysis of Visual Similarity in News Videos with Robust and Memory-Efficient Image Retrieval**

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Image, Video, and Multimedia Systems Group  
Stanford University

Search for news broadcasts:

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The **Vanderbilt Television News Archive** is the world's most extensive and complete archive of television news. We have been recording, preserving and providing access to television news broadcasts of the national networks since August 5, 1968.



The collection spans the presidential administrations of Lyndon Baines Johnson, Richard Nixon, Gerald Ford, Jimmy Carter, Ronald Reagan, George H.W. Bush, Bill Clinton, George W. Bush and Barack Obama. The core collection includes evening news broadcasts from ABC, CBS, and NBC (since 1968), an hour per day of CNN (since 1995) and Fox News (since 2004). Special news broadcasts found in the Archive include political conventions, presidential speeches and press conferences, Watergate hearings, coverage of the Persian Gulf War, the events of September 11, 2001, the War in Afghanistan, and the War in Iraq.

## Transcript

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 Include In Report
**KOLO (ABC) - Reno, NV**  
**Good Morning America**

+ Local Market Viewership: 18,336  
 Local Publicity Value: \$868.96 per 30s

**KOLO 11/01/2012 07:18:03:** ...387,000 credit and debit card numbers. state officials say, like most other government agencies across the country, south carolina never encrypted that data to protect it from hackers because it's such an expensive and lengthy process. >>> and this morning another big bank could be in big trouble, this time for allegedly manipulating the price of electricity in california. regulators are threatening to fine barclays \$470 million for allegedly gaming the market to lower prices just so it could make bigger profits later. the [bank](#) denies the scheme. >>> an unusual sight to bring you along the mexico/arizona border. instead of digging a tunnel, smugglers tried to build makeshift ramp to try to drive over the border fence. as you can see, they came up just a bit short. they did manage to run off, but they left their jeep teetering some 14 feet in the air. >> a balancing act. >> that is some balance there. >>> hey, sam, how about some national weather? >> as we do that, i want to thank wabc for giving us the flight yesterday. they're always in the air, by the way, and the best in the business. let me show you what's going on with this cold air that drops down in behind the storm. wait until you see these temperatures. it's what folks without power don't need are these temperatures. look at the high temperatures. they're close to the 40s by the time we get into sunday and maybe monday in new york city. we're going to see colder air dipping in after that. the possibility of all of this rain into the northwest, now drying out, is good news. it's been six days of heavy rain in seattle, also in the portland area. we've seen california begin to dry out a little bit. that will happen during the day. ...


[Save Clip](#) [Clip Editor](#)



01:20/02:27

- At Least 30 Dead in Egypt**  
 Good Morning America  
 July 6, 2013, 4:01 a.m.  
 0 0 25 25 40
- Highlights: Subway Firecracker 250**  
 Fox Sports  
 July 6, 2013, 10:28 a.m.  
 0 0 25 25 0
- Custody Battle Leads to Confiscated Passports**  
 Good Morning America  
 July 6, 2013, 4:11 a.m.  
 0 0 25 25 10
- Celebrity Wines: Worth the Hype?**  
 HLN Morning Express  
 July 6, 2013, 4:54 a.m.  
 0 0 25 25 6
- Dwight Howard Heading to Houston**  
 HLN Morning Express  
 July 6, 2013, 4:13 a.m.  
 0 0 25 25 6
- Rip Currents Close Beaches**  
 HLN Morning Express  
 July 6, 2013, 4 a.m.  
 0 0 25 25 6
- Superstar Brandy Headlines Event**  
 Good Morning America  
 July 6, 2013, 4:40 a.m.  
 0 0 25 25 0
- The Lone Ranger Shot Down by Critics**  
 HLN Morning Express  
 July 6, 2013, 4:24 a.m.

Related Videos



**At Least 1,077 More Are Injured**  
 CNN Newsroom  
 July 6, 2013, 8:04 a.m.



**More on the Deadly Confrontations in Egypt**  
 PBS News Hour  
 July 5, 2013, 3:13 p.m.



**Deadly Confrontation as Supporters March to Free Morsi**  
 NBC Nightly News  
 July 5, 2013, 5:33 p.m.



**Street Battle Rages in Egypt**  
 NBC Nightly News  
 July 5, 2013, 5:31 p.m.





Plays 30 second clip around query phrase match

Would benefit from accurate segmentation of stories

Would benefit from reliable generation of summary clips

be its next to last witness today. a dna expert and **trayvon martin's mother** expected to take the stand on friday before the prosecution rests. another big day in a trial that's had nothing but big days so far. martin savidge starts us off. >> reporter: though the symbol to many, the hooded sweatshirt trayvon martin wore the night he was killed is also a key piece of evidence. the state expert said he found no trace of george zimmerman's dna on that sweatshirt, not each on the sleeves or cuffs nearest to

their word  
it into tray  
martin we  
we turn to  
on that an  
key developm  
martin wore the night  
he was killed is a key  
piece of evidence. the  
state expert said he  
found no trace of  
between two sets of  
town homes and  
looking into, i believe  
there was a window to  
one where the light  
anything. >> when  
you mentioned a  
moment ago that you  
didn't know what the  
tape was about  
location? >> i walked  
towards it, yes. >>  
and how was trayvon  
martin's body  
positioned when you  
ce  
ts were  
e body.  
re you  
to  
trayvon  
martin? >> yes. >> all  
right. did you know  
whether or not he was  
dead or alive at that  
point? >> i did not. >>  
did you know what his  
involvement was at  
that point? >> i did  
not. >> did you give  
him any commands,  
trayvon martin? >>  
yes, i did. >> what  
commands did you  
give him? >> i asked  
to see his hands. >>

# Applications of Anchor Detection

1. Provide strong cues for story segmentation



2. Extract news story summaries/previews



TURNING TO TECH, SHARES OF RESEARCH IN MOTION REBOUNDED FROM A ONE MONTH LOW. THE COMPANY'S NEXT GENERATION BLACKBERRY-10 PRODUCT LINE IS EXPECTED TO BE UNVEILED IN JUST A FEW WEEKS. YOU MAY REMEMBER SHARES SOLD OFF LAST WEEK AFTER THE COMPANY ISSUED A CAUTIOUS OUTLOOK FOR ITS FOURTH QUARTER RESULTS. BUT TODAY SHARES BOUNCED BACK: UP 11.5% TO A UNDER \$12.



3. Identify anchors for general person recognition



Anchor Brian Williams



Anchor Susie Gharib

*Don't confuse anchors with other people in the videos*

# Applications of Preview Matching

1. Provide strong cues for story segmentation



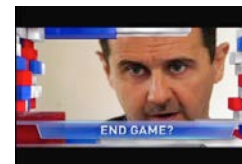
2. Extract news story summaries/previews



*JUST A MESS. IN WASHINGTON, LAWMAKERS LEAVE TOWN FOR THE HOLIDAYS. THE CLOCK TICKS DOWN TO THE SO-CALLED FISCAL CLIFF. LATE TODAY, THE PRESIDENT HASTILY APPEARS TO ASK IF SOME OF THIS BUSINESS CAN BE FINISHED SOON.*



3. Indicate the most important stories in a broadcast



# Outline

- Related work in news video analysis
- Long-range visual similarity
- Anchor detection algorithm
- Preview matching algorithm
- Experimental results



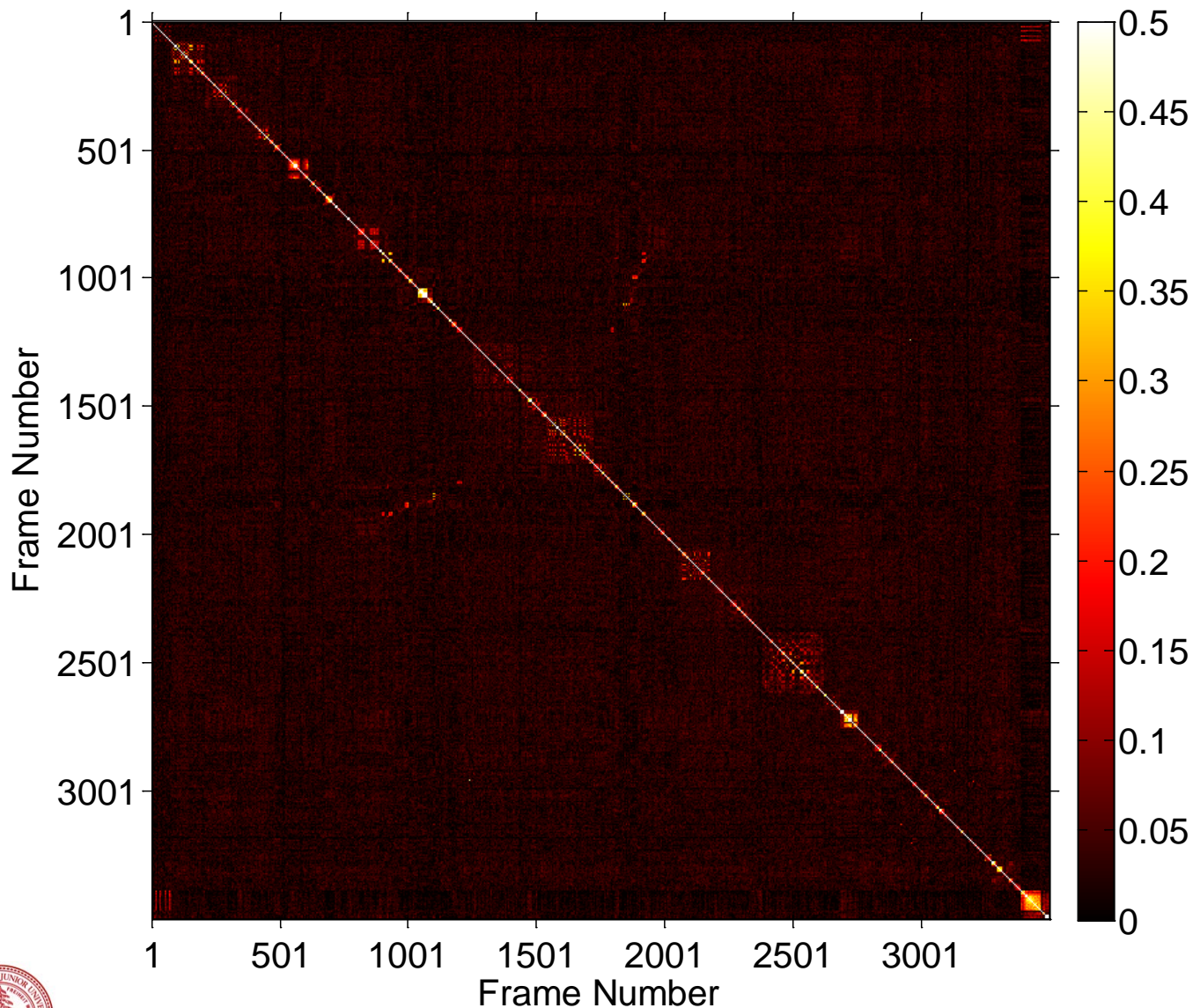


# Related Work in News Video Analysis

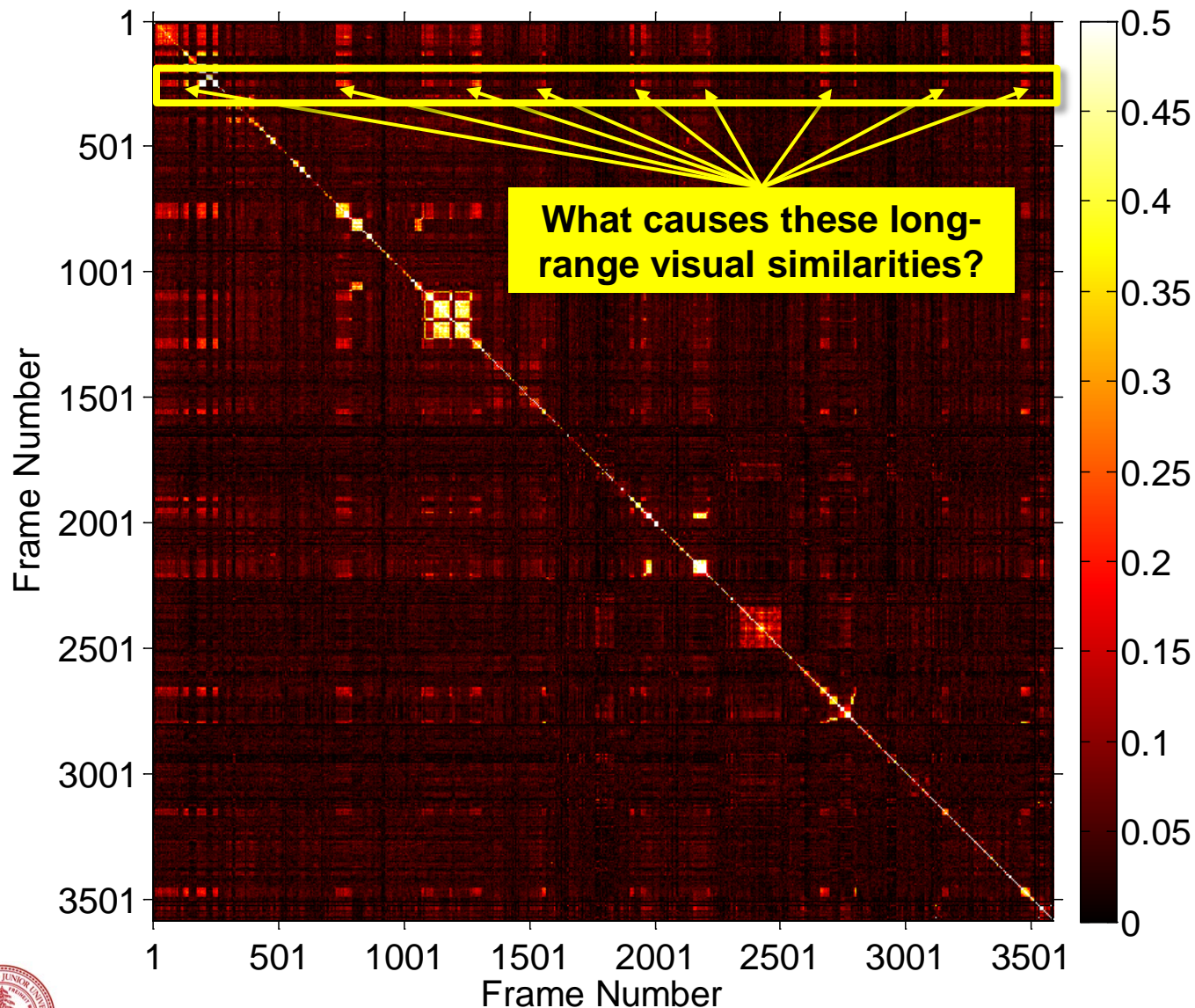
- Model-based anchor detection  
*[Zhang et al., 1998] [Hanjalic et al., 1998] [Liu et al., 2000]*
- Model-free anchor detection  
*[Gao et al., 2002] [De Santo et al., 2006] [D'Anna et al., 2007]  
[Ma et al., 2008] [Broilo et al., 2011]*
- Spatio-temporal slices for reporter detection  
*[Liu et al., 2007] [Zheng et al., 2010]*
- Classification of news video shots  
*[Bertini et al., 2001] [Xiao et al., 2010] [Lee et al., 2011]*



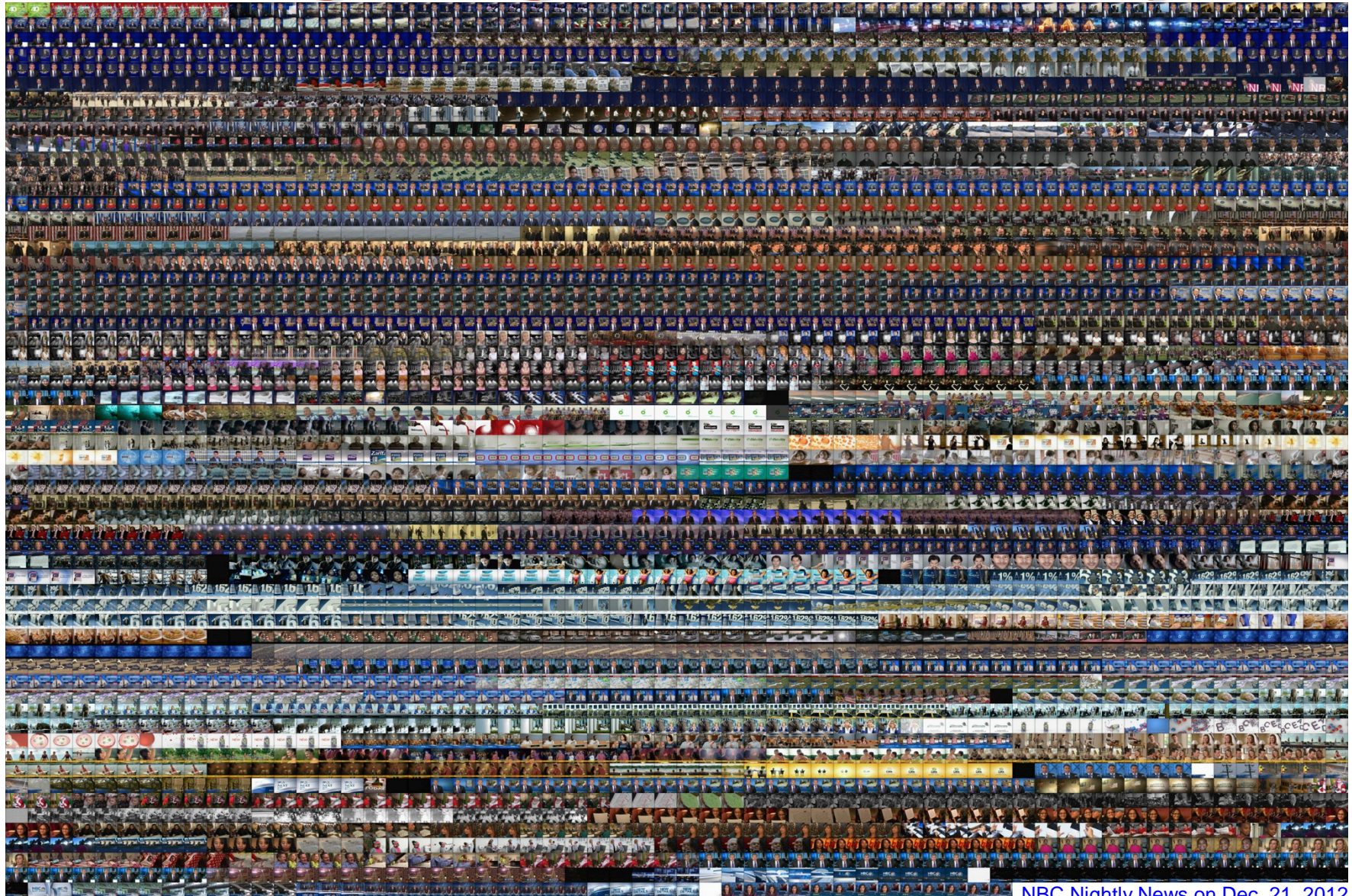
# Long-Range Visual Similarity



# Long-Range Visual Similarity



# Long-Range Visual Similarity

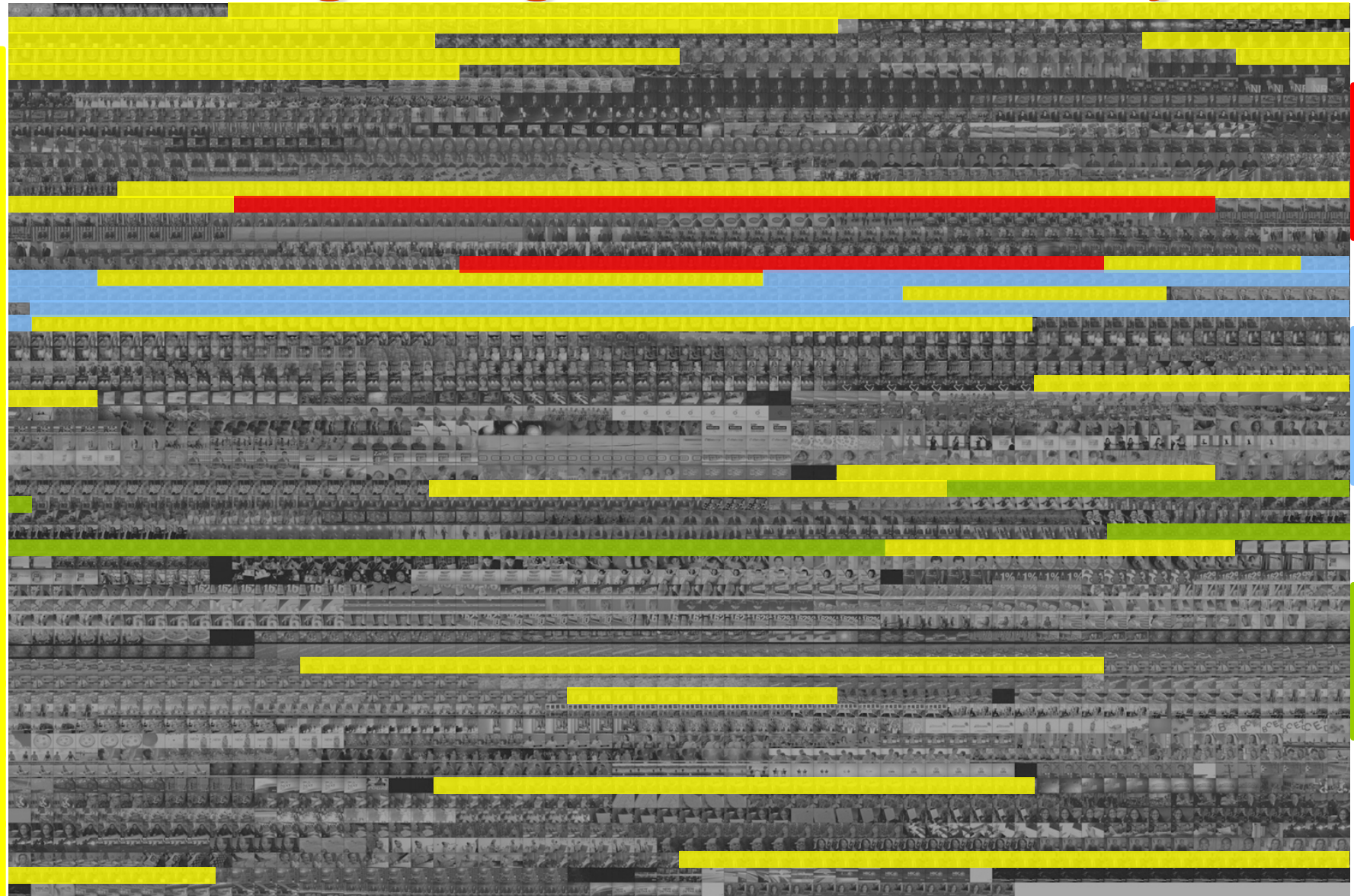


NBC Nightly News on Dec. 21, 2012



# Long-Range Visual Similarity

Anchor:  
Brian  
Williams



Reporter:  
Kelly  
O'Donnell



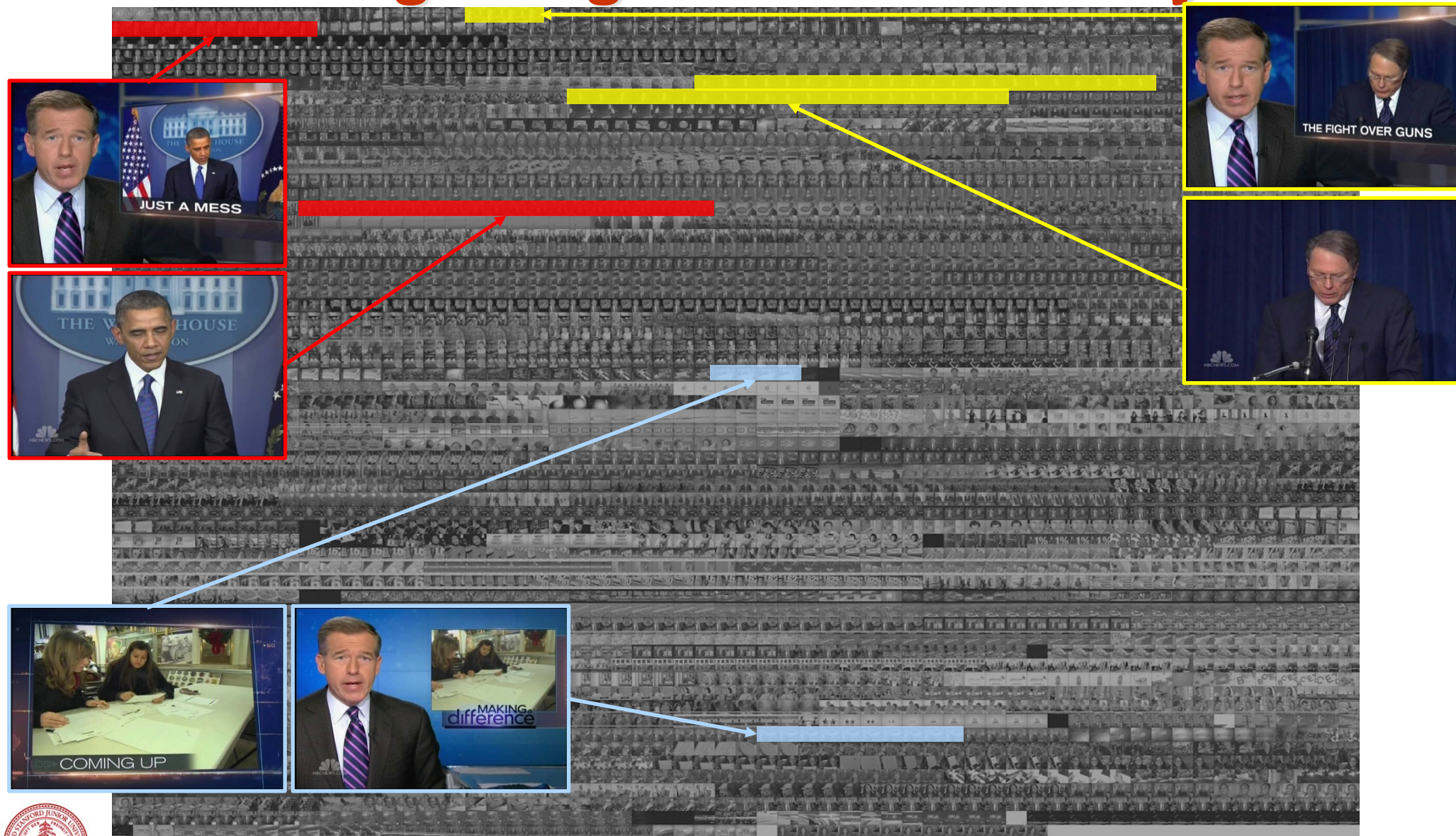
Analyst:  
David  
Gregory



Reporter:  
Andrea  
Mitchell

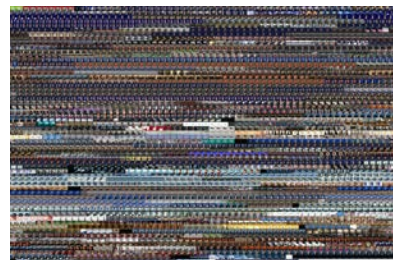


# Long-Range Visual Similarity



# Anchor Detection Pipeline

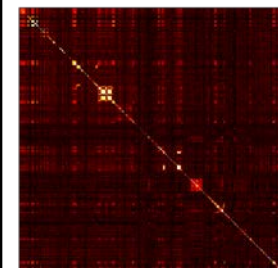
Keyframes



Exclude  
Frames  
Without Faces

Extract Image  
Signatures

Compare  
Image  
Signatures



Similarity  
Matrix

Include  
Temporally  
Nearby  
Candidates

Prune Away  
False  
Candidates

Form Initial  
Anchor  
Candidates



Detections

From pruned set of candidates, expand to include temporally nearby candidates which are also very similar in appearance



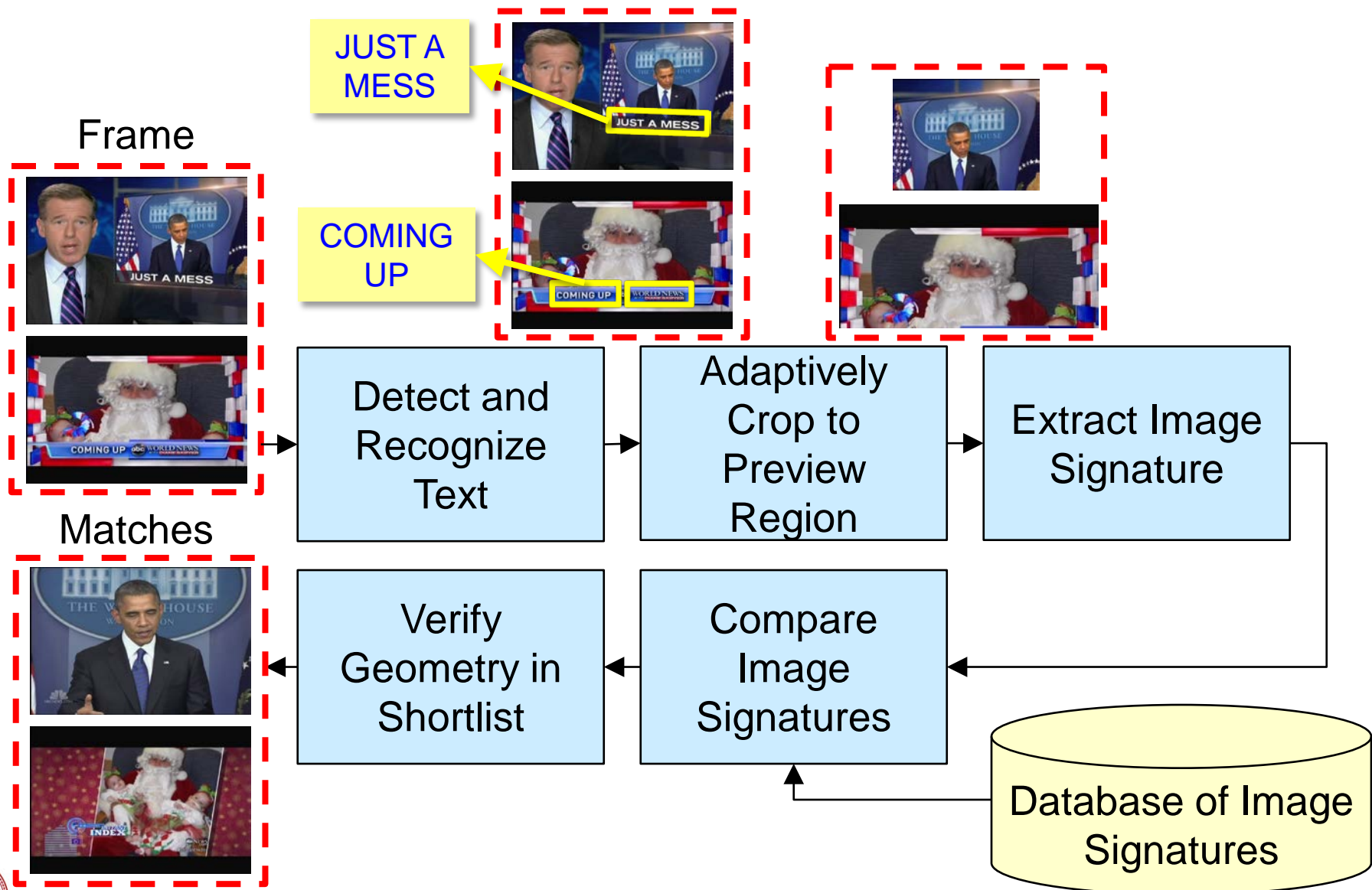
# Intra-Episode vs. Inter-Episode

- Intra-episode: compare frames within a single episode of a news program
- Inter-episode: compare frames between different episodes of a news program

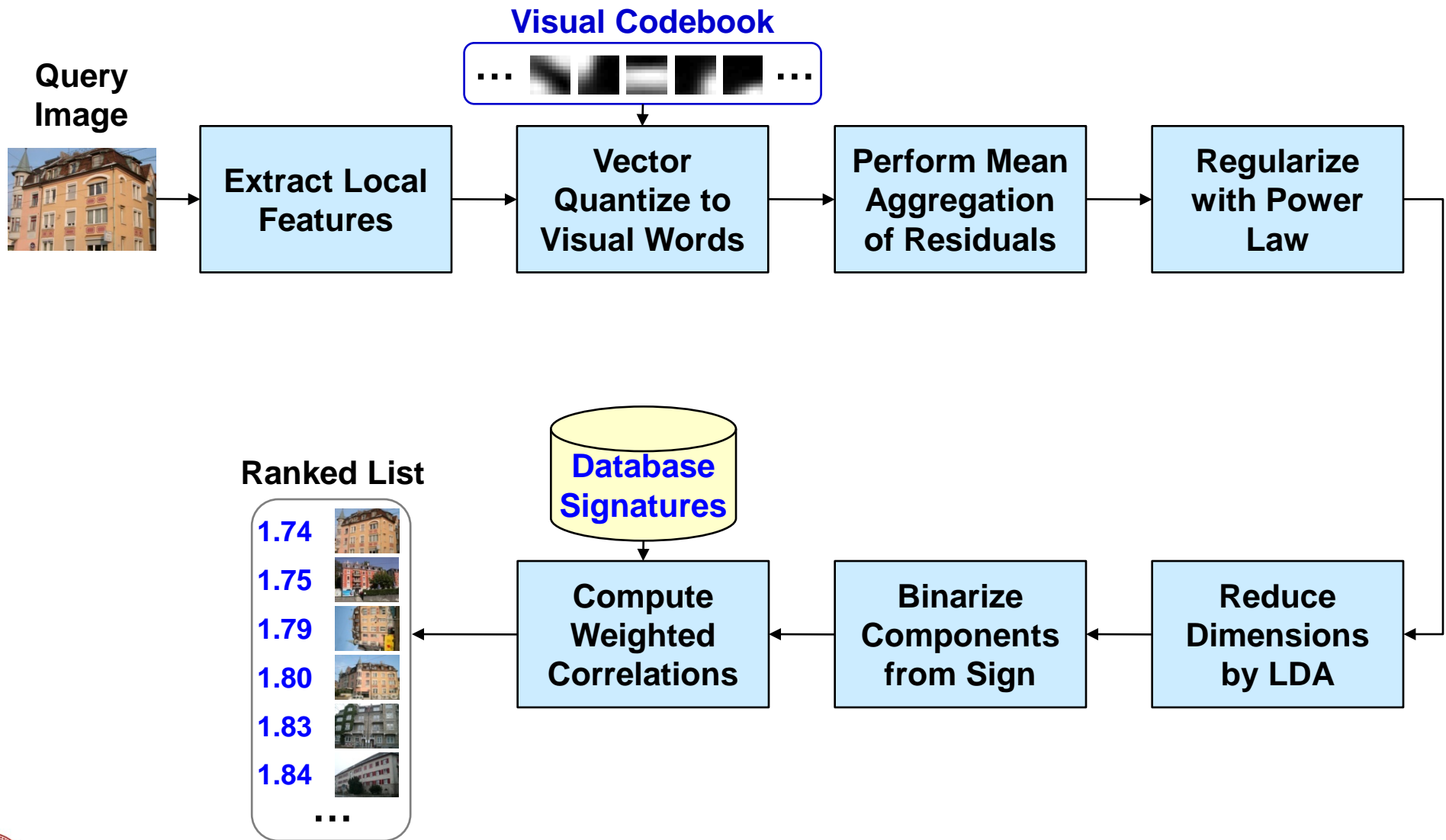




# Preview Matching Pipeline



# REVV: Residual Enhanced Visual Vector



# Experimental Setup

- Anchor detection
  - Training on 12 episodes of NBC Nightly News (1 anchor/episode), ABC World News (1 anchor/episode), Nightly Business Report (2 anchors/episode)
  - Testing on 21 episodes of same three programs
  - Measure precision / recall / F-score
- Preview matching
  - Testing on 10 episodes of NBC Nightly News and ABC World News
  - Measure precision / recall / F-score
- Comparison of two memory-efficient signatures
  - GIST: 66 MB/episode [*Oliva et al., 2001*] [*Douze et al., 2009*]
  - REVV: 10 MB/episode [*Chen et al., 2013*]



# Anchor Detection Results

	Recall	Precision	F-Score
GIST Intra	0.53	0.84	0.65
REVV Intra	0.87	0.90	0.88



# Anchor Detection Results

	Recall	Precision	F-Score
REVV Intra	0.87	0.90	0.88
REVV Intra + Inter	0.90	0.91	0.90



# Preview Matching Results



**Type A:** Preview occurs at beginning of broadcast

	Recall	Precision	F-Score
GIST	0.48	1.00	0.65
REVV	0.90	1.00	0.95

# Preview Matching Results



**Type B:** Preview occurs prior to a commercial

	Recall	Precision	F-Score
GIST	0.62	1.00	0.77
REVV	0.93	1.00	0.96

# Conclusions

- Long-range visual similarity in news videos provides a general and effective method for anchor detection and preview matching
- A robust image signature is required to handle challenging appearance variations throughout a newscast
- The image signature should be memory-efficient to enable parallelized processing of large video archives







**Thank You**

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