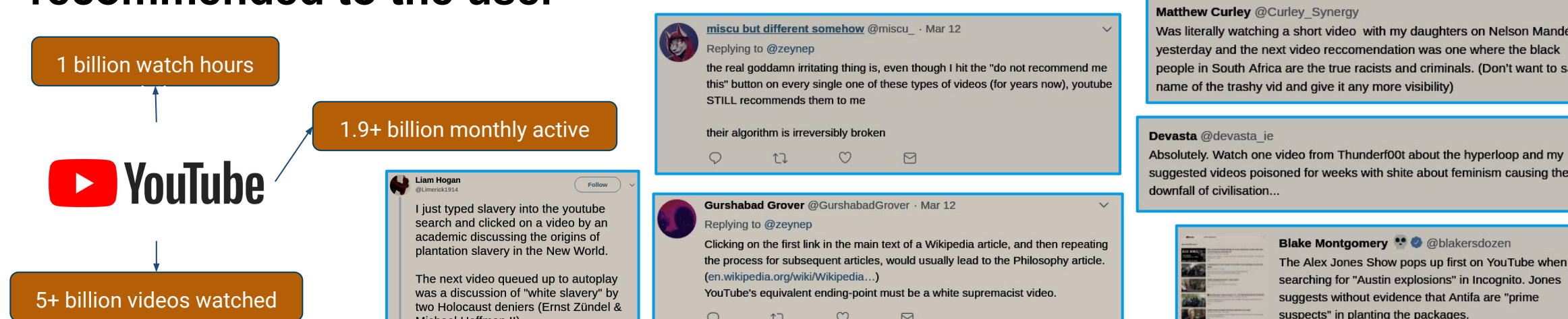


INTRODUCTION

YouTube recommendation system has received recently much criticism of recommending misinformation (conspiracies, fake news, hoaxes) or disturbing (hateful, racist) videos to its users. Users claimed that even watching a normal video would lead YouTube to recommend a misinformation video. In this project we aim to:

- Audit the recommendation algorithm of YouTube
- Identify the features that would generate and amplify the misinformation recommended to the user



METHODS

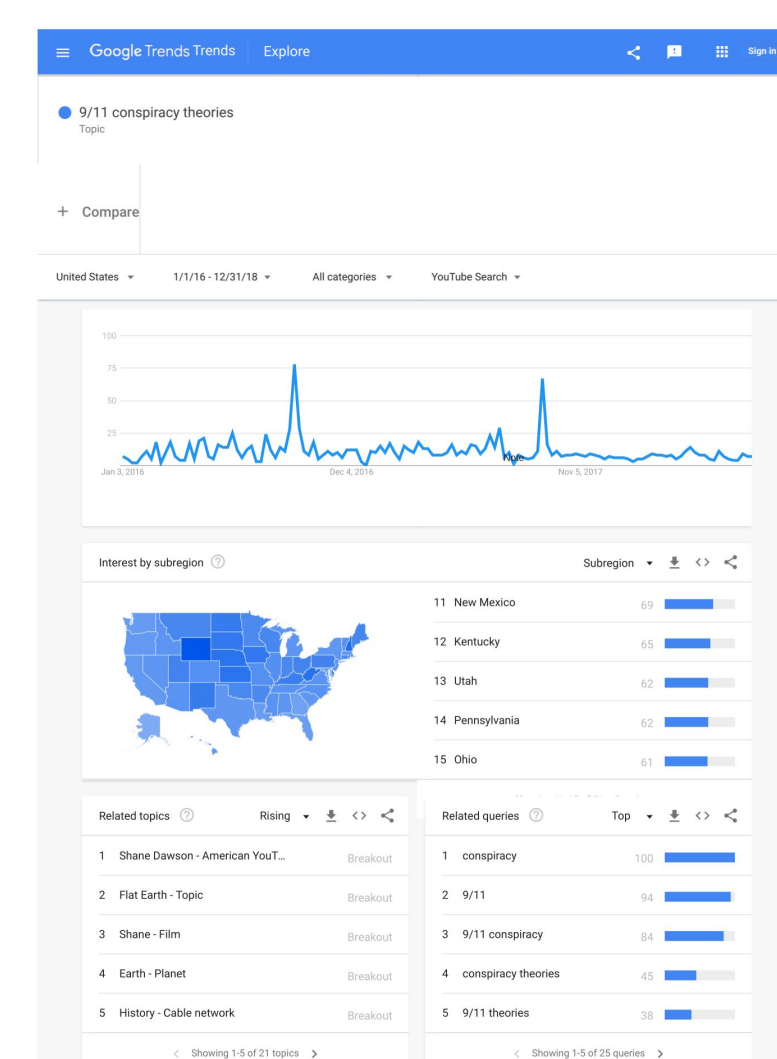
Google Trends

Use Analysis from Google Trends to select for each misinformation topic:

- Top related search queries
- Ranked list of *interest-by-region*

Where each topic analysis done:

- In the United states
- Between January 1, 2016 and December 31, 2018
- Selected search service was YouTube



Topics

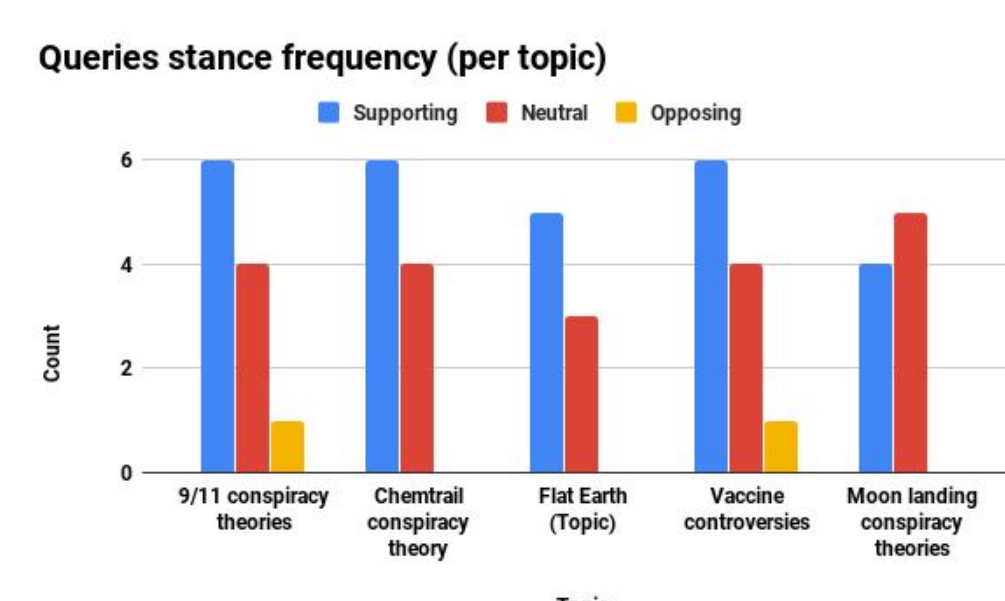
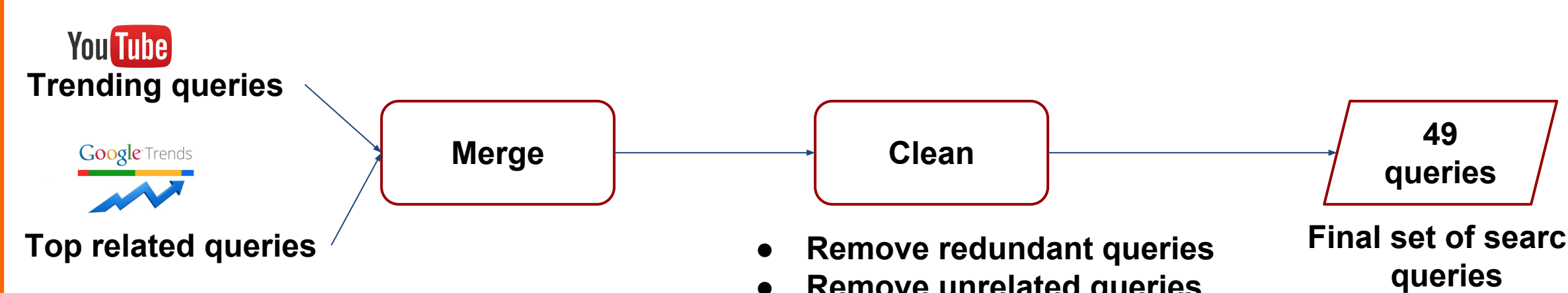
5 of the hottest and most controversial and popular misinformation topics were selected to study

- 9/11 conspiracy theories
- Chemtrail conspiracy theories
- Flat Earth
- Moon landing conspiracy theories
- Vaccines controversies

Search Queries

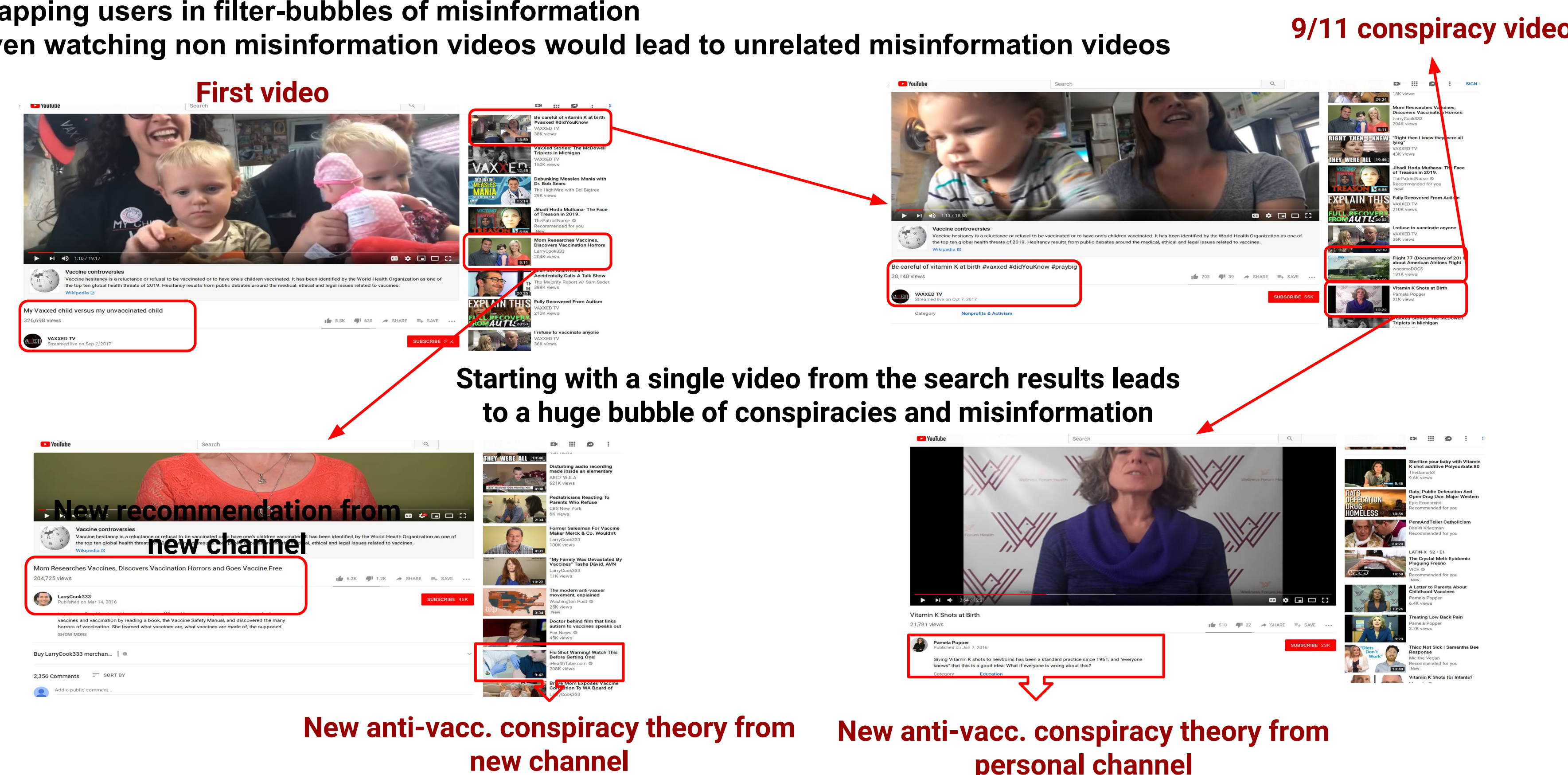
For each topic select most related search queries that both:

- Trending: Use YouTube suggestions
- Most searched: Use top related queries of Google Trends



YOUTUBE RECOMMENDATION PROBLEMS

- Misinformation amplified by Up-Next and Recommended-for-You lists
- One misinformation topic could lead to another
- Trapping users in filter-bubbles of misinformation
- Even watching non misinformation videos would lead to unrelated misinformation videos

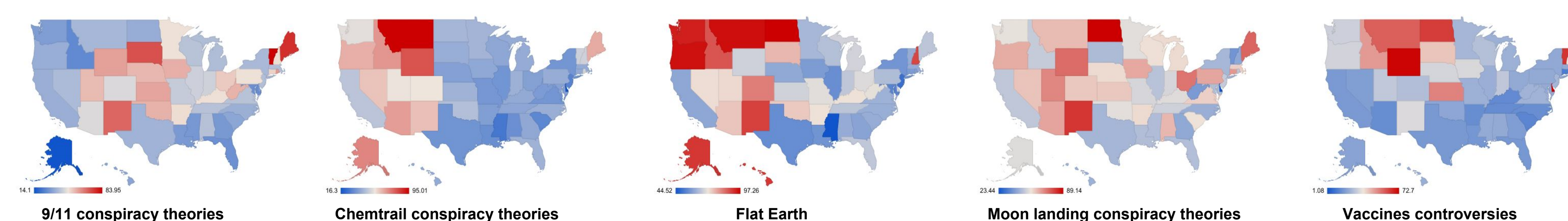


EXPERIMENT 1: USER DEMOGRAPHICS

- Objective: study which of the demographic settings of a Google account would affect the amount of misinformation recommended to the user of YouTube
- Hypothesis: YouTube recommends misinformation differently based on user age and gender
- Study two main demographic settings
 - Age: four age groups (< 18), (between 18 and 34), (between 35 and 50), (≥ 51)
 - Gender
- Enumerating values of age and gender leads to creating 8 unique Google accounts
- For each Google account search simultaneously the 49 search queries covering all 5 topics
- For each search query store the top 20 results (videos) recommended by YouTube
- Results: 647 unique videos

Feature	Tested values
Age (years)	15, 24, 43, 65
Gender	Male, Female

EXPERIMENT 2: GEOLOCATION



- Objective: study the effect of the geo-location of the user over YouTube misinformation recommendations
- For each topic curate list of geo-locations from Google-Trends *interest-by-region*
- Create list of **hot** and **cold** regions for each topic
- Search a topic from one **hot** and one **cold** regions

Topic	Hot	Cold
9/11 conspiracy theories	Ohio	Maryland
Chemtrail conspiracy theories	Montana	New Jersey
Flat Earth	Montana	New Jersey
Moon landing conspiracy theories	Ohio	Georgia
Vaccines controversies	Montana	South Carolina

VIDEO ANNOTATION

Both experiments resulted in:

- 840+ unique videos
- 530+ unique channels

Objective: Annotate videos regarding their standing to the misinformation topic under study

Stance classes:

- Opposing MT:** Video opposing, debunking, or mocking the misinformation topic
- Neutral-MT:** Video neutral to the misinformation topic
- Supporting-MT:** Video supporting, explaining the misinformation topic
- Opposing-OMT:** Video opposing, debunking, or mocking another misinformation topic
- Neutral-OMT:** Video neutral to another misinformation topic
- Supporting-OMT:** Video supporting, explaining another misinformation topic
- Not-Misinformation:** Video is not displaying any misinformation
- Not-English:** Video not in English
- Unsure:** Video is manipulative and deceptive (Hard to tell if supporting or opposing the misinformation theory)

Source/Channel Type classes:

- Mainstream news**
- Non-mainstream news**
- Organization**
- Individual**
- Youtuber**

Video type classes:

- News**
- Interview**
- Scientific**
- Opinion**
- Documentary**

Annotation Examples

URL	https://www.youtube.com/watch?v=O9y_AVYMEUs
Topic	Flat earth
Stance	Oppose-MT
Type	Scientific
Source	Organization (NVIDIA)

URL	https://www.youtube.com/watch?v=sWhavDJIVyw
Topic	9/11 conspiracy theories
Stance	Support-MT
Type	News
Source	Non-Mainstream/Russia Today

ANALYSIS

