

# Week 7: Wednesday

Ethical Issues in Technology



# Unit 5: Platforms

# Roadmap

## ~~Monday~~

Personalized feeds

Filter bubbles and echo chambers

Recommendation algorithms

## Wednesday

[Case study] YouTube Recommendations

\*\*\**Project Midpoint Due*\*\*\*

## Friday

Who is responsible for content moderation?

Platform election response

[Current events]

# [Case Study] YouTube Recommendations

The YouTube Recommendation System has played a major role in the platform's success - but at what cost?

Recommendations help you discover more of the videos you love, whether it's a great new recipe to try or your next favourite song. We share recommendations both on YouTube's homepage and in the "Up next" section as a suggestion of what to watch next when you're watching a video. We're constantly testing, learning, and adjusting to recommend videos that are relevant to you.

# YouTube Homepage - Not logged into account

The screenshot shows the YouTube homepage interface. At the top, there's a search bar and a 'SIGN IN' button. Below the search bar, there are several category tabs: All, Oceans, Woodworking, Music, Science Fiction, Playlists, Greatest hits albums, Chill-out music, Comedy, Baseball fields, Albums, and a 'More' button. The main content area displays a grid of video thumbnails. The first row includes 'lofi hip hop radio - beats to relax/study to' (LIVE NOW), 'Extreme \$100,000 Game of Tag!' (23M views), 'Luke, grab that little ho' (5.2M views), and 'Keep Calm And Feel The Reggae 2021 (6 Hours)' (1M views). The second row includes 'Freezing, Crying Puppy Rescued by Police Officers | The Dodo' (3.9M views), 'How a Kar98k Works' (6.7M views), 'Trusova attempts five quads in valiant free skate, vaults from 12t...' (757K views), and 'CLASSIC ROCK' (10:32:36). The left sidebar contains navigation links: Home, Explore, Subscriptions, Library, History, and a 'SIGN IN' button. Below these are 'BEST OF YOUTUBE' categories: Music, Sports, Gaming, Movies & Shows, News, Live, and Fashion & Beauty. The bottom of the screen shows a Windows taskbar with various application icons and the system clock displaying 11:23 AM on 4/19/2021.

YouTube

Search

SIGN IN

Home Explore Subscriptions Library History

Sign in to like videos, comment, and subscribe.

SIGN IN

BEST OF YOUTUBE

Music Sports Gaming Movies & Shows News Live Fashion & Beauty

All Oceans Woodworking Music Science Fiction Playlists Greatest hits albums Chill-out music Comedy Baseball fields Albums

lofi hip hop radio - beats to relax/study to  
Lofi Girl  
53K watching  
LIVE NOW

Extreme \$100,000 Game of Tag!  
MrBeast  
23M views • 1 day ago

Luke, grab that little ho  
Martin Caidin  
5.2M views • 1 year ago

Keep Calm And Feel The Reggae 2021 (6 Hours)  
PMB Music  
1M views • 2 months ago

Freezing, Crying Puppy Rescued by Police Officers | The Dodo  
The Dodo  
3.9M views • 3 years ago

How a Kar98k Works  
Matt Rittman  
6.7M views • 1 week ago

Trusova attempts five quads in valiant free skate, vaults from 12t...  
NBC Sports  
757K views • 3 weeks ago

CLASSIC ROCK  
10:32:36

Scorpions, GNR, Bon Jovi, U2, Led Zeppelin, Aerosmith  
Music In Paradise  
2.5M views • Streamed 3 months ago

Type here to search

11:23 AM  
4/19/2021

# YouTube Homepage - Logged into account

The screenshot displays the YouTube homepage for a logged-in user. The interface is dark-themed. At the top, a search bar is visible with the text "Search". Below the search bar, a horizontal row of category buttons includes "All", "Music", "Leggings", "Demi Lovato", "Clothing", "Cooking shows", "Weekend Update", "Comedies", "Comedy", "Shane Dawson", "Hamburgers", and "Deba". The left sidebar contains navigation options: "Home", "Explore", "Subscriptions", "Library", "History", "Watch later", "Liked videos", "SUBSCRIPTIONS" (with a list of channels: David Evans, UVA CS 3240, and a "Browse channels" button), and "MORE FROM YOUTUBE" (with options: YouTube Premium, Movies & Shows, Gaming, and Live). The main content area features a grid of video thumbnails. The first row includes: "amazon's SECRET OUTFITS" (17:57), "Open Door AD" (12:22), "SNL Weekend Update: New Dick's Sporting Goods Store & Taylor Swi..." (2:18), and "bon appétit" (19:48). The second row includes: "I Bought from Amazon's SECRET Outlet // 8 outfits for \$150!" (182K views • 3 days ago), "Inside Troye Sivan's Victorian-Era Melbourne Home | Open Door [...]" (2.6M views • 4 days ago), "Weekend Update: New Dick's Sporting Goods Store & Taylor Swi..." (1.9M views • 1 week ago), and "Recreating Chrissy Teigen's Stuffed Chicken Breast from Taste [...]" (308K views • 3 weeks ago). The third row includes: "Parents Go Through Their Kid's Phone" (2.2M views • 3 days ago), "DEMI LOVATO: DANCING WITH THE DEVIL S1 • E4 rebirthing : Dancing with the Devil" (5.6M views • 1 week ago), "The Coldest Case Ever Solved" (507K views • 2 weeks ago), and "Weird DM's: Destroying A Cracker Barrel" (1.2M views • 2 months ago). The bottom of the screen shows a Windows taskbar with various application icons and a system clock indicating 11:25 AM on 4/19/2021.



## The YouTube Video Recommendation System

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### ABSTRACT

We discuss the video recommendation system in use at YouTube, the world's most popular online video community. The system recommends personalized sets of videos to users based on their activity on the site. We discuss some of the unique challenges that the system faces and how we address them. In addition, we provide details on the experimentation and evaluation framework used to test and tune new algorithms. We also present some of the findings from these experiments.

### Categories and Subject Descriptors

H.3 [Information Systems]: Information Storage and Retrieval; H.4 [Information Systems]: Information Systems Applications

### General Terms

and every minute, users upload more than 24 hours of video to YouTube.

In this paper, we present our video recommendation system, which delivers personalized sets of videos to signed in users based on their previous activity on the YouTube site (while recommendations are also available in a limited form to signed out users, we focus on signed in users for the remainder of this paper). Recommendations are featured in two primary locations: The YouTube home page (<http://www.youtube.com>) and the "Browse" page at <http://www.youtube.com/videos>. An example of how recommendations are presented on the homepage can be found in Figure 1.

### 1.1 Goals

Users come to YouTube for a wide variety of reasons which span a spectrum from more to less specific: To watch a single video that they found elsewhere (*direct navigation*), to

## 2. SYSTEM DESIGN

The overall design of the recommendation system is guided by the goals and challenges outlined above: We want recommendations to be reasonably recent and fresh, as well as diverse and relevant to the user's recent actions. In addition, it's important that users understand why a video was recommended to them.

The set of recommended videos is generated by using a user's personal activity (watched, favorited, liked videos) as seeds and expanding the set of videos by traversing a co-visitation based graph of videos. The set of videos is then ranked using a variety of signals for relevance and diversity.

From an engineering perspective, we want individual components of the system to be decoupled from each other, allowing them to be understood and debugged in isolation. Given that our system is part of the larger YouTube ecosystem, recommendations also needs to be resilient to failure and degrade gracefully in case of partial failures. As a consequence, we strive to minimize complexity in the overall system.



## 2012: Shift to focus on “Watch Time” over clicks

NEWS & EVENTS

# YouTube Now: Why We Focus on Watch Time

By Eric Meyerson

Head of Content Creator Communications

Aug. 10. 2012



To support this, we've updated what we call video discovery features, meaning how our viewers find videos to watch via search and [suggested videos](#). These changes better surface the videos that viewers actually watch, over those that they click on and then abandon.

Why this shift? Our video discovery features were previously designed to drive views. This rewarded videos that were successful at attracting clicks, rather than the videos that actually kept viewers engaged. (Cleavage thumbnails, anyone?)

## Deep Neural Networks for YouTube Recommendations

Paul Covington, Jay Adams, Emre Sargin  
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### ABSTRACT

YouTube represents one of the largest scale and most sophisticated industrial recommendation systems in existence. In this paper, we describe the system at a high level and focus on the dramatic performance improvements brought by deep learning. The paper is split according to the classic two-stage information retrieval dichotomy: first, we detail a deep candidate generation model and then describe a separate deep ranking model. We also provide practical lessons and insights derived from designing, iterating and maintaining a massive recommendation system with enormous user-facing impact.

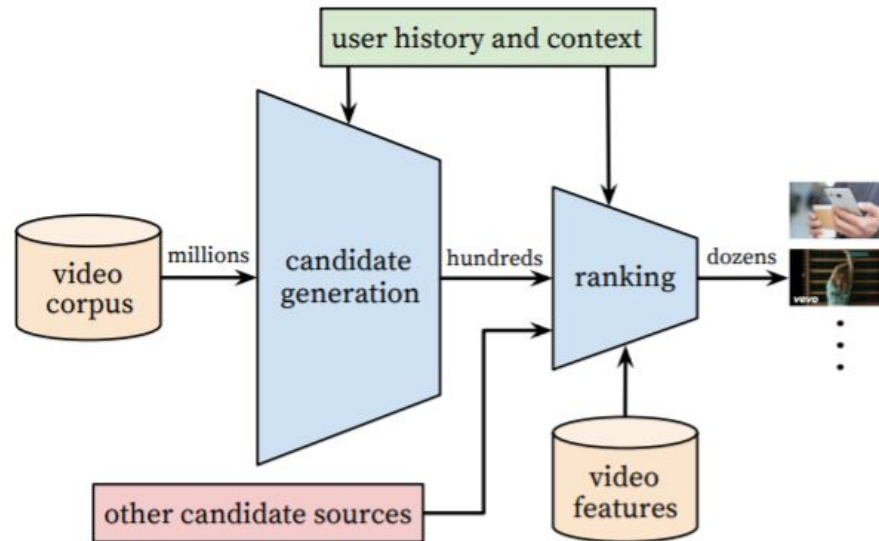
### Keywords

recommender system; deep learning; scalability

### 1. INTRODUCTION

YouTube is the world's largest platform for creating, sharing and discovering video content. YouTube recommendations are responsible for helping more than a billion users discover personalized content from an ever-growing corpus





**Figure 2:** Recommendation system architecture demonstrating the “funnel” where candidate videos are retrieved and ranked before presenting only a few to the user.

### **4.2 Modeling Expected Watch Time**

Our goal is to predict expected watch time given training examples that are either positive (the video impression was clicked) or negative (the impression was not clicked). Positive examples are annotated with the amount of time the user spent watching the video. To predict expected watch time we use the technique of weighted logistic regression, which was developed for this purpose.

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2017: One billion hours watched a day

NEWS & EVENTS

# You know what's cool? A billion hours

By Cristos Goodrow

VP of Engineering At YouTube

Feb.27.2017





2017: One billion hours watched a day

# HOW YOUTUBE PERFECTED THE FEED

*Google Brain gave YouTube new life*

By [Casey Newton](#) | [@CaseyNewton](#) | Aug 30, 2017, 11:11am EDT

*Photography by William Joel*

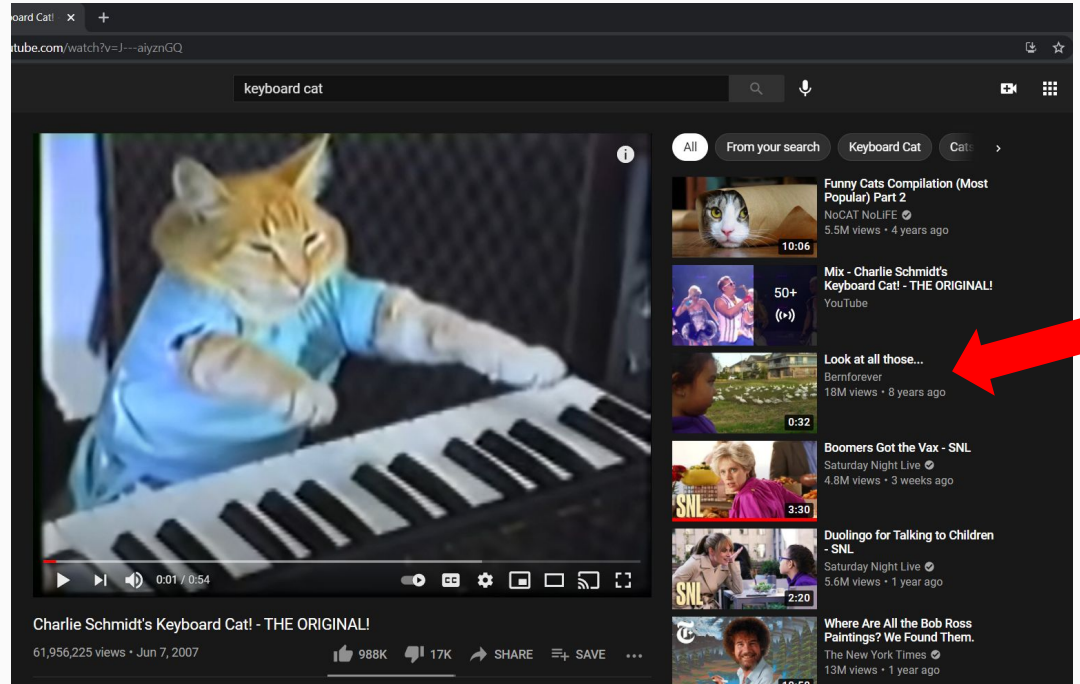
When I visited the company's offices this month, McFadden revealed the source of YouTube's suddenly savvy recommendations: [Google Brain](#), the parent company's artificial intelligence division, which YouTube began using in 2015. Brain wasn't YouTube's first attempt at using AI; the company had applied machine-learning techniques to recommendations before, using a Google-built system known as [Sibyl](#). Brain, however, employs a technique known as unsupervised learning: its algorithms can find relationships between different inputs that software engineers never would have guessed.

**GOOGLE'S BRAIN IS ABLE TO SEE  
PATTERNS THAT ARE LESS  
OBVIOUS**

# Simulation

Simulate a YouTube user going through a “rabbit hole” of recommendations:

- Start with the famous [“keyboard cat”](#) video
- Repeatedly click on the 3rd video in the recommended feed
- Repeat this 8-10 times
- Compare results with your discussion groups



# Media Criticism

- YouTube was widely criticized for surfacing conspiracy theories in their search results after the 2017 Las Vegas Shooting
- Criticism continued after an ex-YouTube engineer came forward to expose the YouTube algorithm for promoting harmful content
- Many small-scale studies and investigations showcased questionable results in the recommended videos

TECH / LAS VEGAS SHOOTING

# Here's How YouTube Is Spreading Conspiracy Theories About The Vegas Shooting

And increasing the chances that users stumble down an algorithm-powered conspiracy video rabbit hole.



**Charlie Warzel**  
BuzzFeed News Reporter

Posted on October 4, 2017, at 6:08 p.m. ET

A YouTube spokesperson provided BuzzFeed News with a statement touting its dedicated news page, which users would have to navigate to instead of simply searching for something like "Vegas shooting."

# 'Fiction is outperforming reality': how YouTube's algorithm distorts truth

An ex-YouTube insider reveals how its recommendation algorithm promotes divisive clips and conspiracy videos. Did they harm Hillary Clinton's bid for the presidency?

● [The methodology behind this story](#)

by [Paul Lewis](#) in San Francisco

Guillaume Chaslot, an ex-Google software engineer. Photograph: Talia Herman/The Guardian

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Fri 2 Feb 2018 07:00 EST

TECH

# How YouTube Drives People to the Internet's Darkest Corners

Google's video site often recommends divisive or misleading material, despite recent changes designed to fix the problem

*By Jack Nicas*

Updated Feb. 7, 2018 1:04 p.m. ET

YouTube is the new television, with more than 1.5 billion users, and videos the site recommends have the power to influence viewpoints around the world.

Those recommendations often present divisive, misleading or false content despite changes the site has recently made to highlight more-neutral fare, a Wall Street Journal investigation found.



# YouTube, the Great Radicalizer



By Zeynep Tufekci

March 10, 2018

At one point during the 2016 presidential election campaign, I watched a bunch of videos of Donald Trump rallies on YouTube. I was writing an article about his appeal to his voter base and wanted to confirm a few quotations.

Soon I noticed something peculiar. YouTube started to recommend and “autoplay” videos for me that featured white supremacist rants, Holocaust denials and other disturbing content.

TECH / TECH + NEWS WORKING GROUP

## We Followed YouTube's Recommendation Algorithm Down The Rabbit Hole

Despite year-old promises to fix its "Up Next" content recommendation system, YouTube is still suggesting conspiracy videos, hyperpartisan and misogynist videos, pirated videos, and content from hate groups following common news-related searches.



**Caroline O'Donovan**  
BuzzFeed News Reporter



**Charlie Warzel**  
BuzzFeed Staff



**Logan McDonald**  
BuzzFeed Staff



**Brian Clifton**  
BuzzFeed Staff



**Max Woolf**  
BuzzFeed Staff

Posted on January 24, 2019, at 3:22 p.m. ET

But as demonstrated by BuzzFeed News' more than 140 journeys through YouTube's recommendation system, the outcome of that decision-making process can be difficult to reverse engineer. In the end, what's clear is that YouTube's recommendation algorithm isn't a partisan monster — it's an engagement monster. It's why its

NEWS & EVENTS

## Continuing our work to improve recommendations on YouTube

By The YouTube Team

Jan. 25, 2019



We'll continue that work this year, including taking a closer look at how we can reduce the spread of content that comes close to—but doesn't quite cross the line of—violating our [Community Guidelines](#). To that end, we'll begin reducing recommendations of borderline content and content that could misinform users in harmful ways—such as videos promoting a phony miracle cure for a serious illness, claiming the earth is flat, or making blatantly false claims about historic events like 9/11.

YouTube addresses issues with recommendations on their official blog for the **first time** in 2019

# YouTube Reponse

INSIDE YOUTUBE

## **The Four Rs of Responsibility, Part 2: Raising authoritative content and reducing borderline content and harmful misinformation**

By The YouTube Team

Dec. 03. 2019



So how does this actually work? Determining what is harmful misinformation or borderline is tricky, especially for the wide variety of videos that are on YouTube. We rely on external evaluators located around the world to provide critical input on the quality of a video. And these evaluators use [public guidelines](#) to guide their work. Each evaluated video receives up to 9 different opinions and some critical areas require certified experts. For example, medical doctors provide guidance on the validity of videos about specific medical treatments to limit the spread of medical misinformation. Based on the consensus input from the evaluators, we use well-tested machine learning systems to build models. These models help review hundreds of thousands of hours of videos every day in order to find and limit the spread of borderline content. And over time, the accuracy of these systems will continue to improve.

YouTube finally gives specific details on their strategy for mitigating “harmful misinformation”

# Academic research supporting “YouTube Radicalization”

Auditing Radicalization Pathways on YouTube

(Dec 2019)

A longitudinal analysis of YouTube’s promotion of conspiracy videos

(Mar 2020)

Do Search Algorithms Endanger Democracy? An Experimental Investigation of Algorithm Effects on Political Polarization

(Apr 2020)

# Academic research not supporting “YouTube Radicalization”

A Supply and Demand Framework for YouTube Politics

(Oct 2019)

Algorithmic Extremism: Examining YouTube's Rabbit Hole of Radicalization

(Dec 2019)

Evaluating the scale, growth, and origins of right-wing echo chambers on YouTube

(Nov 2020)



# Breakout Rooms

- Meet with your discussion groups for 10-15 minutes
- Choose one person to screen-share
- Review one research paper in support of “YouTube Radicalization”
- Review one research paper not in support of “YouTube Radicalization”

# Breakout Rooms - Discussion Questions

- Which research paper did your group find more compelling?
- What were some differences in the approaches used by researchers attempting to quantify this issue?
- What is one reason why there is so much disagreement over this topic?
- How could YouTube help to support independent research and improve the transparency of their algorithm?

# Friday Readings

Facebook: [Preparing for Elections](#)

Twitter: [Additional steps we're taking ahead of the 2020 US Election](#)

YouTube: [Supporting the 2020 U.S. election](#)

***Post-Discussion Forum: Week 7***