Let’s play a memory game…

Clap when you see a repeat!

Start!

Loading videos...

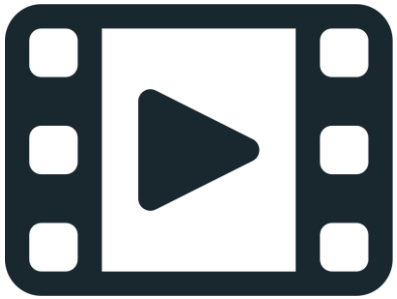
Did you notice any trends?

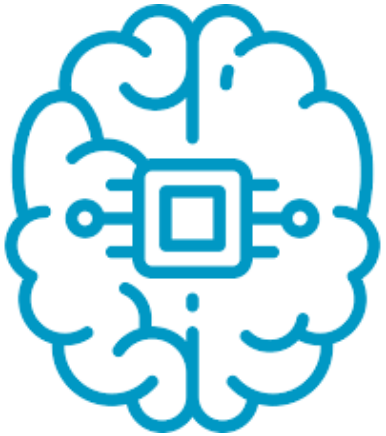

RENEWING
AMERICA'S
PROMISE
WWW.PIC2009.ORG


1
20

Video Memorability is…

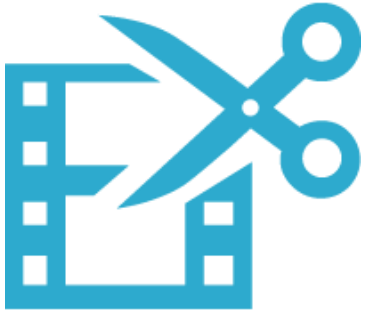
Video Memorability is *intrinsic*…





…and *predictable*

Why predict video memorability?



Video Editing / Summarization

Education

Virtual Assistant

Anelise Newman

Camilo Fosco

Vincent Casser

Barry McNamara

Aude Oliva, P.I.

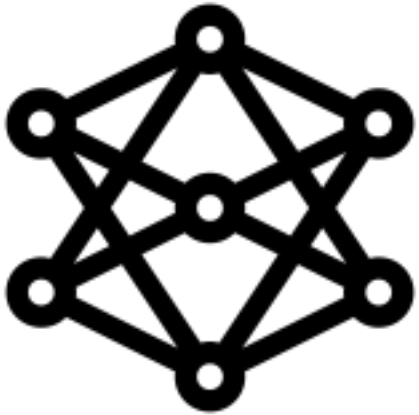
Memento: Modeling Video Memorability

Computational Perception & Cognition

The Memento Project

Which videos are memorable?

How can we predict them?



Why are they memorable?

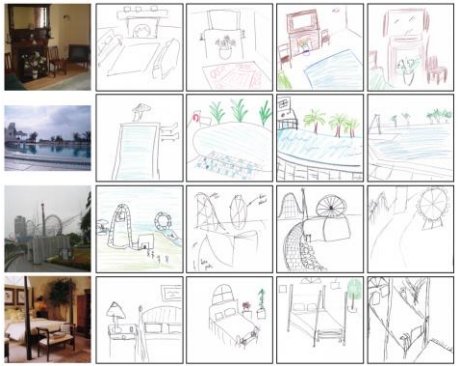
Related Work: Visual Memory

Visual memory is massive and detailed

(Standing 1973, Brady et al. 2008, Konkle et al. 2010, Bainbridge et al. 2019)

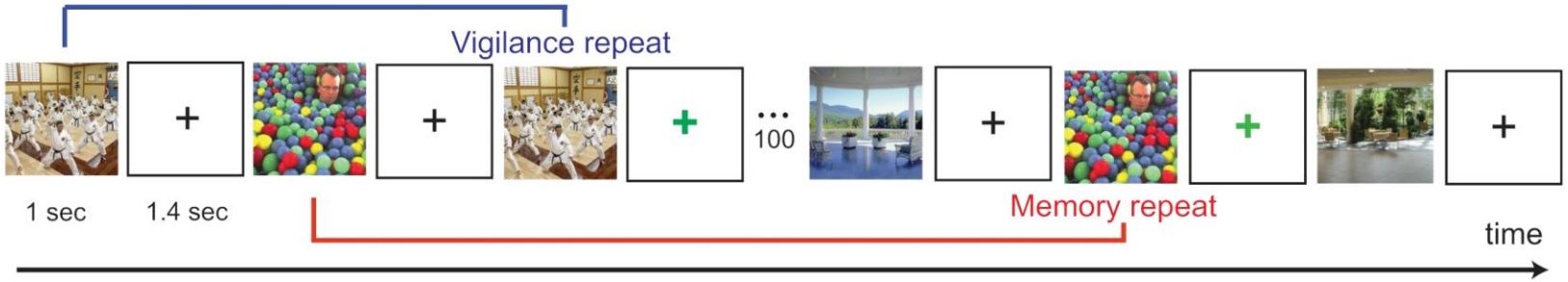
Brady et al., PNAS 2008

Konkle et al., Psych Science 2010



Bainbridge et al., Nature Communications 2019

Related Work: Image Memorability



High

Low

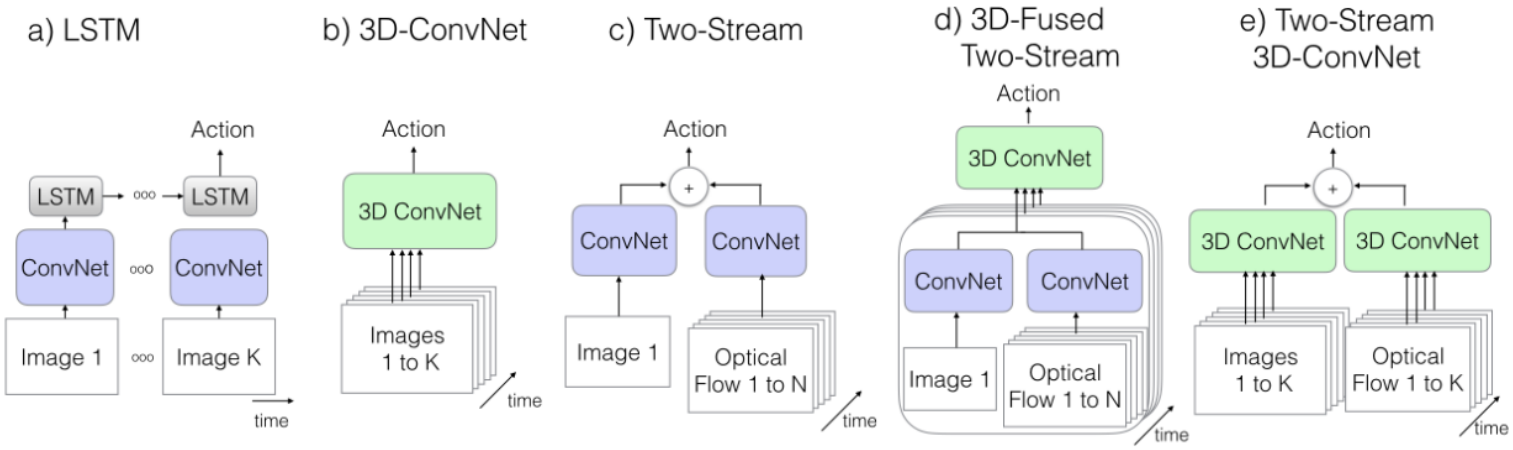
Isola et al. CVPR 2011
Isola et al. NIPS 2011

Related Work: ML for Image Memorability

- LaMem dataset: 60k images with memorability scores (Khosla et al. ICCV 2015)
- MemNet: near human consistency with a CNN (Khosla et al. ICCV 2015)
- Further attempts have used deep learning to improve image memorability predictions (Fajtl et al. CVPR 2018, Baveye et al. ACMMM 2016)

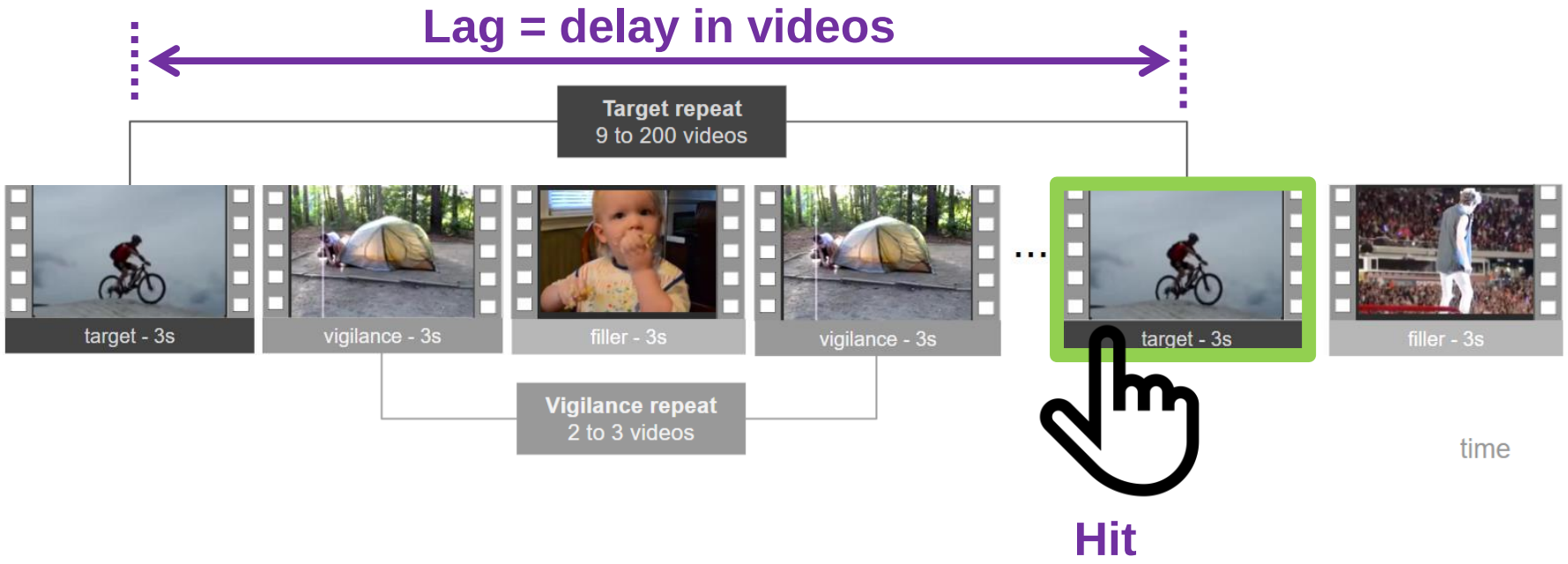
Related Work: Video understanding

- Pose/action recognition, object segmentation, classification, even generation



Carreira & Zisserman, 2017

Which videos are memorable?



Which videos are memorable?

Hit Rate =
 # correct responses / # total responses

memento-game.csail.mit.edu


Memento10k

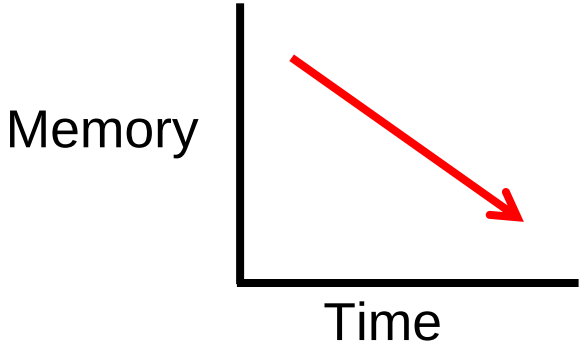
Memento10k

Moments in Time flickr YouTube

- 10,045 videos x 90 responses per video
- Responses at different lags (9-200 videos)
- Response times
- Object, scene, and action labels
- Memorability scores?

Calculating a memorability score

Idea 1: Memory score = Hit rate



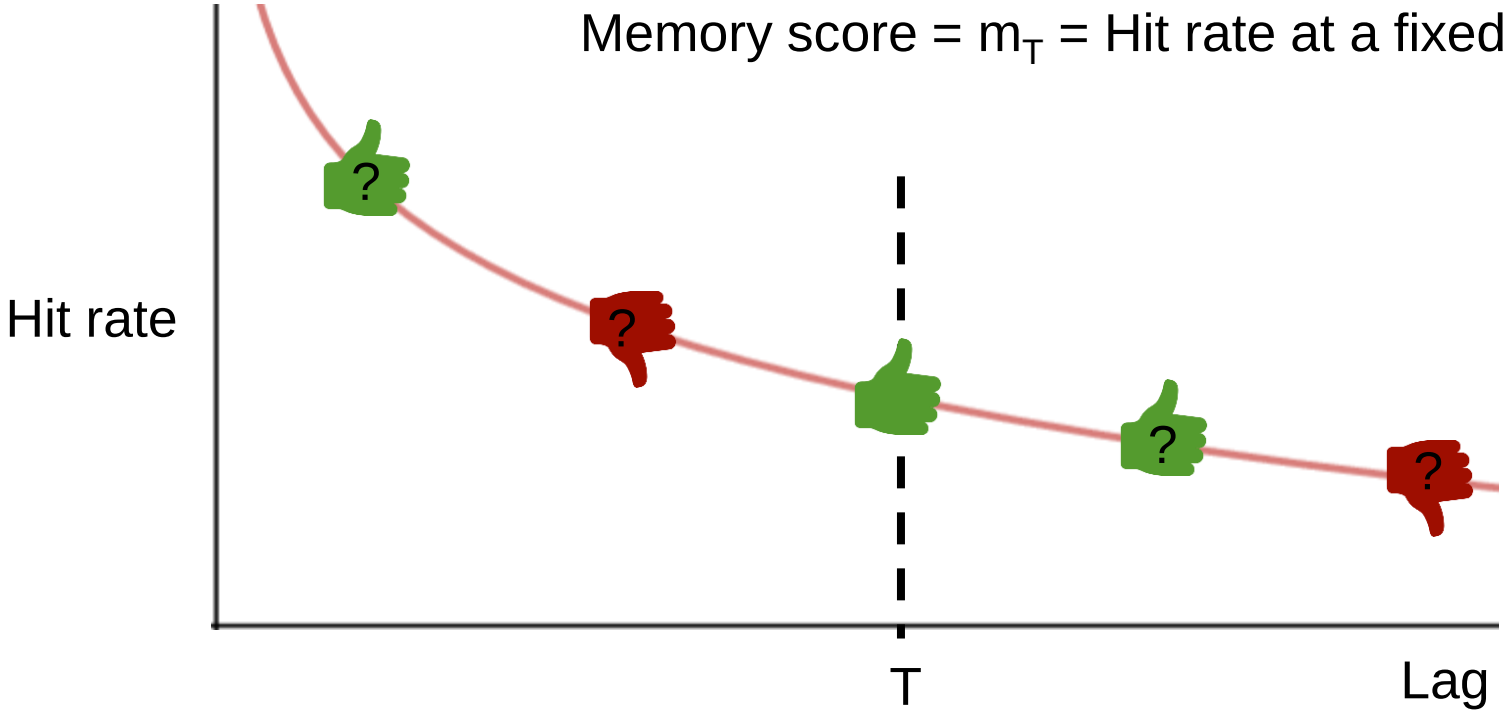
= .80

Lag = 20 Lag = 40 Lag = 60 Lag = 80 Lag = 100

Calculating a memorability score

Idea 2:

Memory score = m_T = Hit rate at a fixed time, T

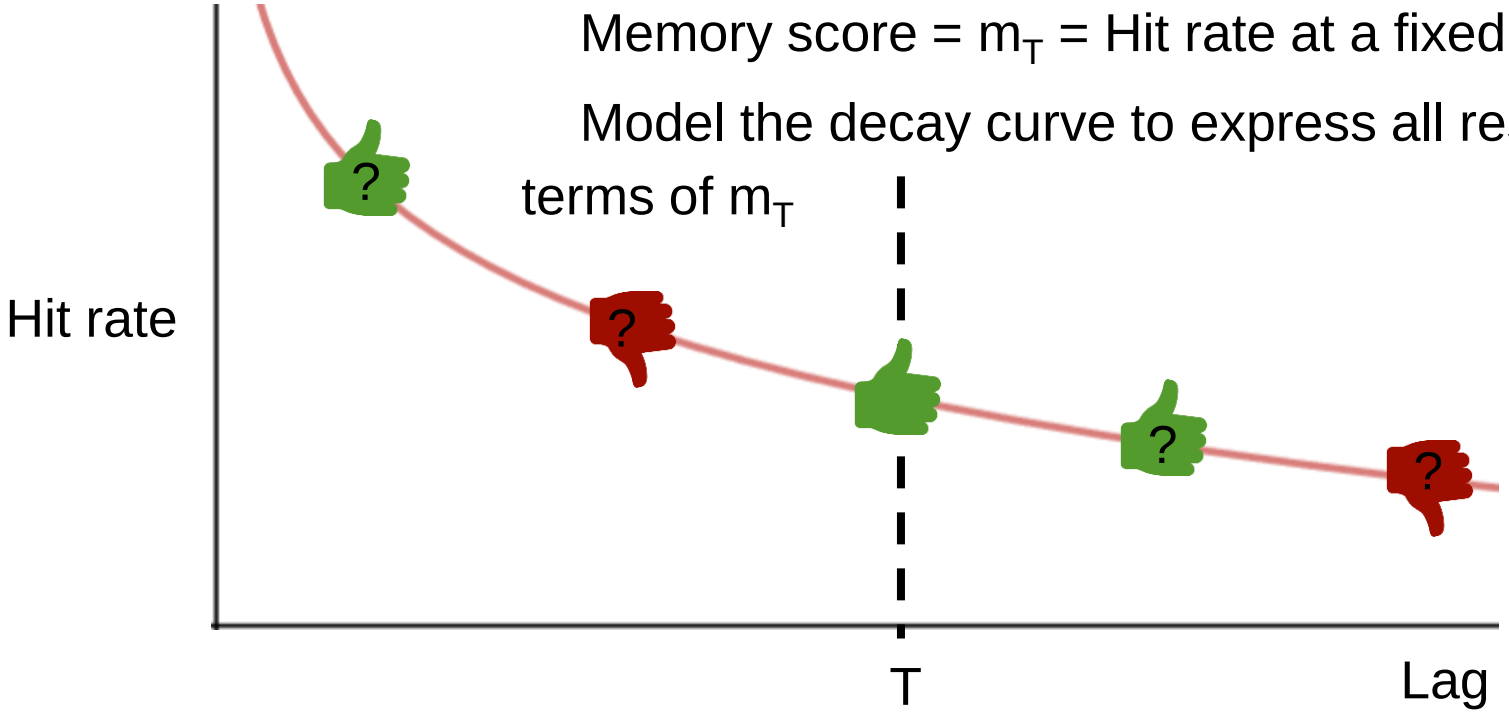


Calculating a memorability score

Idea 2:

Memory score = m_T = Hit rate at a fixed time, T

Model the decay curve to express all responses in terms of m_T



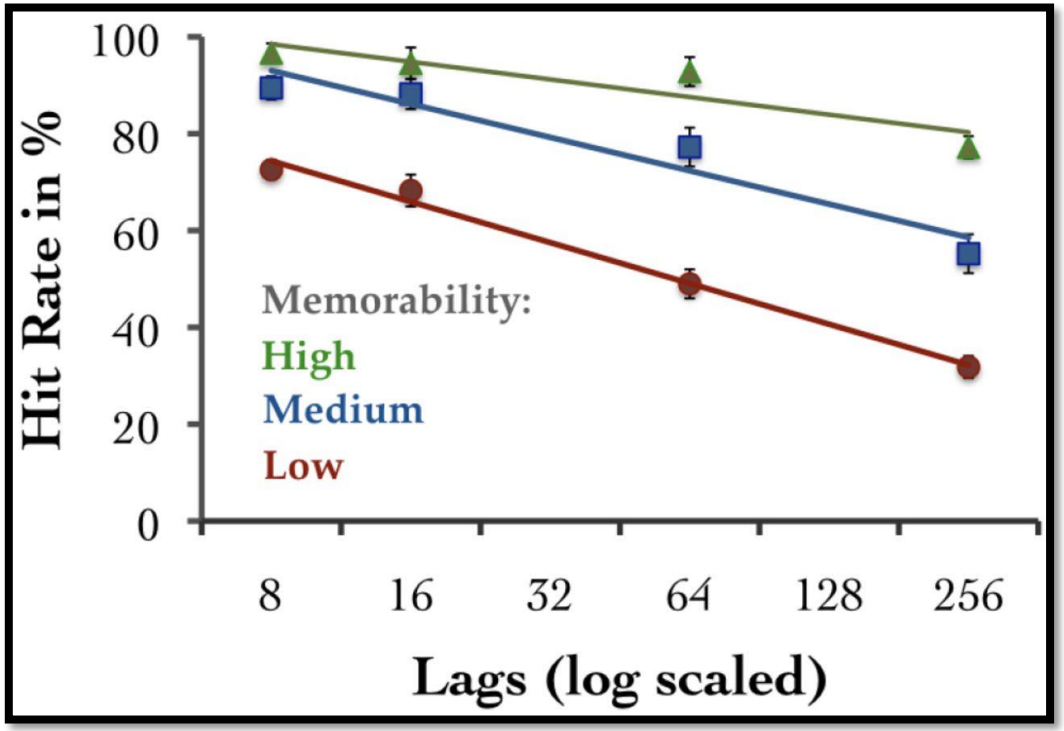
Modeling the memorability curve

$$m_t - m_T \propto \log(t/T)$$

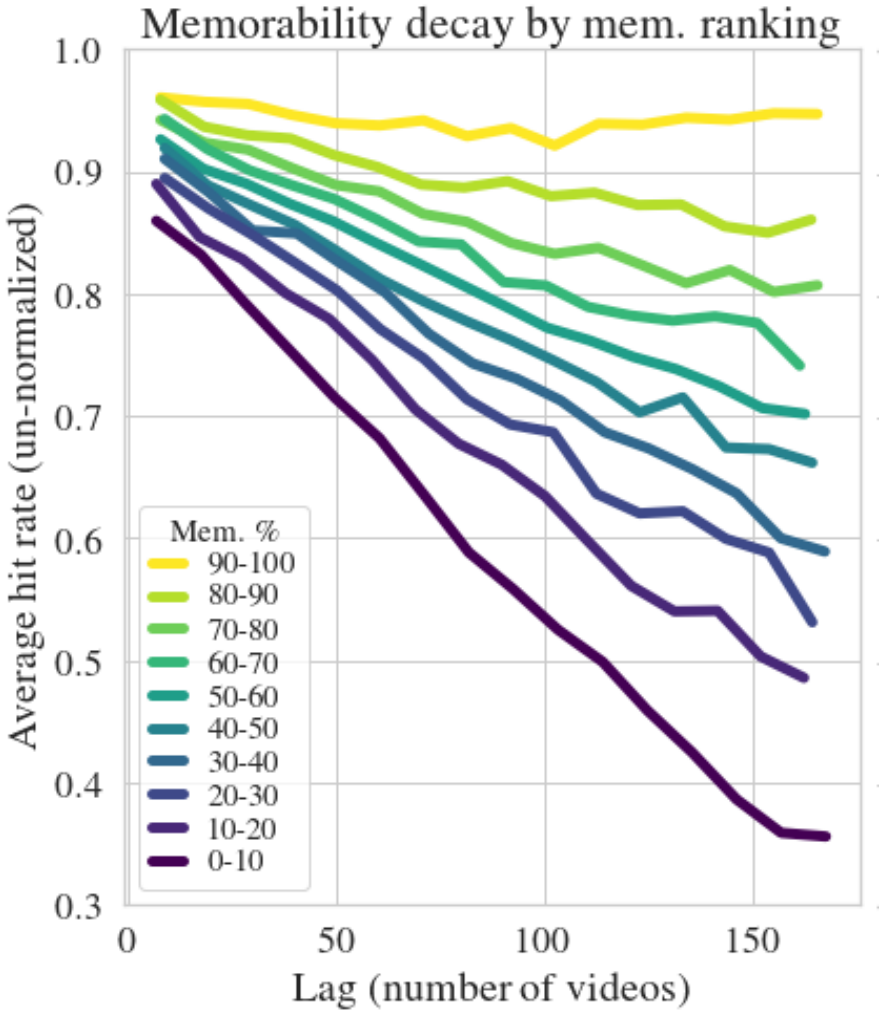
Modeling the memorability curve

$$m_t - m_T = \alpha \log(t/T)$$

Modeling the memorability curve



(Vo et al. BioArxiv 2017)

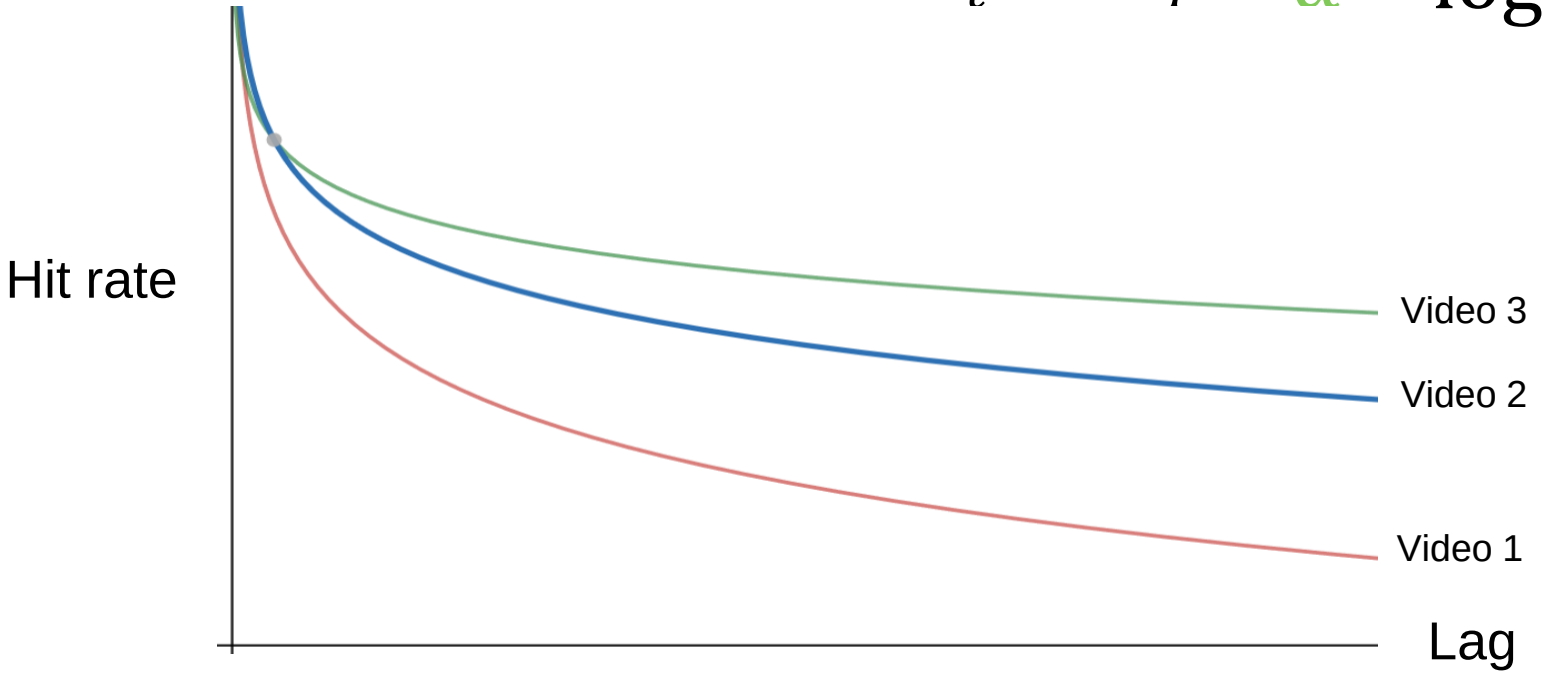

Memorability decay by mem. ranking
Average hit rate (un-normalized)
1.0
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0
50
100
150
Lag (number of videos)
Mem. %
90-100
80-90
70-80
60-70
50-60
40-50
30-40
20-30
10-20
0-10

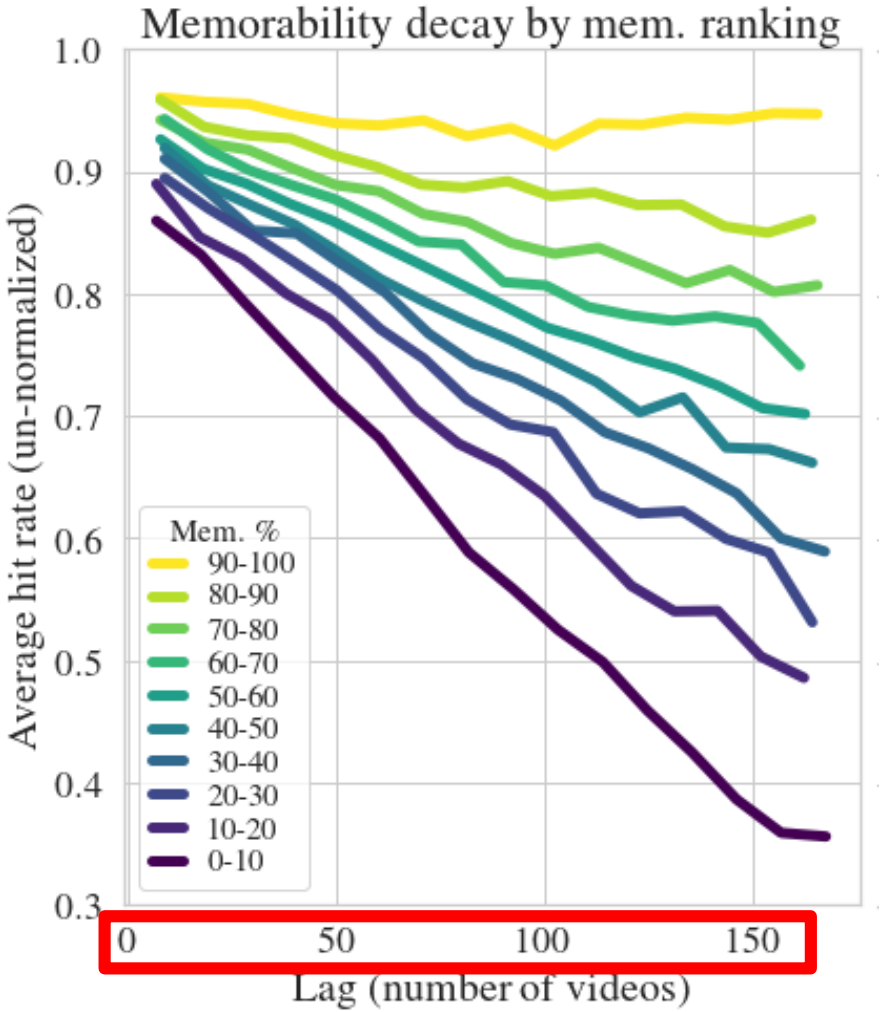
Modeling the memorability curve

$$m_t - m_T = \alpha \log(t/T)$$

Modeling the memorability curve

$$m_t - m_T = \alpha^{(v)} \log(t/T)$$




Memorability decay by mem. ranking
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Mem. %
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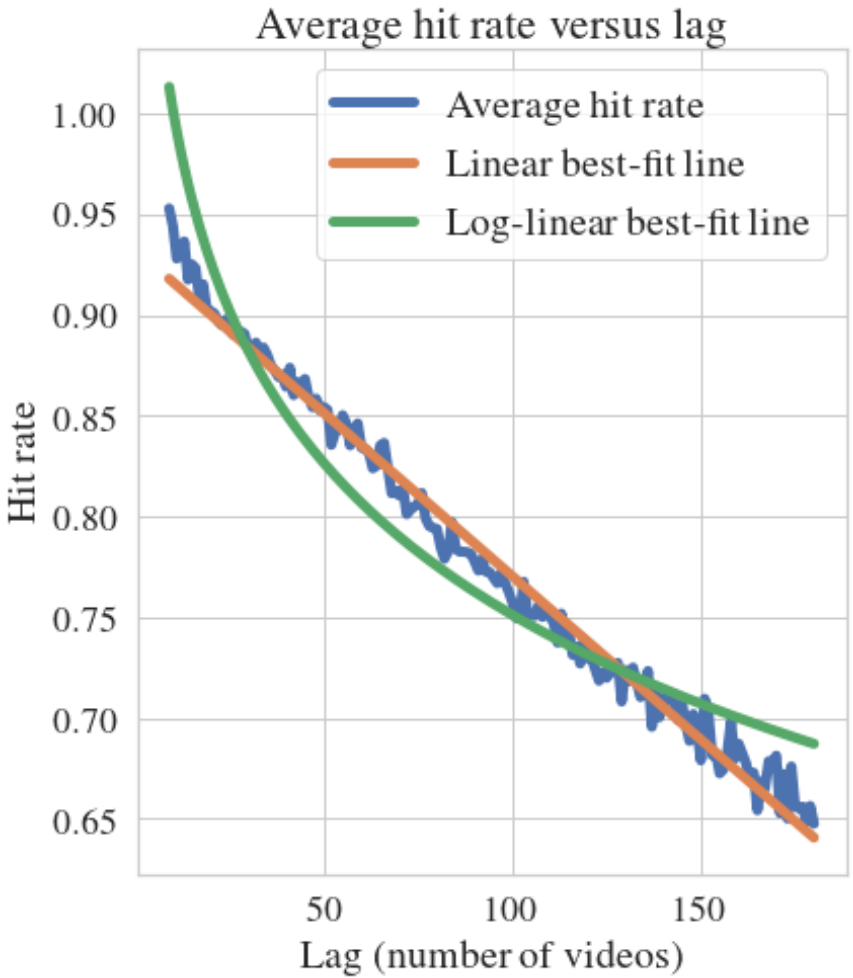
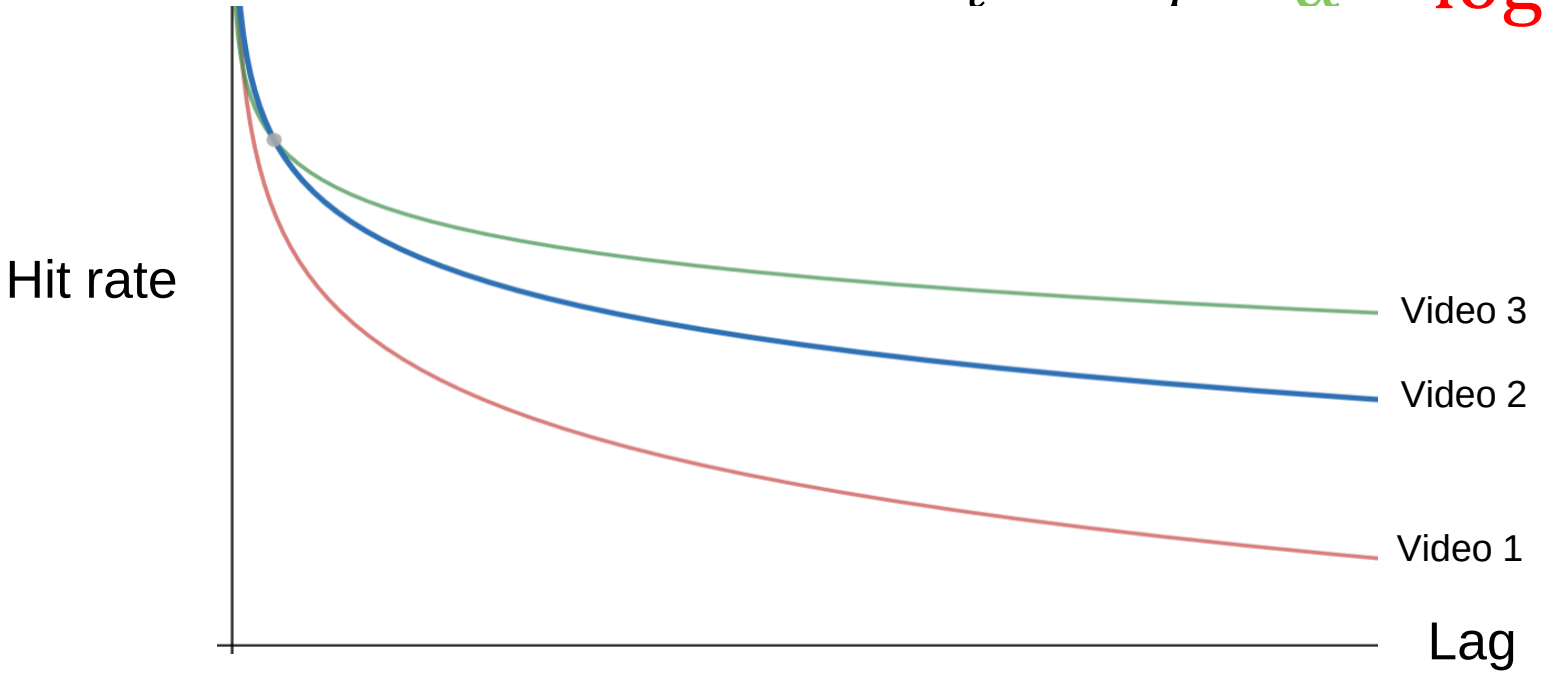
70-80
60-70
50-60
40-50
30-40
20-30
10-20
0-10
0
50
100
150
Lag (number of videos)


Average hit rate versus lag
Average hit rate
Linear best-fit line
Log-linear best-fit line
1.00
0.95
0.90
0.85
0.80
0.75
0.70
0.65
Hit rate
50
100
150
Lag (number of videos)

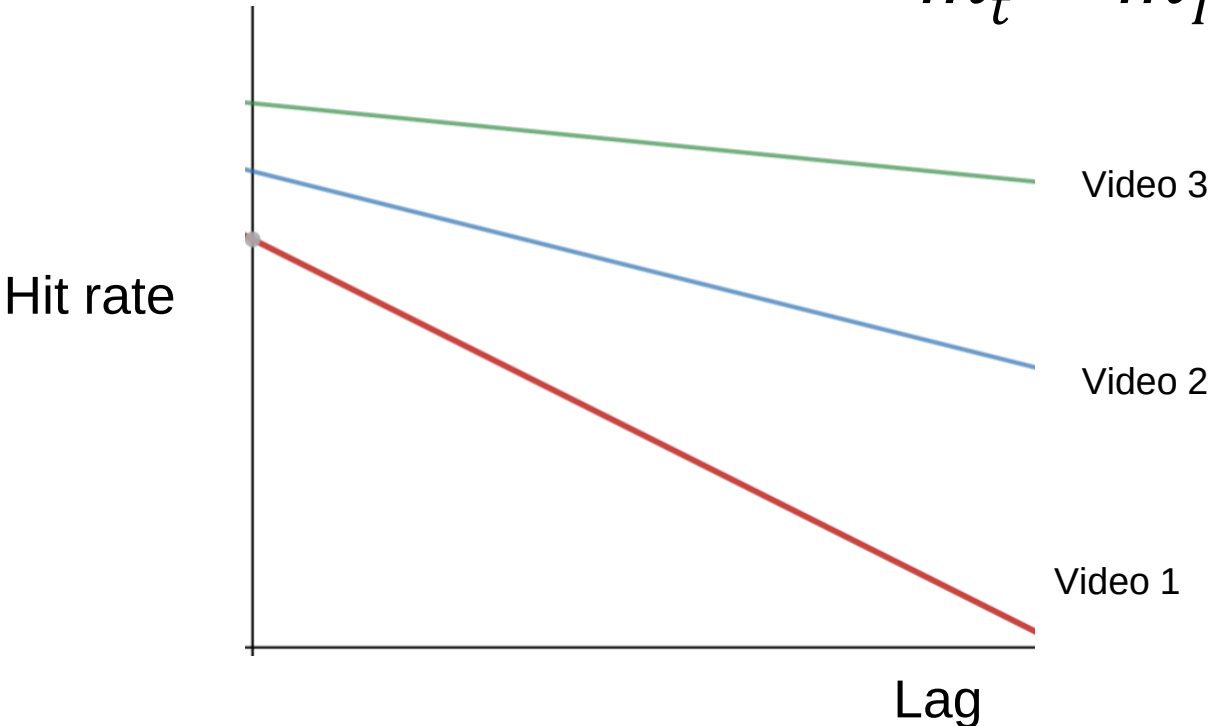
Modeling the memorability curve

$$m_t - m_T = \alpha^{(v)} \log(t/T)$$



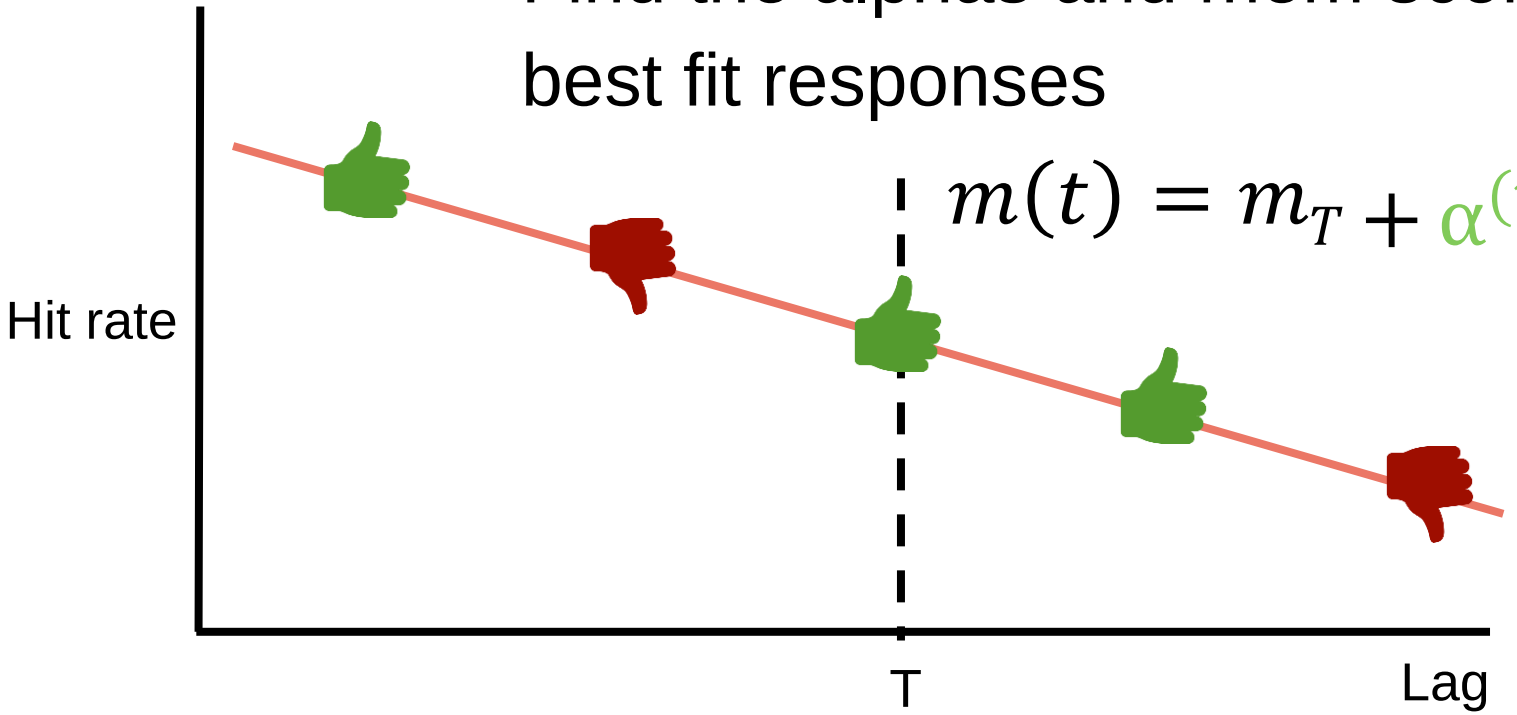
Modeling the memorability curve

$$m_t - m_T = \alpha^{(v)}(t - T)$$



Calculating a memorability score

Find the alphas and mem scores that best fit responses

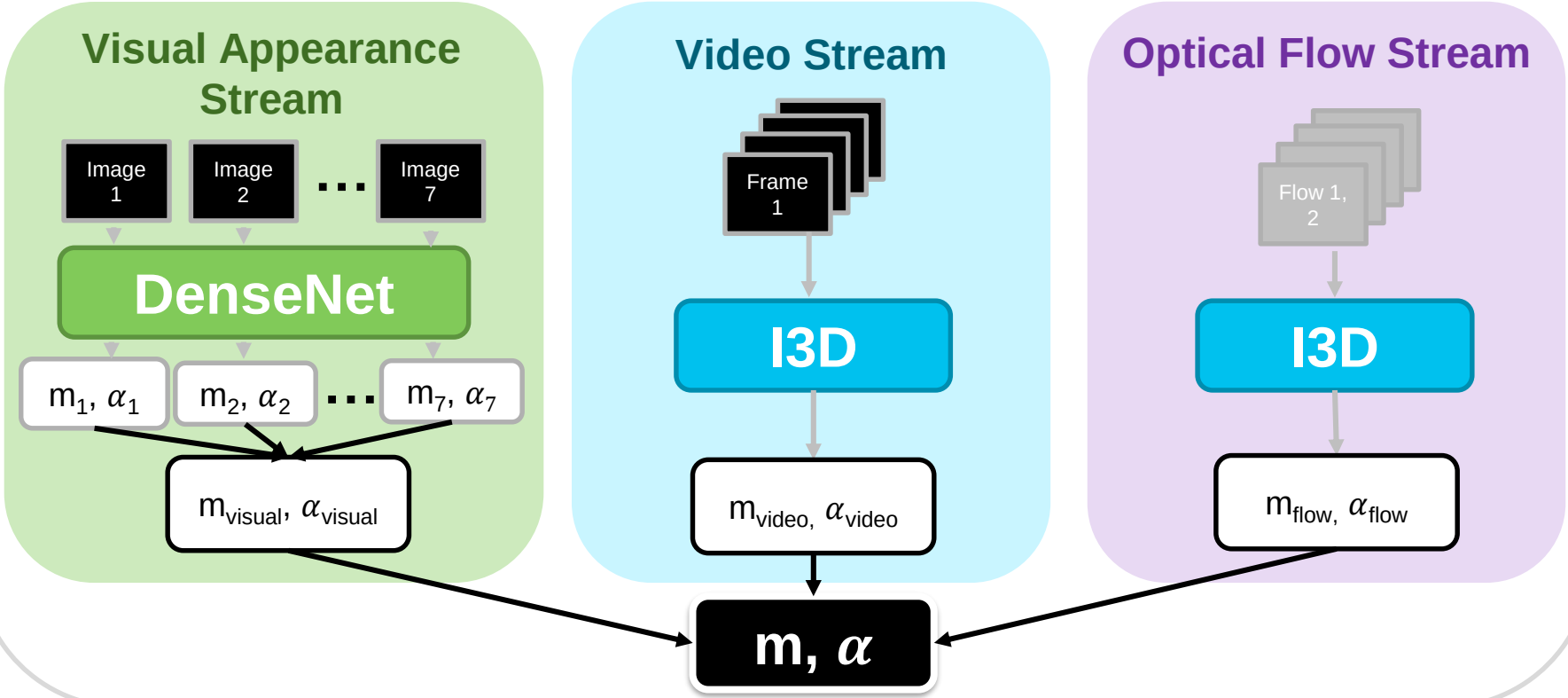


Understanding decay is important

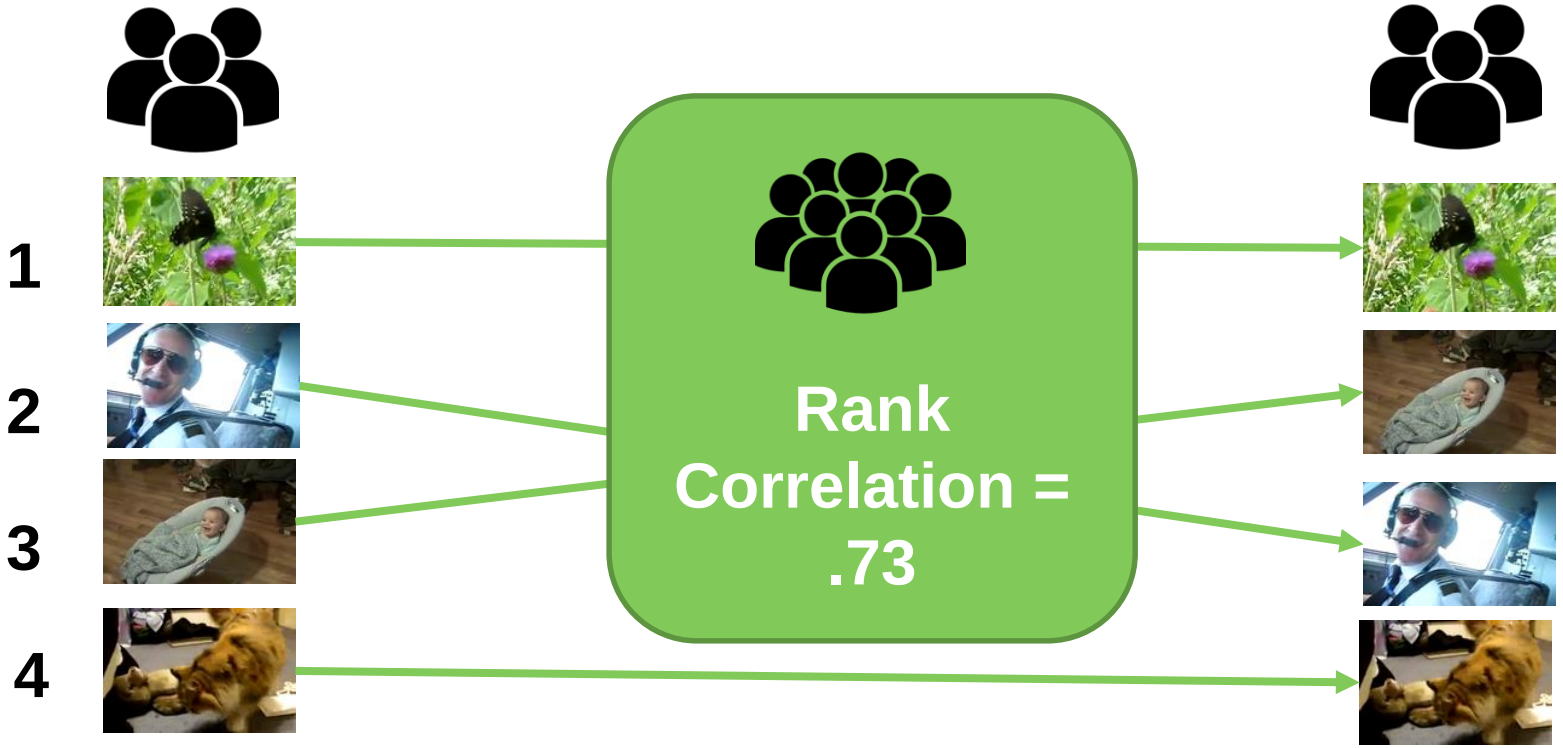
- Better model fit
- Use all the data!

How can we predict memorability on videos?

Temporal MemNet



How do we evaluate a memorability prediction system?



How do we evaluate a memorability prediction system?

Model	Visual App. Only	Video Only	Optical Flow Only	Visual App. + Optical Flow	Visual App. + Video + Optical Flow	Human Consistency
Rank Correlation	.61	.62	.56	.64	**.66**	.73

Why are certain videos memorable?

High memorability

Low memorability

Why are certain videos memorable?

High memorability

m = 1.0 α = 0.0			
m = 1.0 α = 0.0			
m = 0.99 α = -0.00024			
m = 0.99 α = -0.00031			
m = 0.99 α = -0.00026			

Low memorability

m = 0.42 α = -0.0051			
m = 0.42 α = -0.0020			
m = 0.43 α = -0.0027			
m = 0.44 α = -0.0026			
m = 0.46 α = -0.0038			

Why are certain videos memorable?

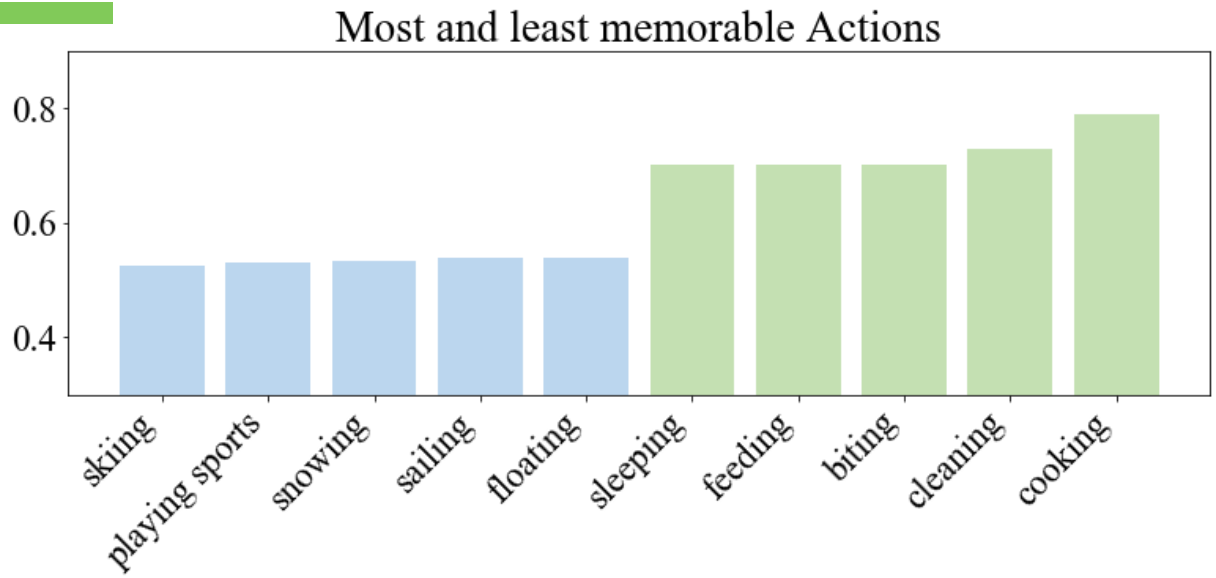
Slow decay

m = 0.80 **α = 0.0017**	
m = 0.75 **α = 0.0015**	
m = 0.92 **α = 0.0013**	
m = 0.87 **α = 0.0011**	
m = 0.66 **α = 0.0011**	

Quick decay

m = 0.62 **α = -0.0065**	
m = 0.66 **α = -0.0060**	
m = 0.50 **α = -0.0058**	
m = 0.67 **α = -0.0058**	
m = 0.62 **α = -0.0057**	

Why are certain videos memorable?



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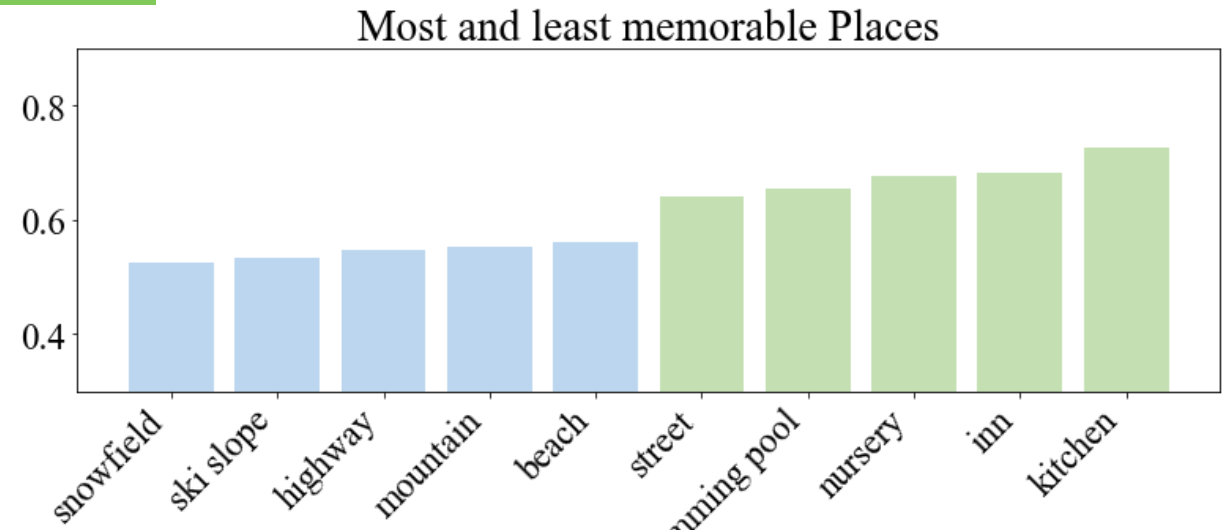
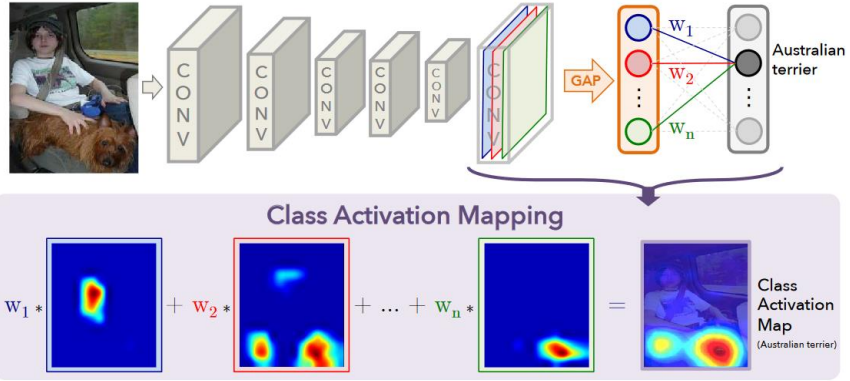
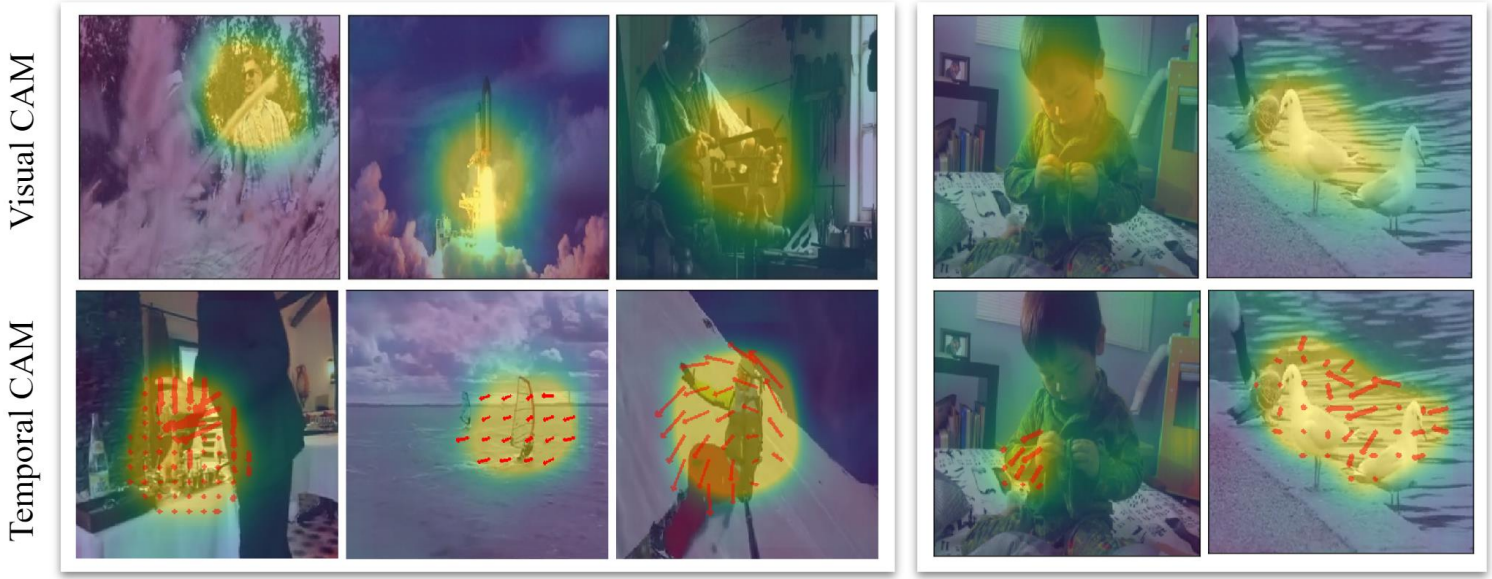


Why are certain videos memorable?

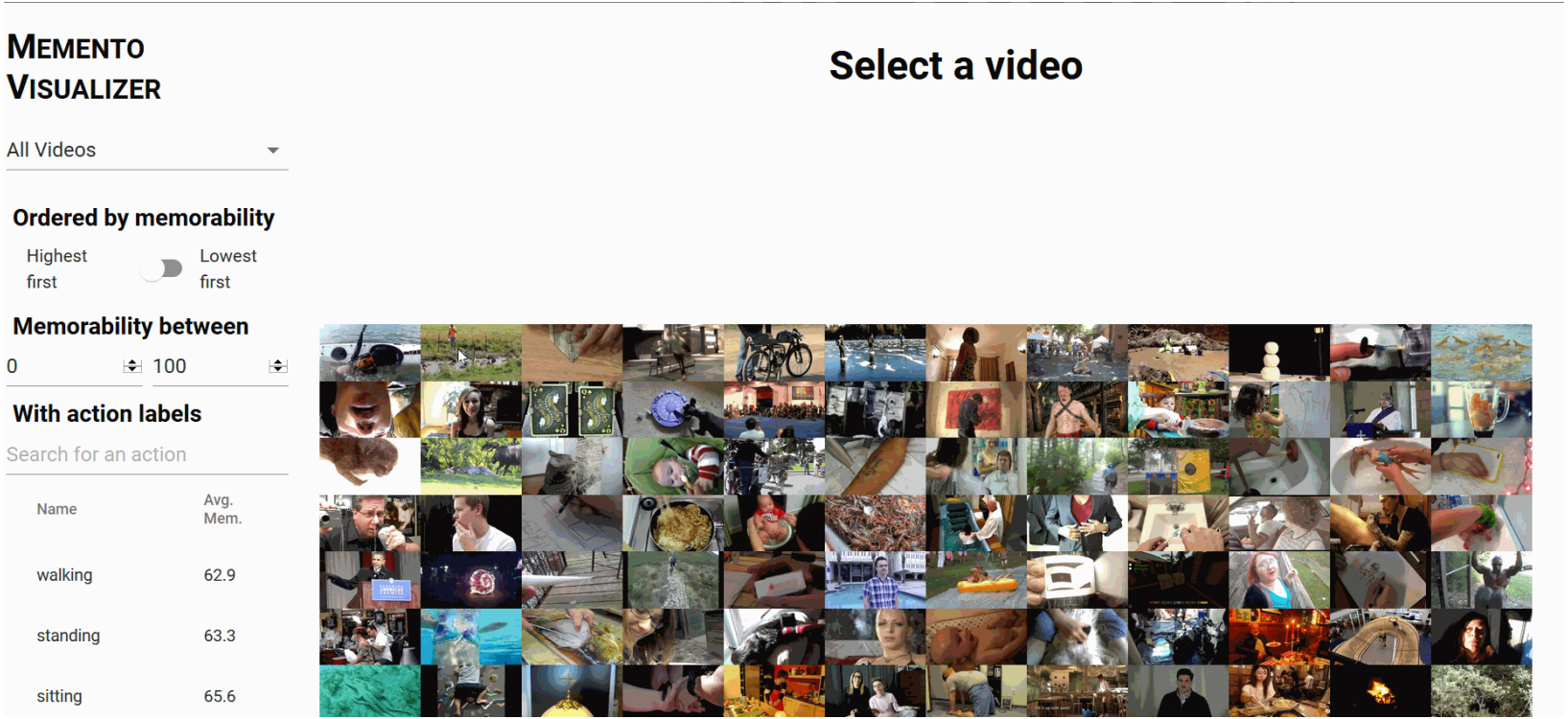


Class Activation Mapping

Zhou et al. CVPR 2016

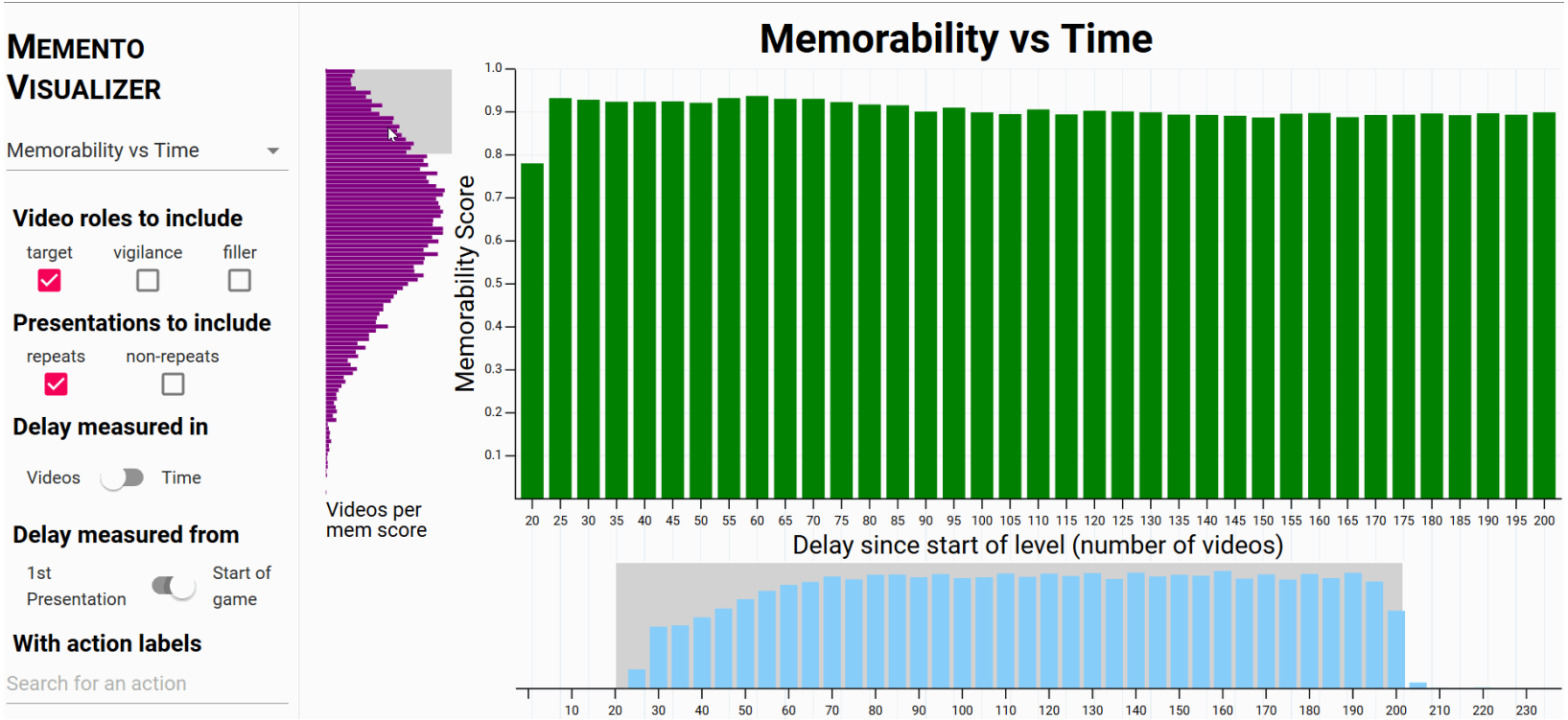


Memento Visualizer



memento-vis.csail.mit.edu

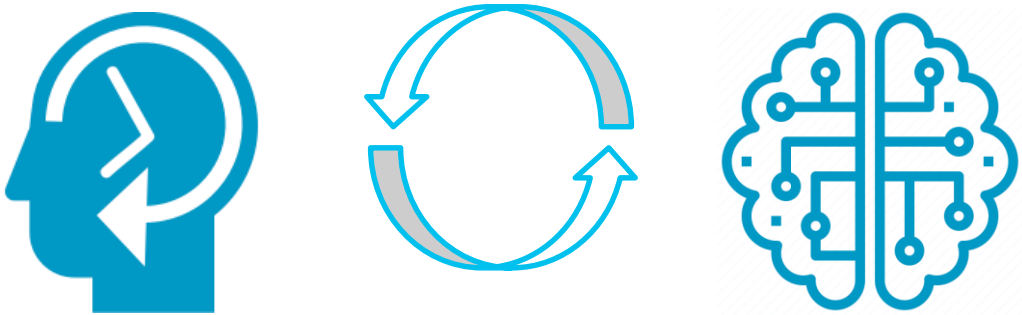
Memento Visualizer



mememto-vis.csail.mit.edu

The future of memory

Memento1M!






Low memorability ⟷ High memorability

I hope you find this talk memorable.

memento-game.csail.mit.edu

memento-vis.csail.mit.edu