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Beyond Views: Measuring and Predicting Engagement in Online Videos

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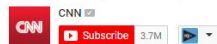
ComputationalMedia @ANU: <http://cm.cecs.anu.edu.au>

ICWSM '18, Stanford, CA, USA

View count does NOT translate to watch time



Obama's surprise brings Joe Biden to tears



3,917,179 views

+ Add to Share ... More

29,894 2,123

Video statistics Up to 27 May 2018

VIEWS	TIME WATCHED	SUBSCRIPTIONS DRIVEN	SHARES
3,907,719	62 years	2,375	8,189

View count: 3,917,179

Watch time: 62 years

<

>



All Bollywood SAD Reactions On Sridevi PASSING AWAY At A Young Age



7,833,595 views

+ Add to Share ... More

12,366 6,236

Video statistics Up to 27 May 2018

VIEWS	TIME WATCHED	SUBSCRIPTIONS DRIVEN	SHARES
7,833,080	32 years	15,860	5,589

View count: 7,833,595

Watch time: 32 years

YouTube Now: Why We Focus on Watch Time <https://bit.ly/2G9iuvv>

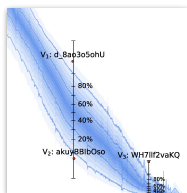
Facebook: Updating How We Account For Video Completion Rates <https://bit.ly/2iuca5b>

Research questions on engagement

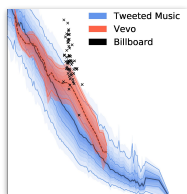
User-specific engagement: the key for video recommendation [Covington et al. *RecSys* '16][Park et al. *ICWSM* '16]

Aggregate engagement: open data available to researchers

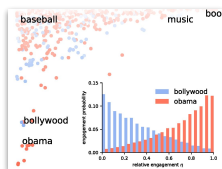
Applications: better recommender systems, mitigate information overload, etc.



1. How to measure aggregate engagement?



2. Characteristics of aggregate engagement
 - (a) Does engagement relate to content quality?
 - (b) How does engagement evolve over time?



3. Can aggregate engagement be predicted?

Popularity and engagement for web content

Domain	Popularity metrics	Engagement metrics
Webpages	Visit number [Li and Moore <i>JMLR</i> '08]	Click-through-rate [Richardson et al. <i>WWW</i> '07]
Search ads	Display number [He et al. <i>ADKDD</i> '14]	Conversion rate [Barbieri et al. <i>WWW</i> '14]
Songs	Listening count [Bellogin et al. <i>ICWSM</i> '13]	Download number [Salganik et al. <i>Science</i> '06] [Krumme et al. <i>PLoS</i> '12]
Videos	View count [Pinto et al. <i>WSDM</i> '13] [Szabo and Huberman <i>Com.ACM</i> '10] [Rizoiu et al. <i>WWW</i> '17]	Watch time [Guo et al. <i>L@S</i> '14] [Park et al. <i>ICWSM</i> '16]

- ★ **No browser extension**
- ★ **New metric**
- ★ **Cold-start prediction**

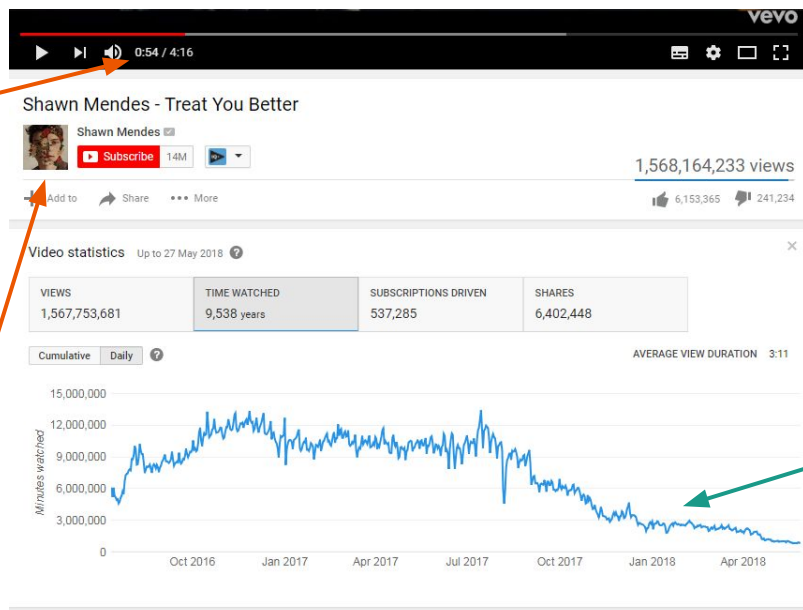
Tweeted Videos dataset

Tweeted Videos: 5 million YouTube videos published and tweeted in July and August 2016.

Video duration: 4M16S
Visual definition: HD or SD

Video Title:
Shawn Mendes - Treat You Better
Channel Id:
UC4-TgOSMJHn-LtY4zCzbQhw
Channel Title:
ShawnMendesVEVO

Freebase topics:
Shawn Mendes; Music; Music
video; Pop music

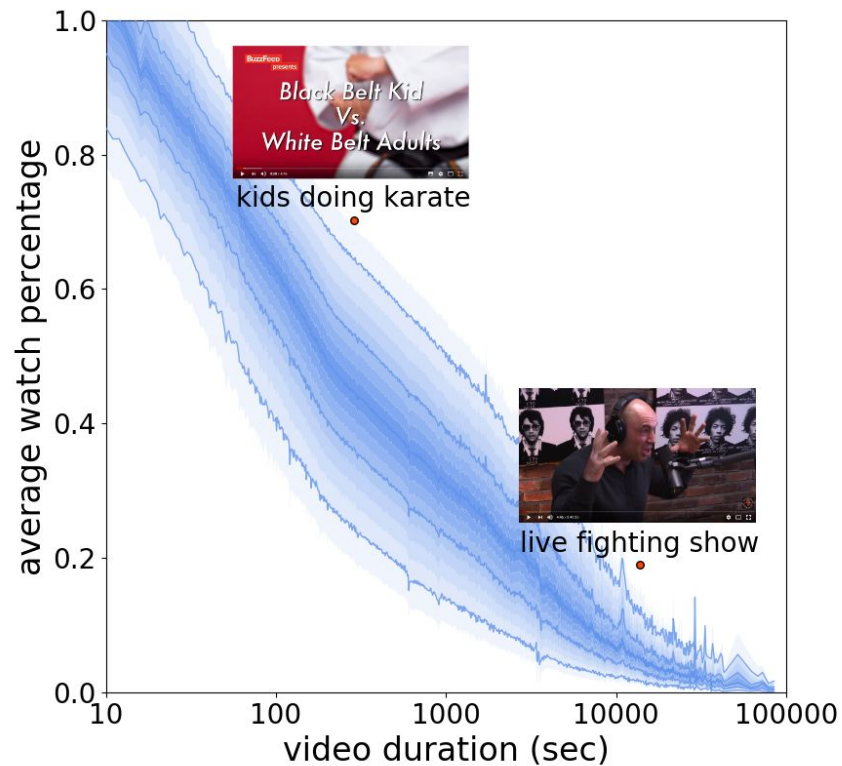
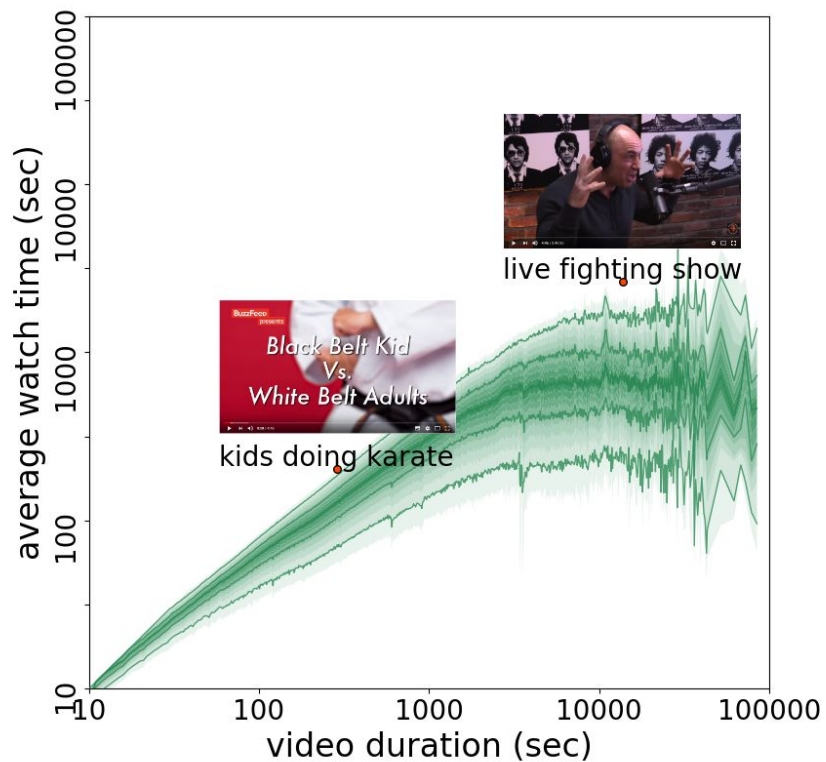


Insight time series:
(a) Daily watch time
(b) Daily view count
(c) Daily share count
(d) Avg watch time

Published on 12 Jul 2016
Shawn Mendes; "Treat You Better"
Get "Treat You Better" here now:
<http://smarturl.it/TreatYouBetter>
<http://vevo.ly/OmBn2p>
Best of Shawn Mendes: <https://goo.gl/kcEHK5>
Subscribe here: <https://goo.gl/aBCeW6>
Category Music
Licence Standard YouTube Licence
Song Treat You Better
Artist Shawn Mendes

Category: Music
Language: en

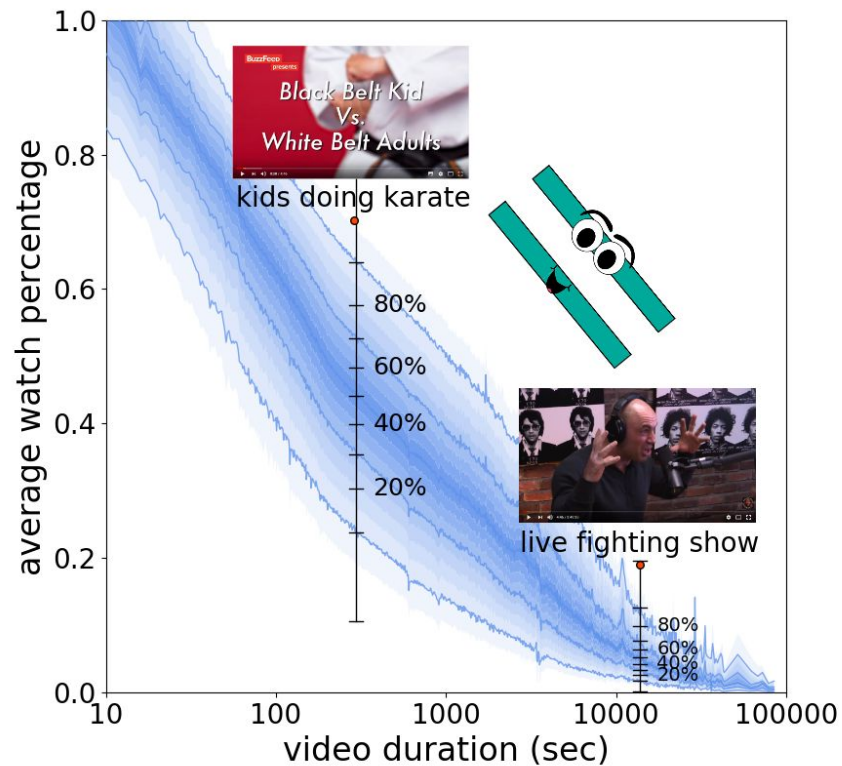
The engagement maps



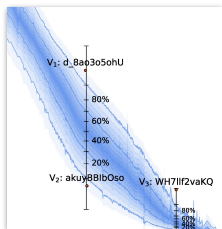
New metric: *relative engagement*

Relative engagement

Rank percentile of average watch percentage
among videos with similar lengths

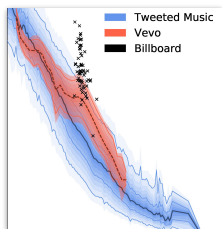


Talk outline



1. How to measure aggregate engagement?

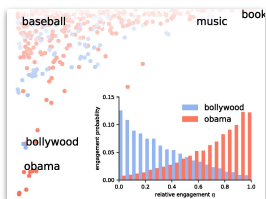
Relative engagement - a new metric invariant wrt video duration



2. Characteristics of aggregate engagement

(a) Does engagement relate to content quality?

(b) How does engagement evolve over time?



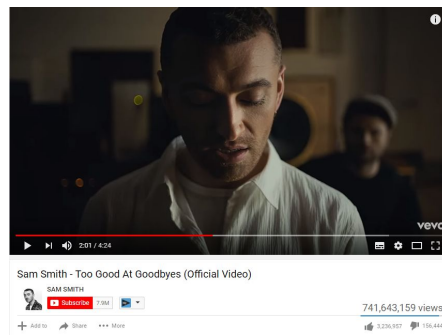
3. Can aggregate engagement be predicted?

Quality Videos datasets: Music and News

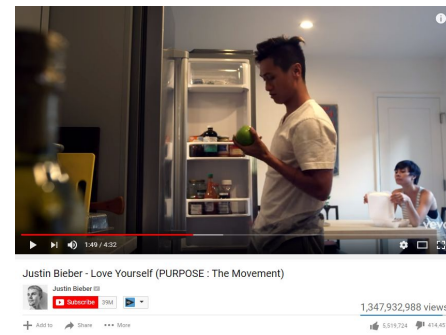
Music



Tweeted music clip
449,314 videos



Professional Vevo video
67,649 videos



Billboard top hit
63 videos

News

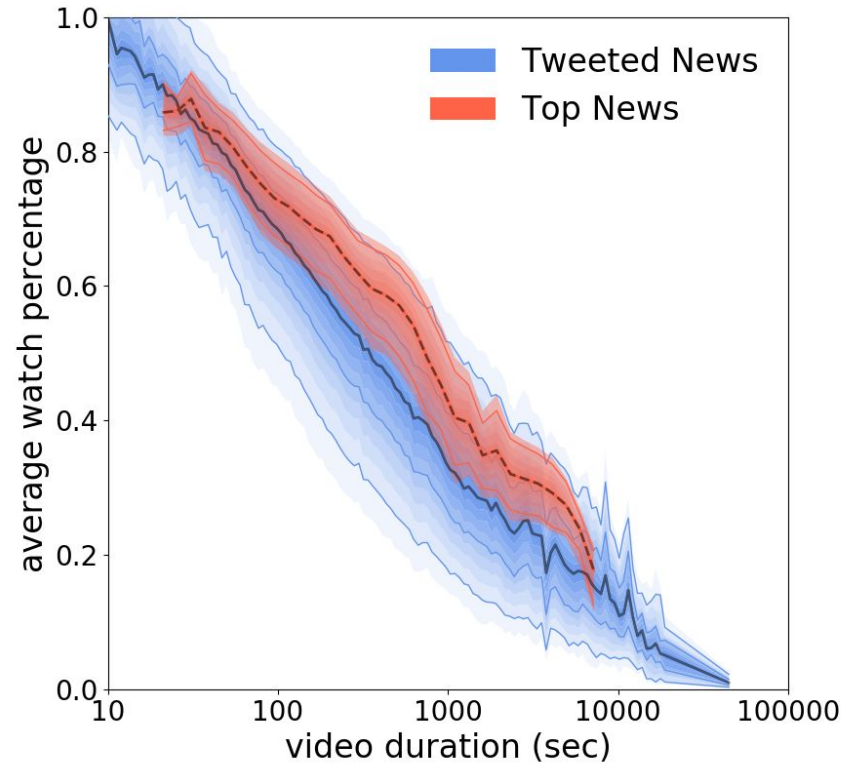
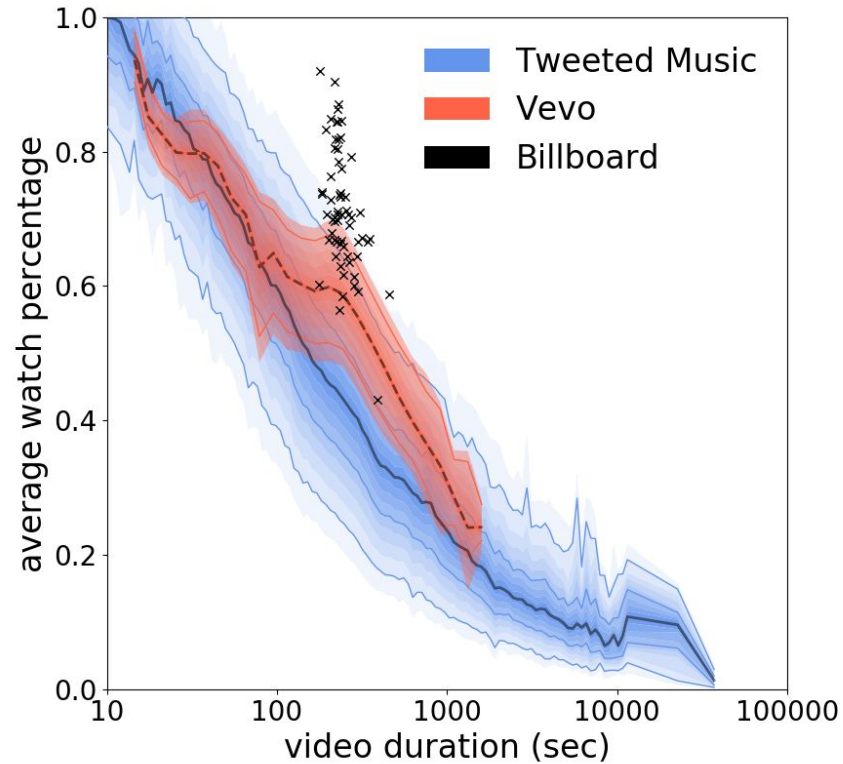


Tweeted news clip
459,728 videos



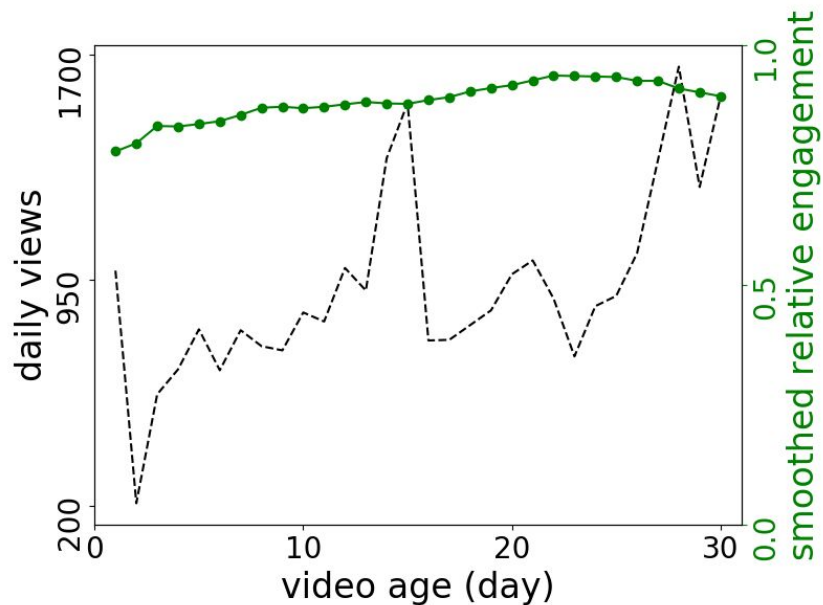
Top News video
28,685 videos

Relative engagement is correlated with video quality



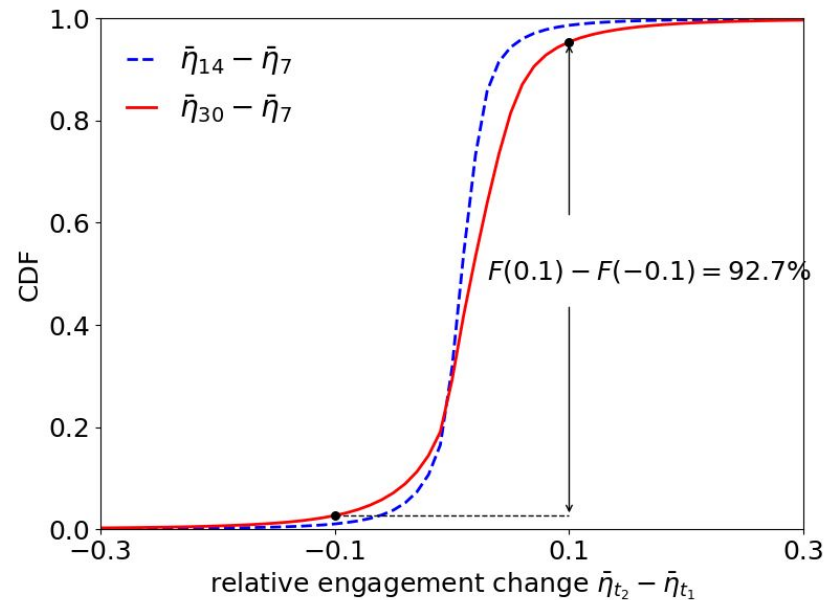
Post-clicking behavior is only relevant to product quality. [Krumme et al. *PLoS* '12]

Relative engagement is stable over time



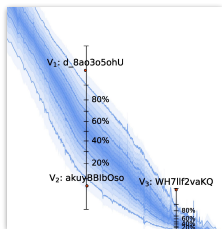
Video Id: XIB8Z_hASOs

Video Title: DC Super Hero Girls S02E10



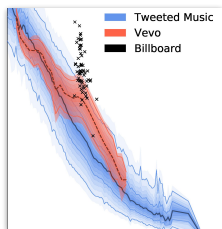
92.7% of videos stay within 0.1 in relative engagement

Talk outline



1. How to measure aggregate engagement?

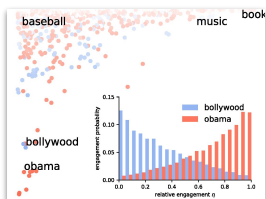
Relative engagement - a new metric invariant wrt video duration



2. Characteristics of aggregate engagement

(a) Relative engagement is correlated with content quality

(b) Relative engagement is stable over time



3. Can aggregate engagement be predicted?

Prediction task setup

Video duration: 4M16S

Channel activity level:

Daily upload number

Channel past engagement:

Summary of past performance

Visual definition: HD or SD

Category: Music

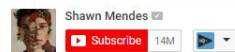
Language: en

Freebase topics:

Shawn Mendes; Music; Music video; Pop music



Shawn Mendes - Treat You Better



1,568,164,233 views

+ Add to Share More

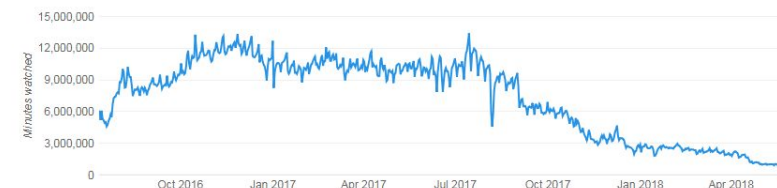
6,153,365 241,234

Video statistics Up to 27 May 2018

VIEWS	TIME WATCHED	SUBSCRIPTIONS DRIVEN	SHARES
1,567,753,681	9,538 years	537,285	6,402,448

Cumulative Daily

AVERAGE VIEW DURATION 3:11



Published on 12 Jul 2016
Shawn Mendes, "Treat You Better"

Get "Treat You Better" here now:
<http://smarturl.it/TreatYouBetter>

<http://vevo.ly/OmBn2p>
Best of Shawn Mendes: <https://goo.gl/kcEHK5>
Subscribe here: <https://goo.gl/aBcEw6>

Category	Music
Licence	Standard YouTube Licence
Song	Treat You Better
Artist	Shawn Mendes

Prediction targets:

- (a) Relative engagement
- (b) Avg watch percentage

Prediction method:

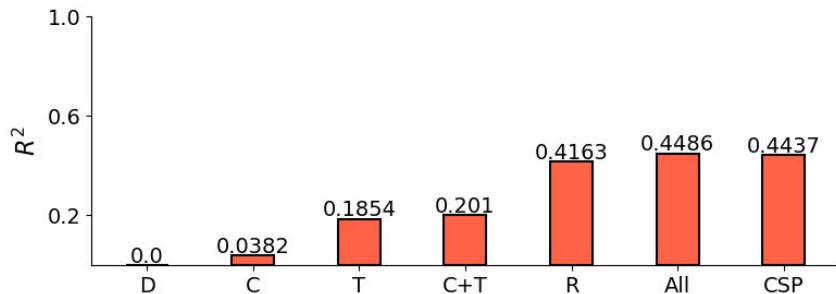
Ridge regression

Evaluation metric:

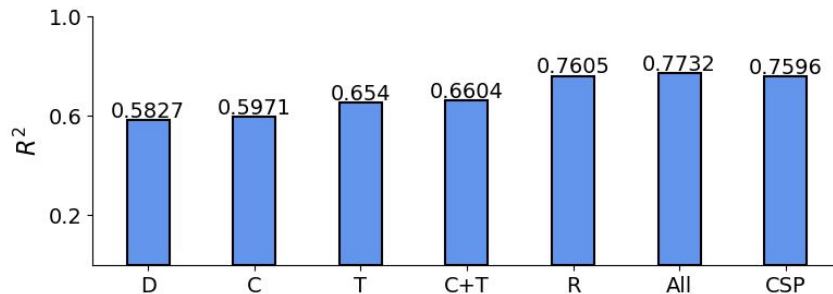
R2

Prediction results

Predict relative engagement



Predict average watch percentage

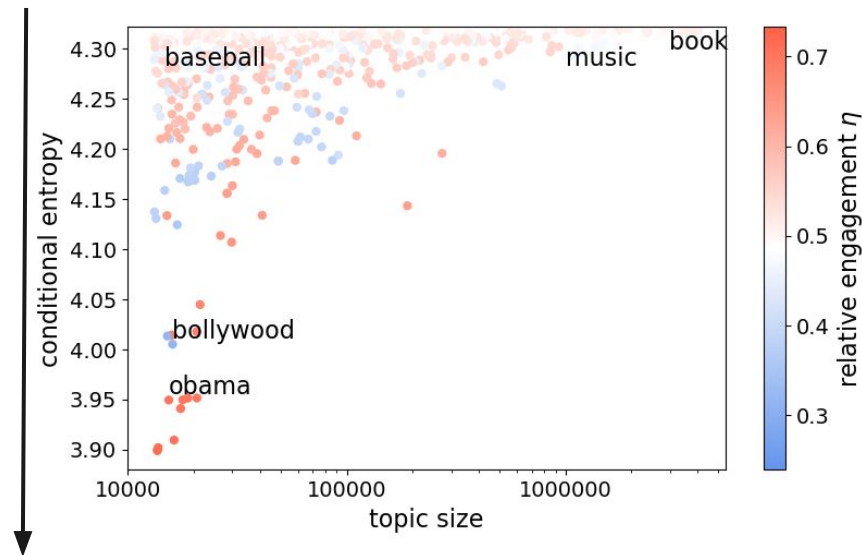


D: duration; **C:** context; **T:** topic; **C+T:** context+topic;
R: channel past reputation; **All:** all features; **CSP:** channel specific predictor

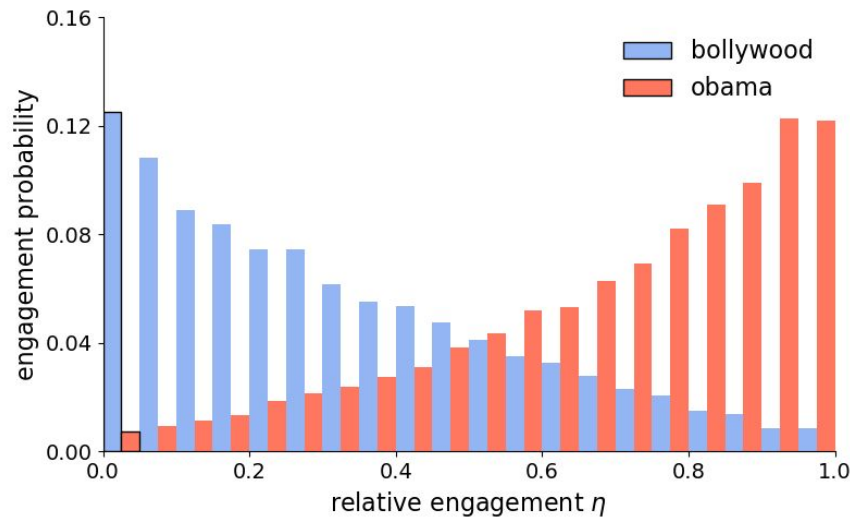
- R^2 up to 0.45 for relative engagement and 0.77 for average watch percentage.
- Channel related features are the most predictive, consistent with [Cheng et al. WWW'14]
- Topic features are somewhat predictive, contrasting to [Martin et al. WWW'16]

What are engaging topics?

Conditional entropy: $H(Y|X_i = 1) = - \sum_{y \in Y} P(y|x_i = 1) \log_2 P(y|x_i = 1)$

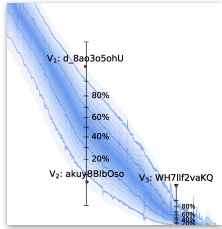


500 most frequent topics



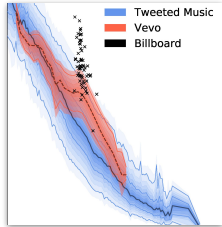
Engagement distribution of "Obama"
and "Bollywood" videos

Summary



1. How to measure aggregate engagement?

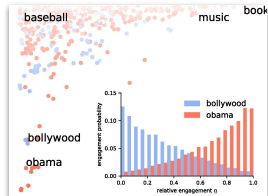
Relative engagement - a new metric invariant wrt video duration



2. Characteristics of aggregate engagement

(a) Relative engagement is correlated with content quality

(b) Relative engagement is stable over time

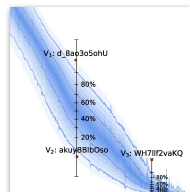


3. Can aggregate engagement be predicted?

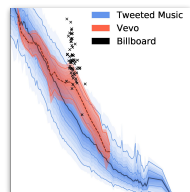
Engagement can be predicted before video's upload, $R^2=0.77$



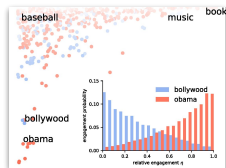
Scan me



1. How to measure aggregate engagement?
Relative engagement - a new metric invariant wrt video duration



2. Characteristics of aggregate engagement
(a) **Relative engagement is correlated with content quality**
(b) **Relative engagement is stable over time**



3. Can aggregate engagement be predicted?
Engagement can be predicted before video's upload, $R^2=0.77$

Future work

- Quantifying the gap between aggregate and user-specific measures
- Quantifying the level of quality variations across different channels via relative engagement