# Algorithmic auditing of political biases in recommender systems

**Kempelen Institute of Intelligent Technologies**

Ivan Srba

AI Mellontology e-Symposium
on Computational Politics
March 1, 2023

[Motivation]

# AI algorithms in social media online platforms

Social media
AI algorithm
(e.g., YouTube recommender)

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- A need for external independent oversight

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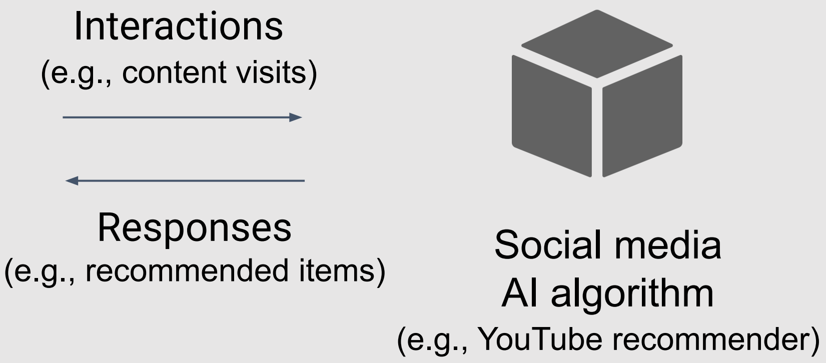
External algorithmic audits



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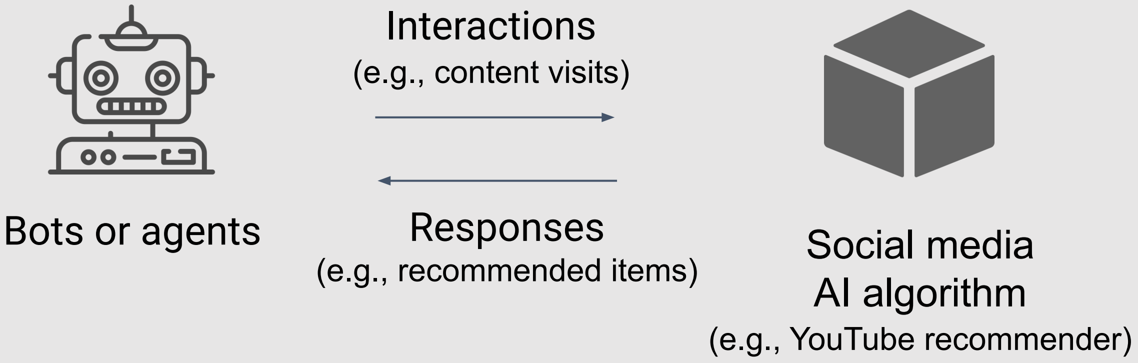

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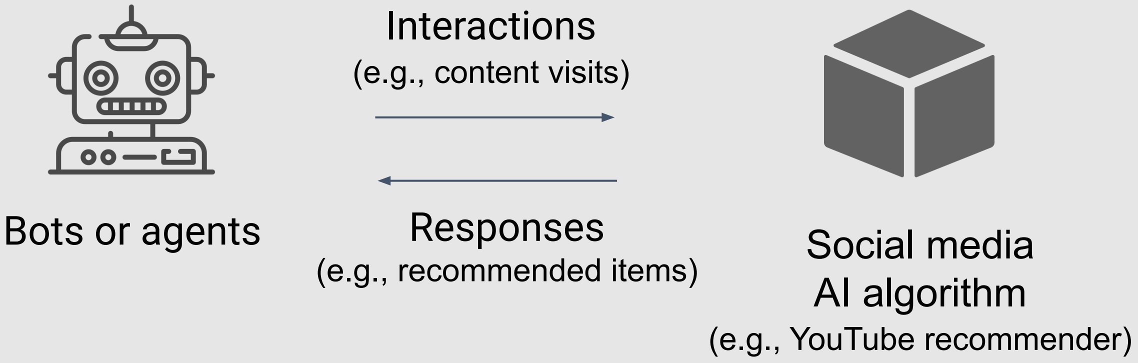
# AI algorithms in social media online platforms

- A need for external independent oversight

External algorithmic audits

- Recognized not only in research works, but also in EU legislation – Digital Service Act (DSA), Article 28



Bots or agents

Interactions
(e.g., content visits)

Responses
(e.g., recommended items)

Social media
AI algorithm
(e.g., YouTube recommender)

[Concept description]

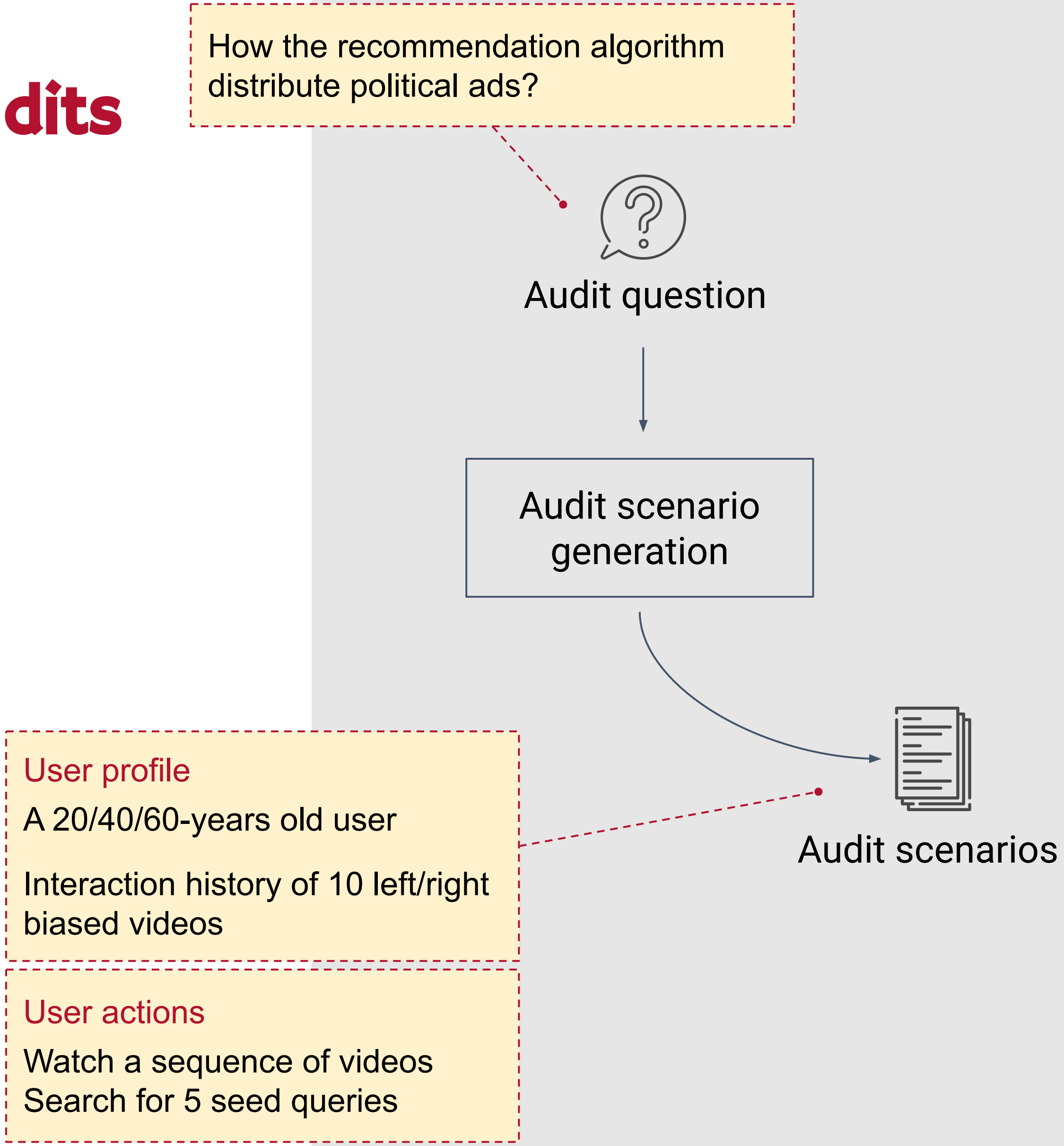
# External algorithmic audits

How the recommendation algorithm distribute political ads?

Audit question

[Concept description]

# External algorithmic audits



How the recommendation algorithm distribute political ads?

User profile

A 20/40/60-years old user

Interaction history of 10 left/right biased videos

User actions

Watch a sequence of videos
Search for 5 seed queries

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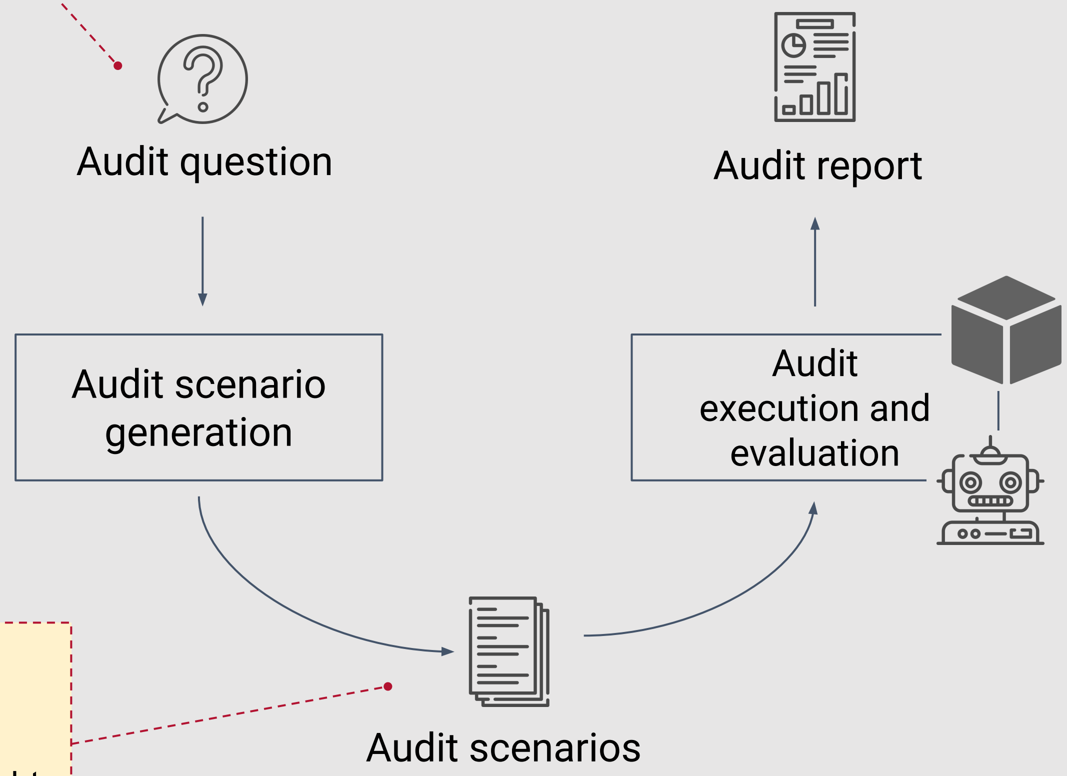

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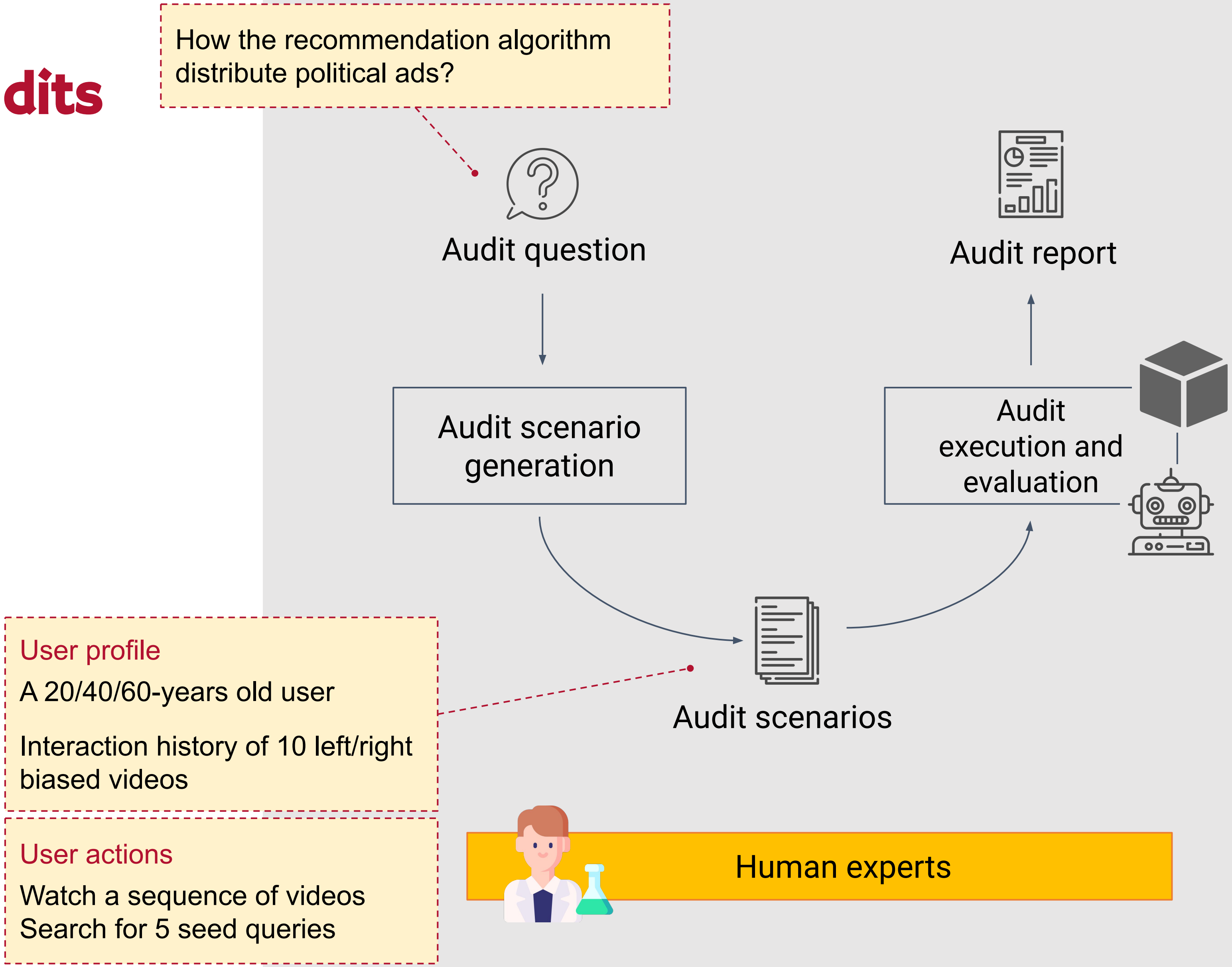

How the recommendation algorithm distribute political ads?

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Audit scenario generation

Audit scenarios

Audit execution and evaluation

Audit report

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Human experts

# Typical use cases for algorithmic audits

**Phenomenon**

Filter bubbles creation

Disinformation spreading

Biases

…

# Typical use cases for algorithmic audits

| **Phenomenon** | **Algorithm type** |
|---|---|
| Filter bubbles creation | Search engines |
| Disinformation spreading | Recommender systems |
| Biases | Ads systems |
| … | … |

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**Platform**

YouTube

Facebook

Google

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YouTube

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# Existing algorithmic audits on political biases

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## Magnitude and direction of personalization

**How does the pro/into-imigration user history influence politically oriented Google News searches?**

2 users, 50 search terms

Google News

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Le et al., Measuring political personalization of Google news search, 2019

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## Biases in political topics

**How does the popularity, topic and emotional content of recommended videos change between recommendations?**

1,650 videos in 150 random walks

YouTube

—

Heueret et al., Auditing the Biases Enacted by YouTube for Political Topics in Germany, 2021

# Existing algorithmic audits on political biases

## Distribution of Political Advertising

**How platforms amplified and moderated the distribution of political advertisements?**

800,000 ads and 2.5 million videos about the 2020 U.S. presidential election

Facebook, Google, and TikTok

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Papakyriakopoulos et al., How Algorithms Shape the Distribution of Political Advertising: Case Studies of Facebook, Google, and TikTok, 2022

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## Ideological/political bias

**Are recommendations aligned with users' ideology?**
**Are users recommended an increasing number of videos aligned with their ideolog?**
**Are the recommendations progressively more extreme?**

100,000 sock puppets, watching a total of 9,930,110 videos from 111,715 channels

YouTube

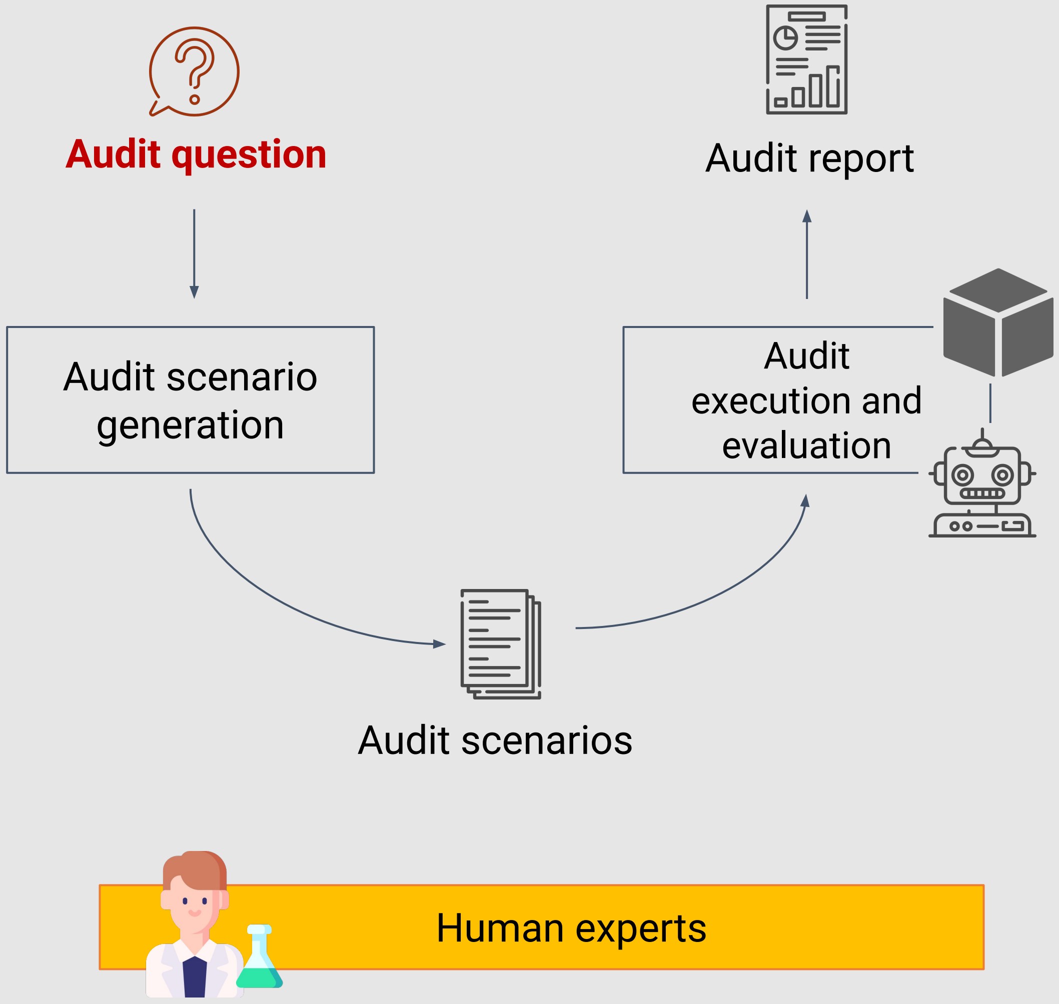
—

Haroon et al., YouTube, The Great Radicalizer? Auditing and Mitigating Ideological Biases in YouTube Recommendations, 2022

# Audit of misinformation filter bubbles on YouTube

[Audit of misinformation on YouTube]

# Audit question



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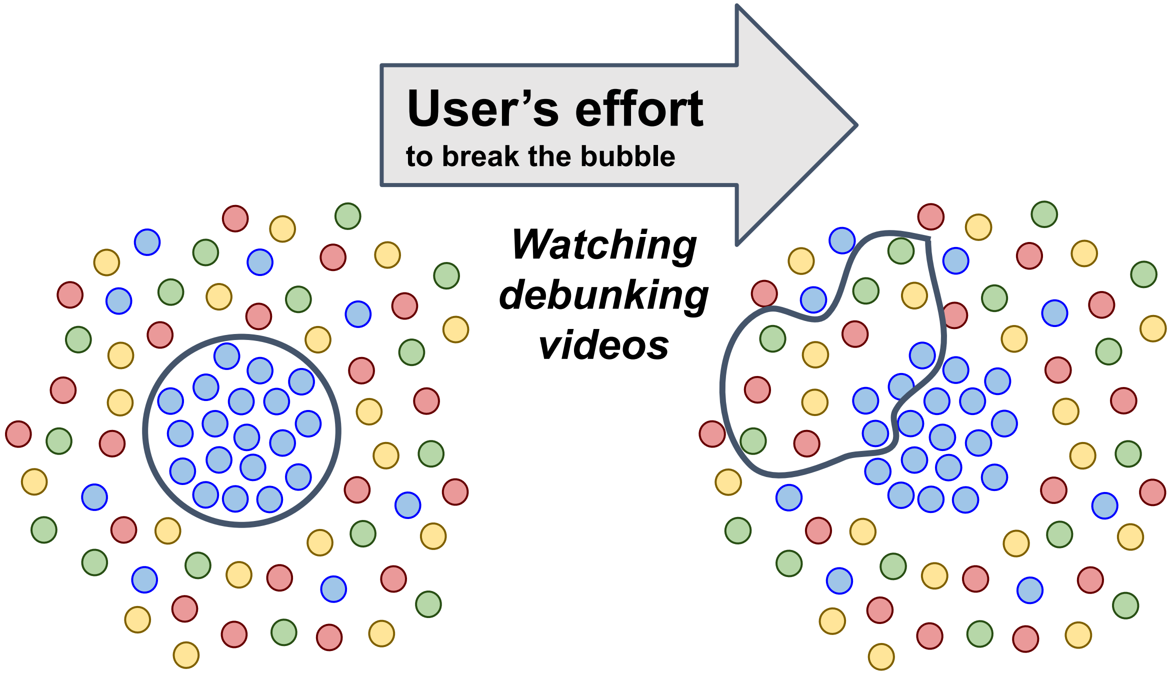

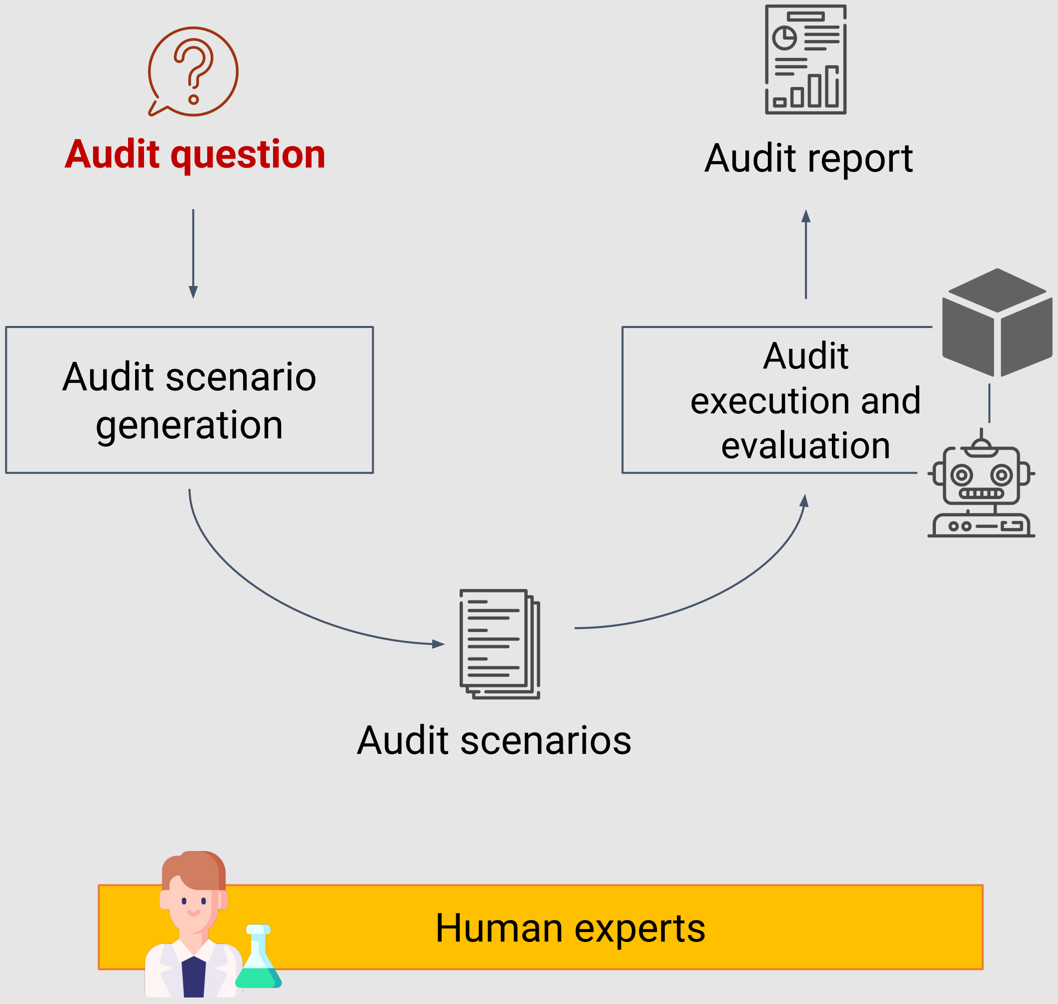

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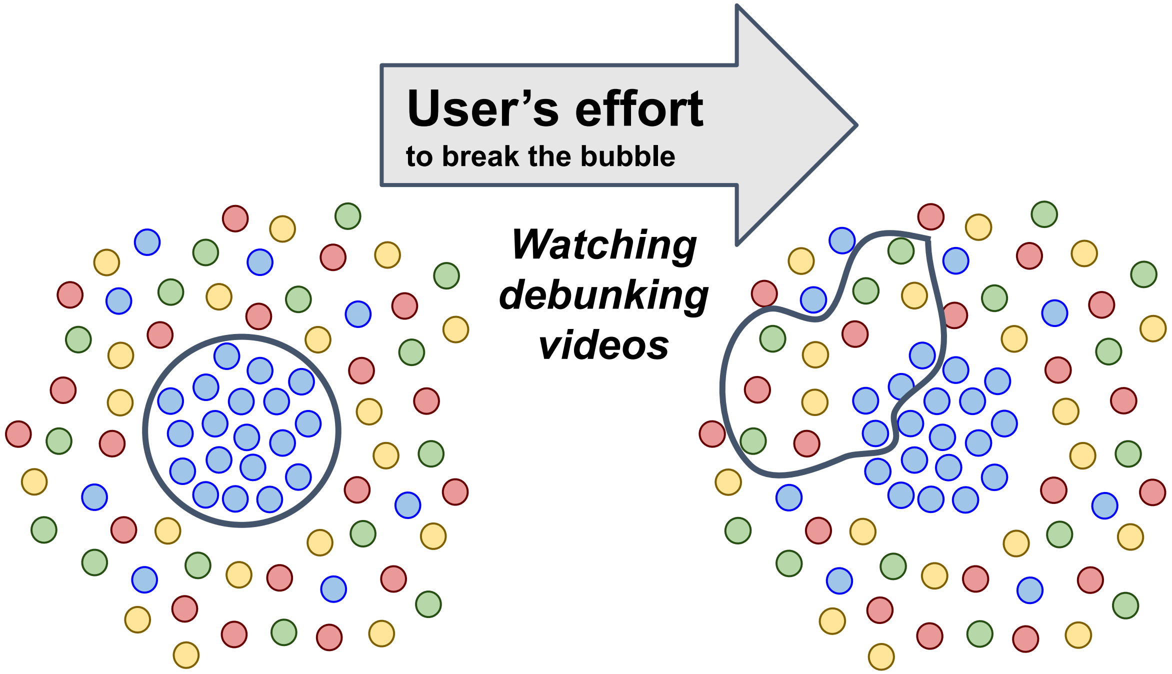
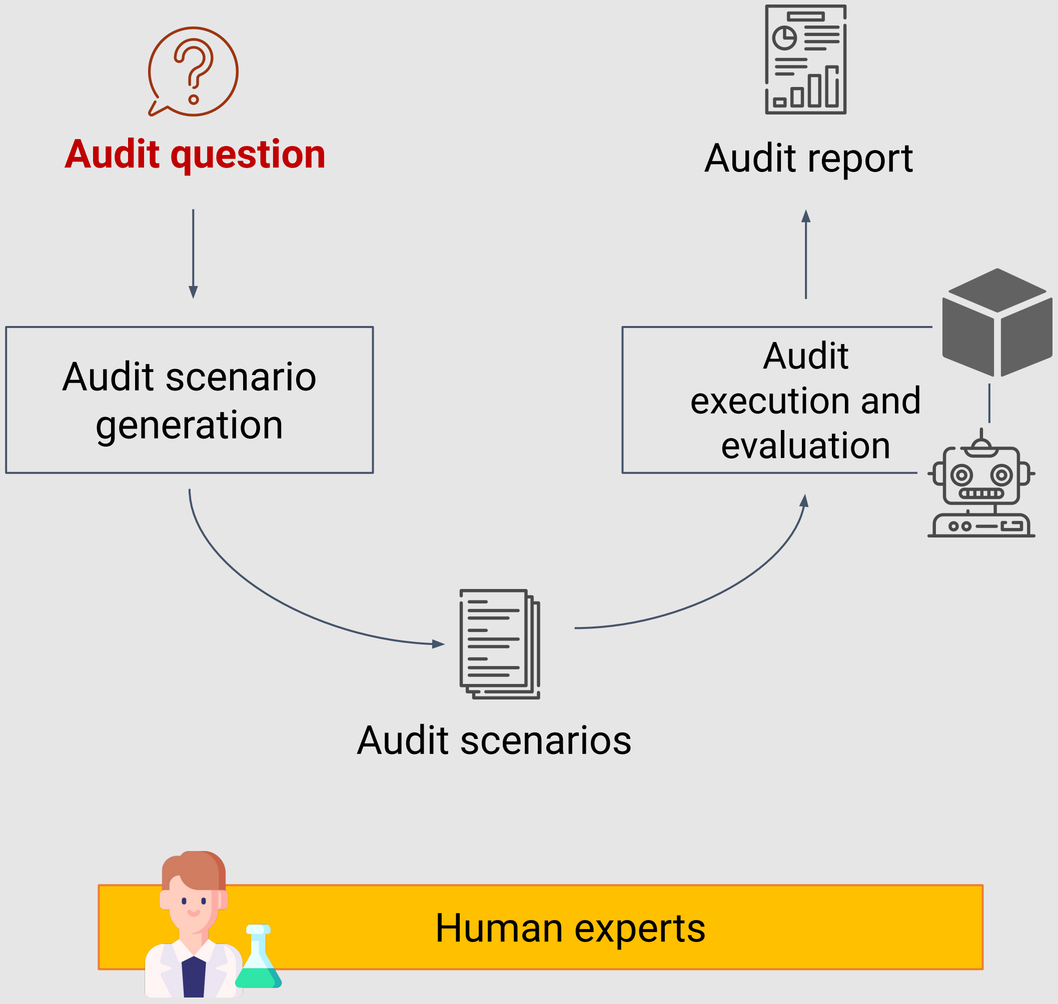


**Additional RQ**

Did the situation improve compared to the reference study (Hussein, 2020) done 1.5 years before?

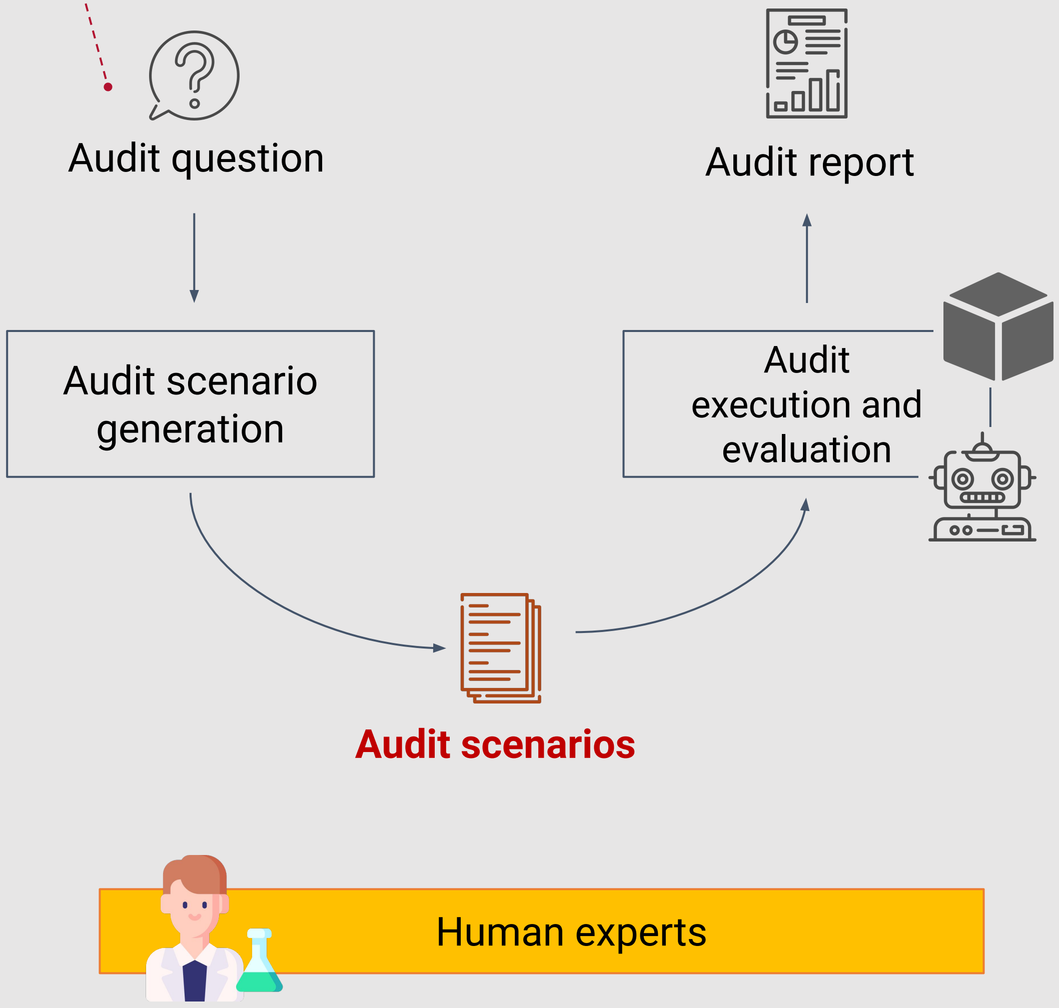


## [Audit of misinformation on YouTube]

# Audit scenarios

- **Bot initialization**
  - Setup browser with AdBlock, login to YouTube, accept cookies

Can a user get out of misinformation filter bubble and how much effort is needed?



# Audit scenarios

- **Bot initialization**
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- **Create misinformation bubble**
  - Watch 40 randomly sorted promoting videos
  - For each video: Save recommendations, Visit homepage and save results, Execute 5 queries and save results (20 min sleep between)

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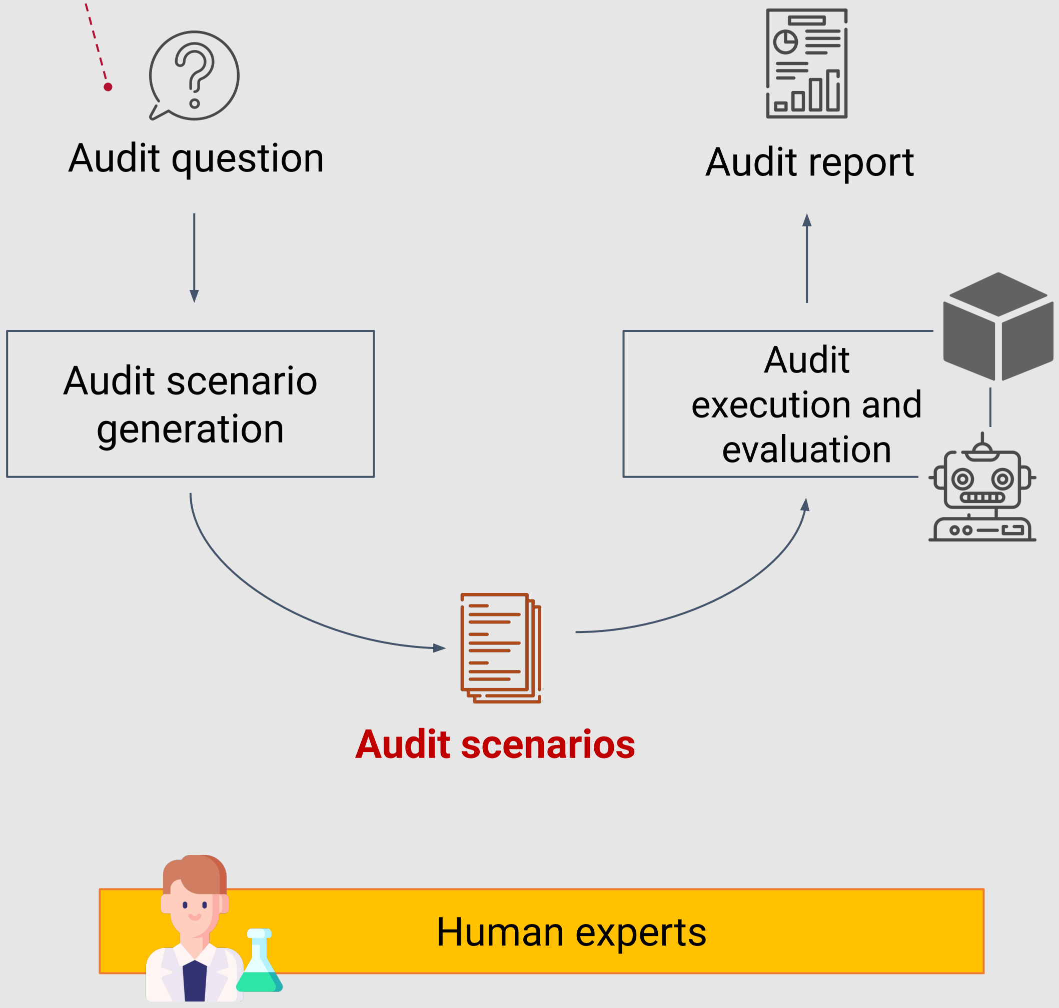

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  - Same as the previous step, with debunking videos

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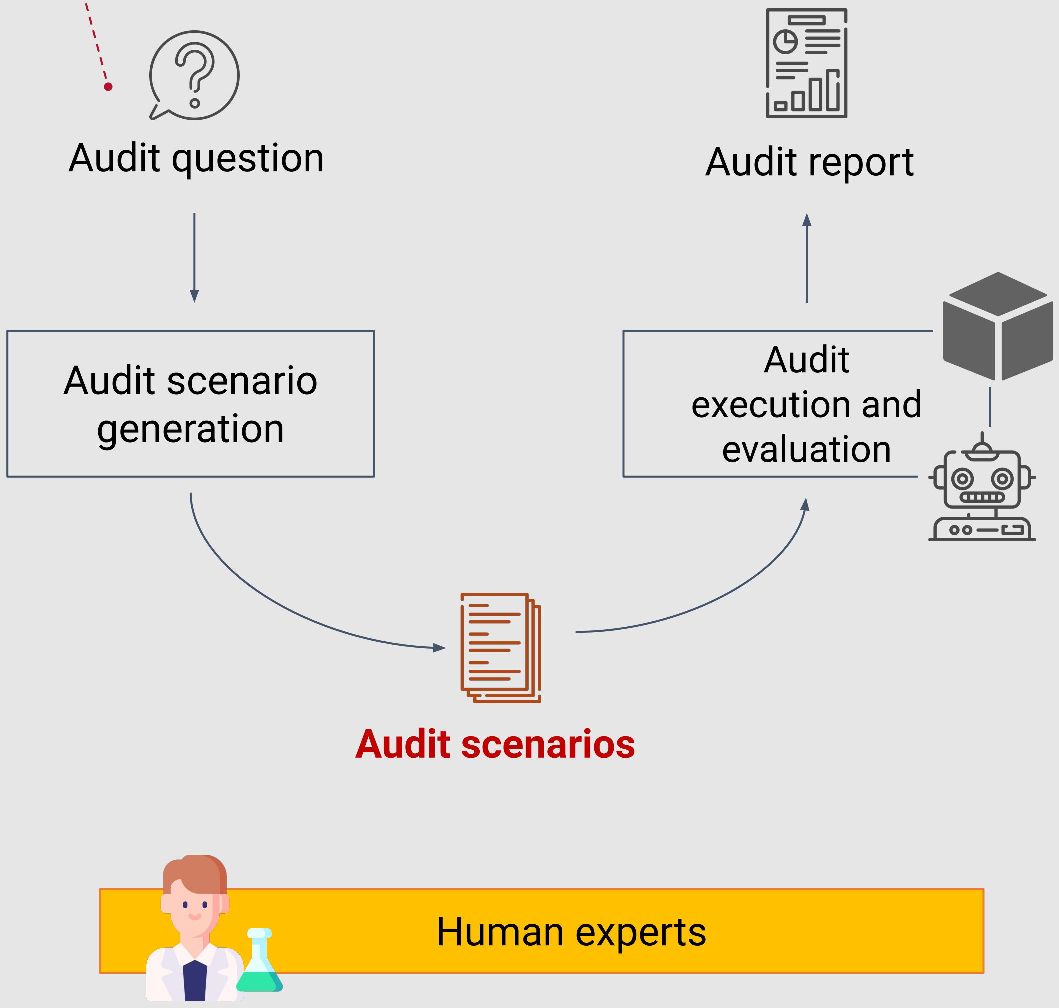

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- **Clean-up**

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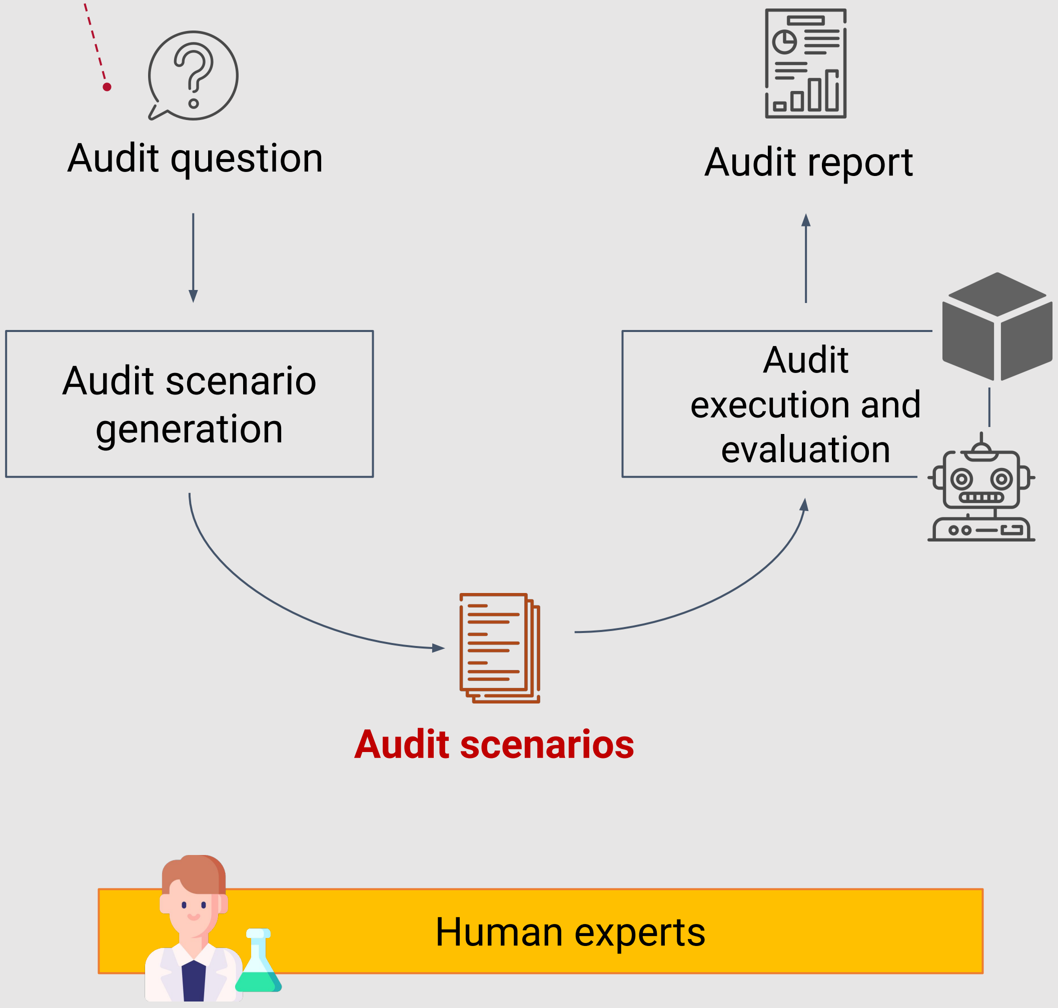
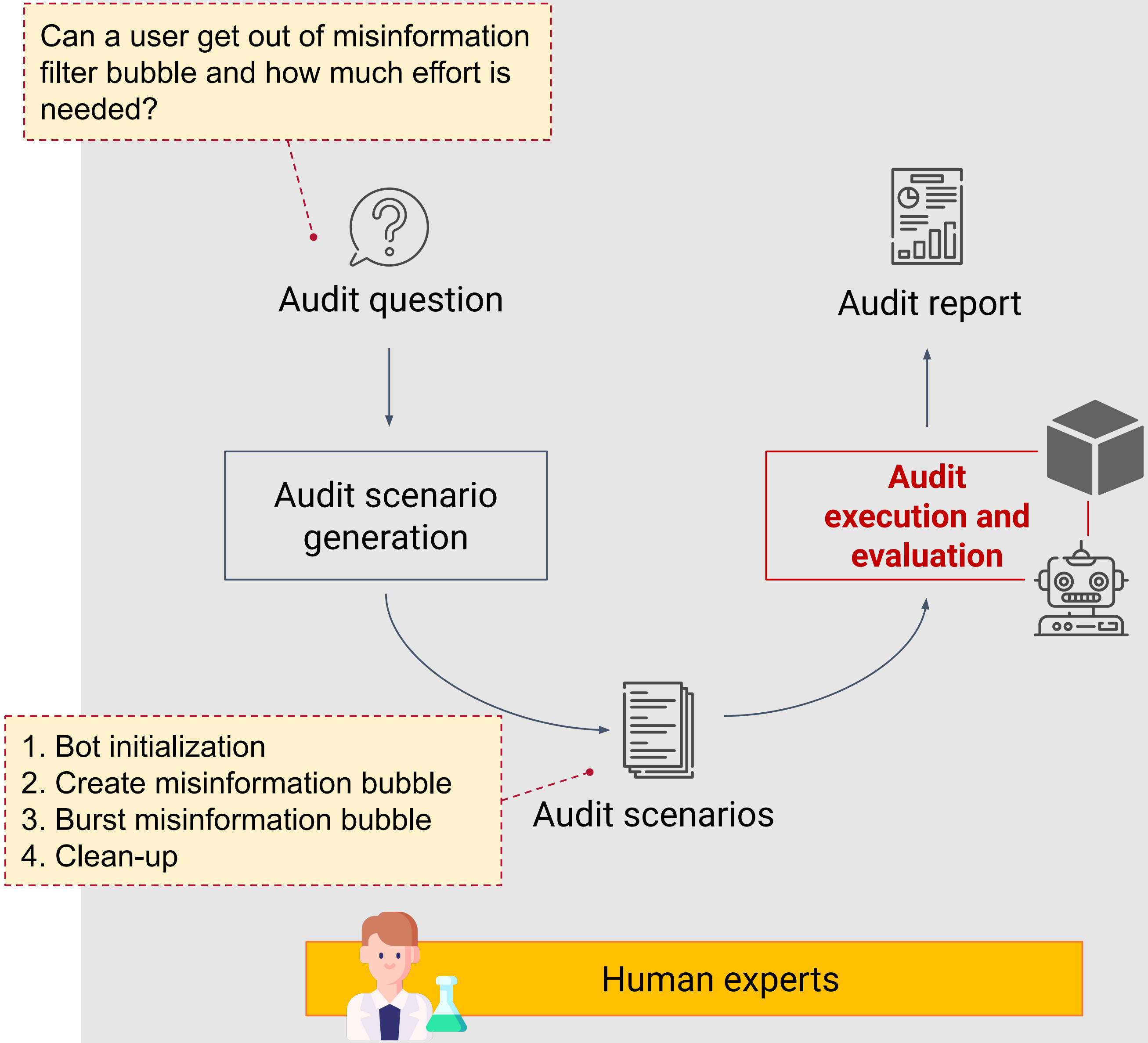


[Audit of misinformation on YouTube]

# Audit execution and evaluation

- Selected misinformation topics
  - 9/11
  - Chemtrails
  - Flat earth
  - Moon landing
  - Anti-vaccination



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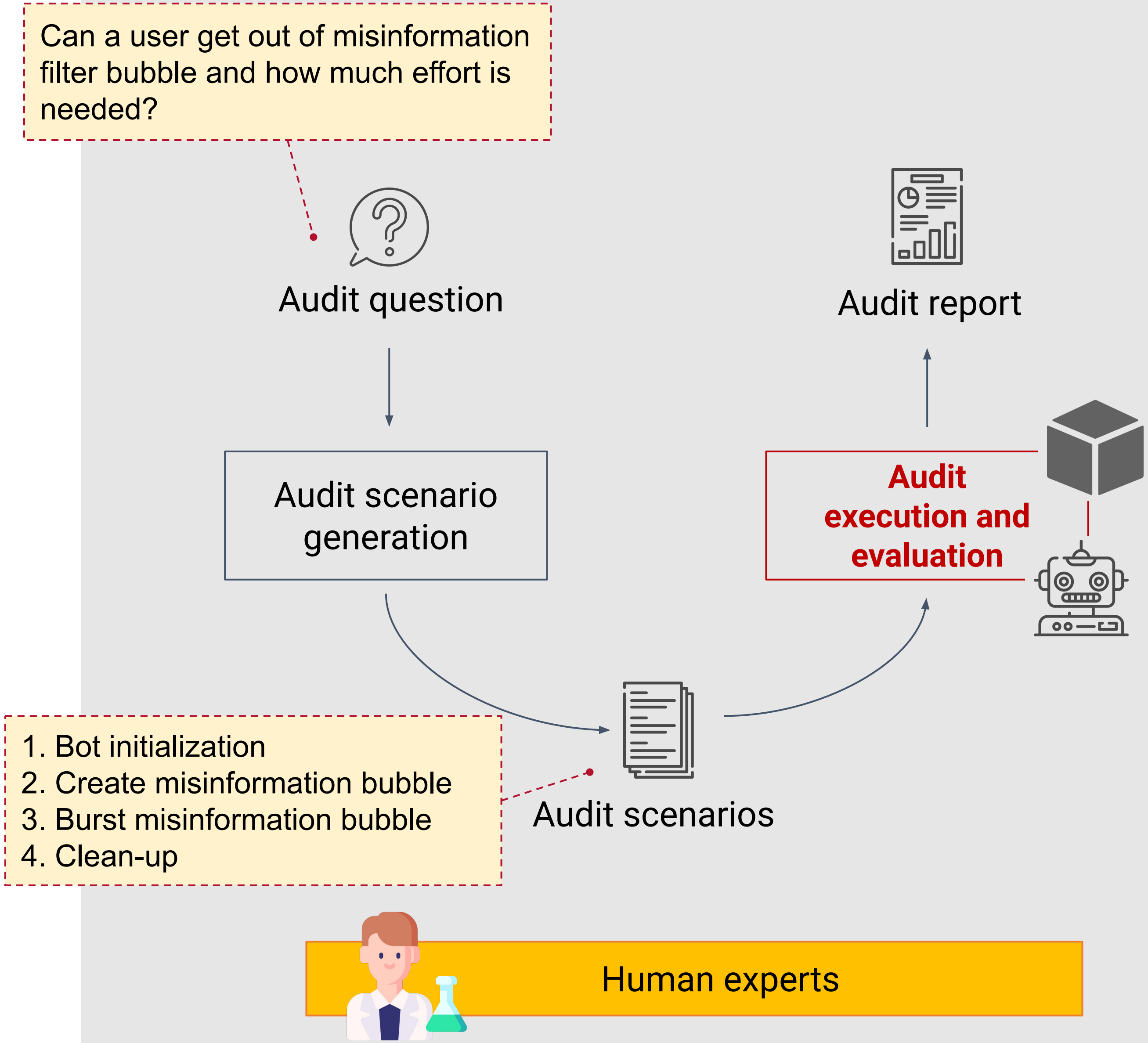
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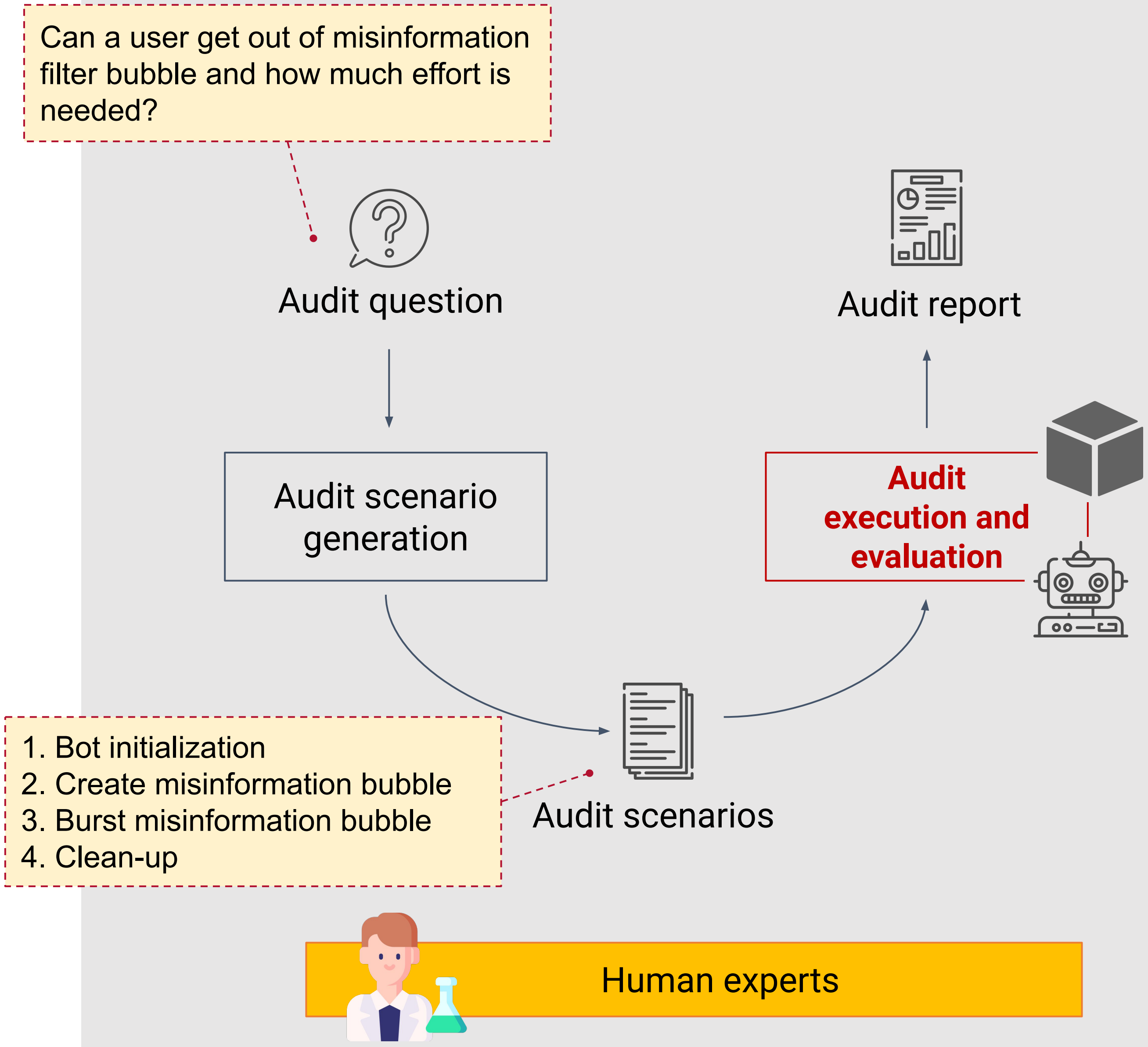

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Audit report

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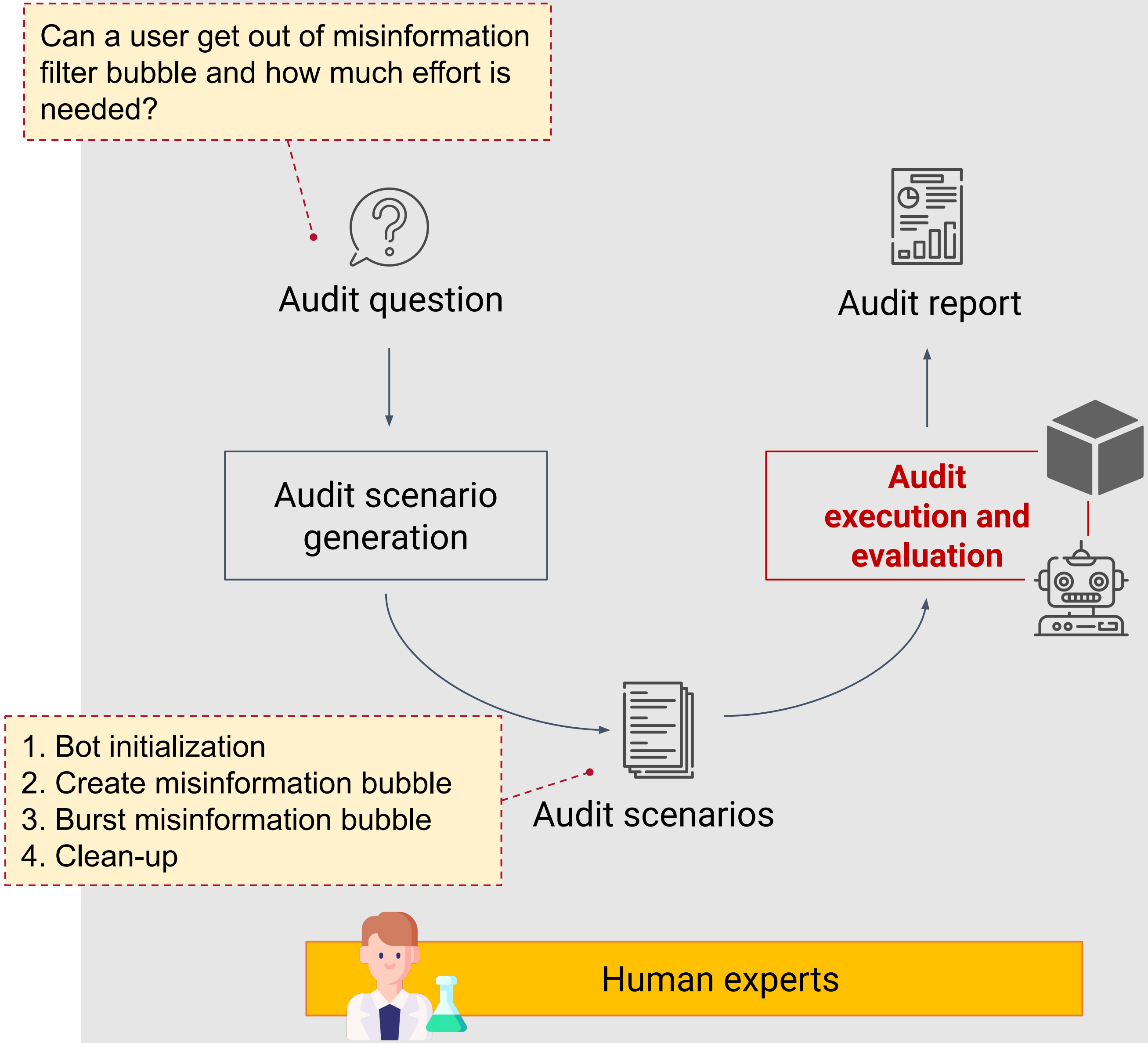
- Manual annotation of almost 3000 videos encountered in recommendation system took hundreds of person-hours
- ML classification model was trained to annotate the videos from homepage



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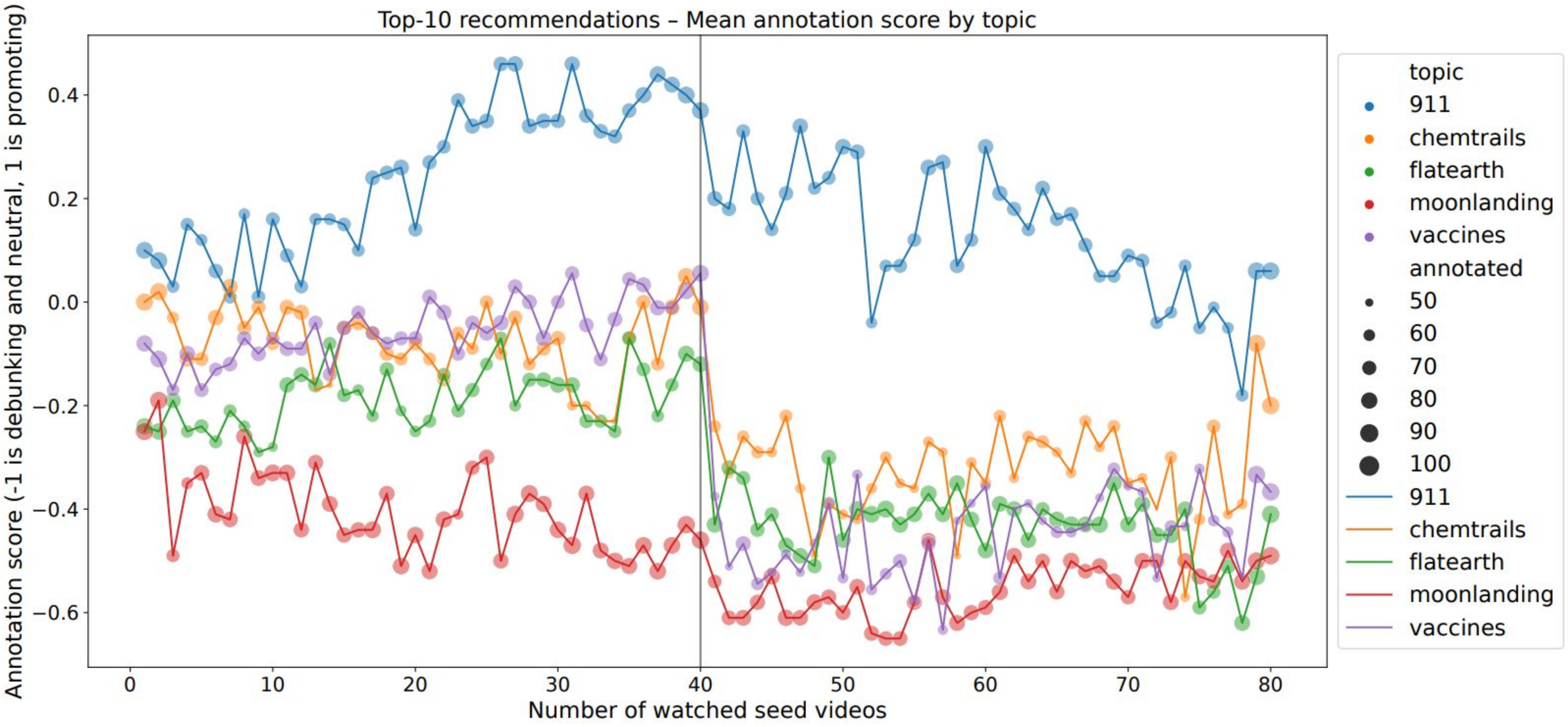
# Disinformation filter bubbles form in recommendations, but not in search results

No significant overall change in behaviour detected in comparison with the reference study from ~1.5 years before


Top-10 recommendations – Mean annotation score by topic
Annotation score (-1 is debunking and neutral, 1 is promoting)
0.4
0.2
0.0
−0.2
−0.4
−0.6
0
10
20
30
40
50
60
70
80
Number of watched seed videos
topic
911
chemtrails
flatearth
moonlanding
vaccines
annotated
50
60
70
80
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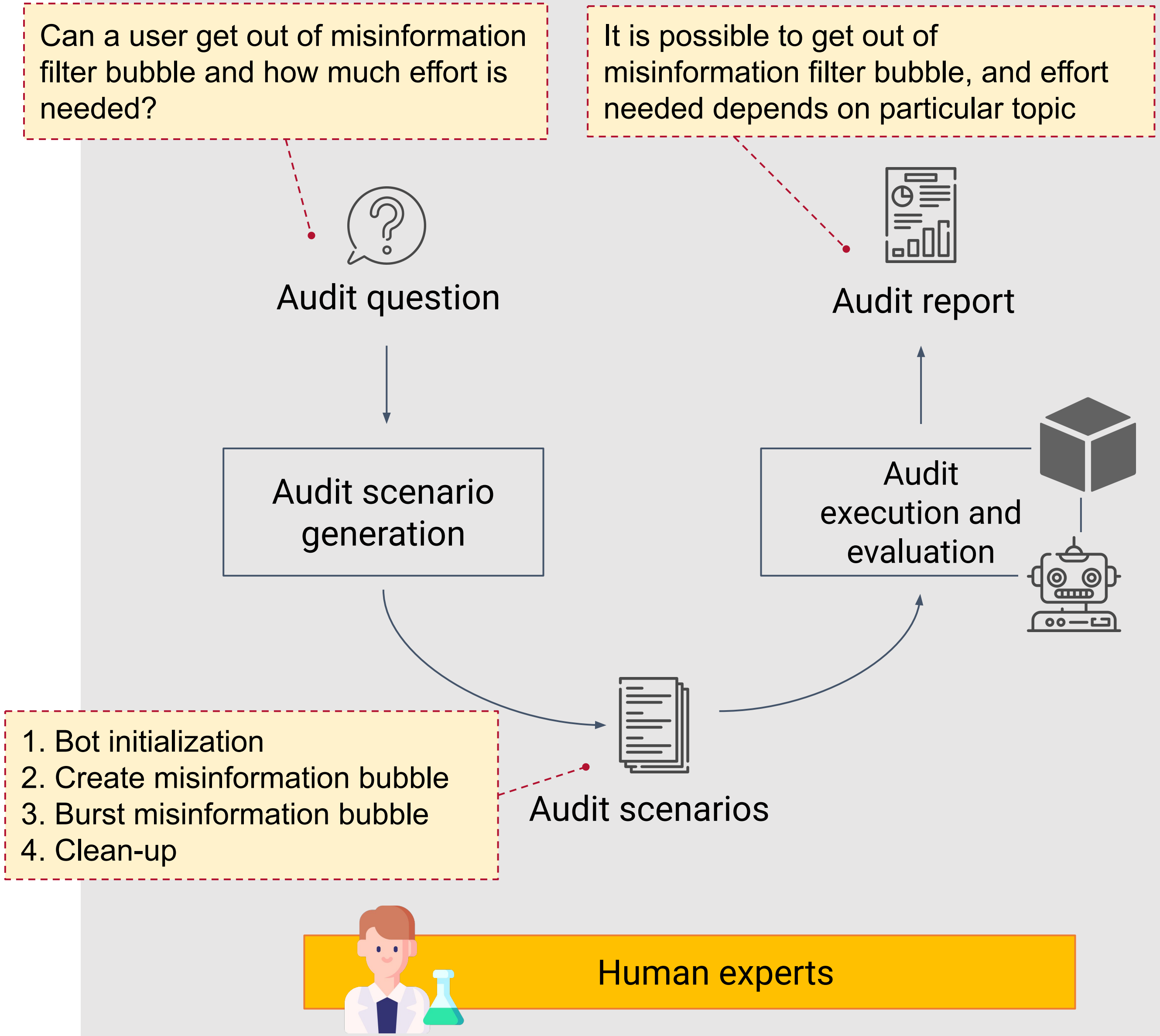
## Watching debunking videos reduces misinformation filter bubble effect (required effort varies by topic)

## [Audit of misinformation on YouTube]

# Contributions

- Simulation of more complex user behaviour



Can a user get out of misinformation filter bubble and how much effort is needed?

It is possible to get out of misinformation filter bubble, and effort needed depends on particular topic

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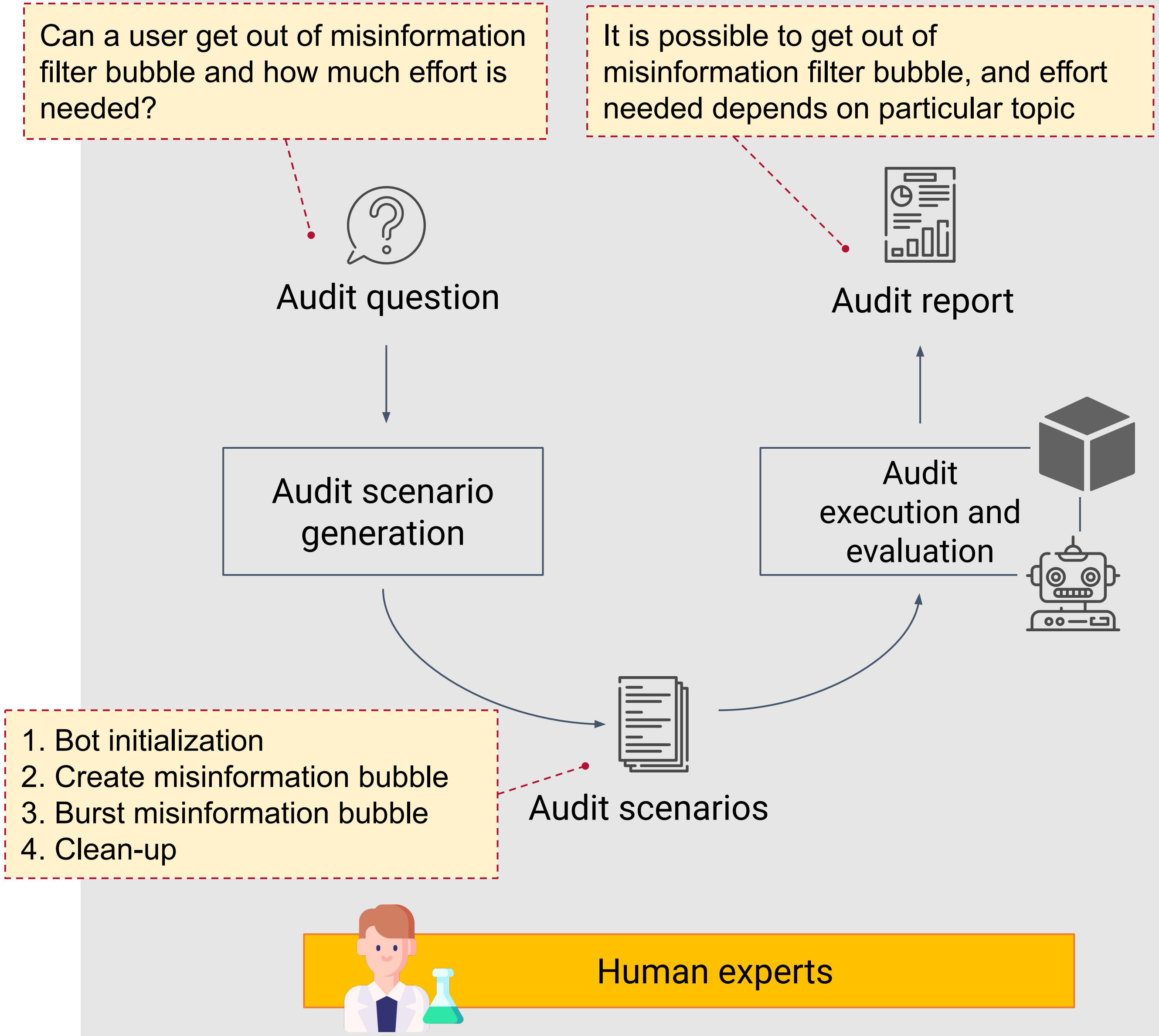
# Contributions

- Simulation of more complex user behaviour
- The first replication of previous audit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# [Audit of misinformation on YouTube]

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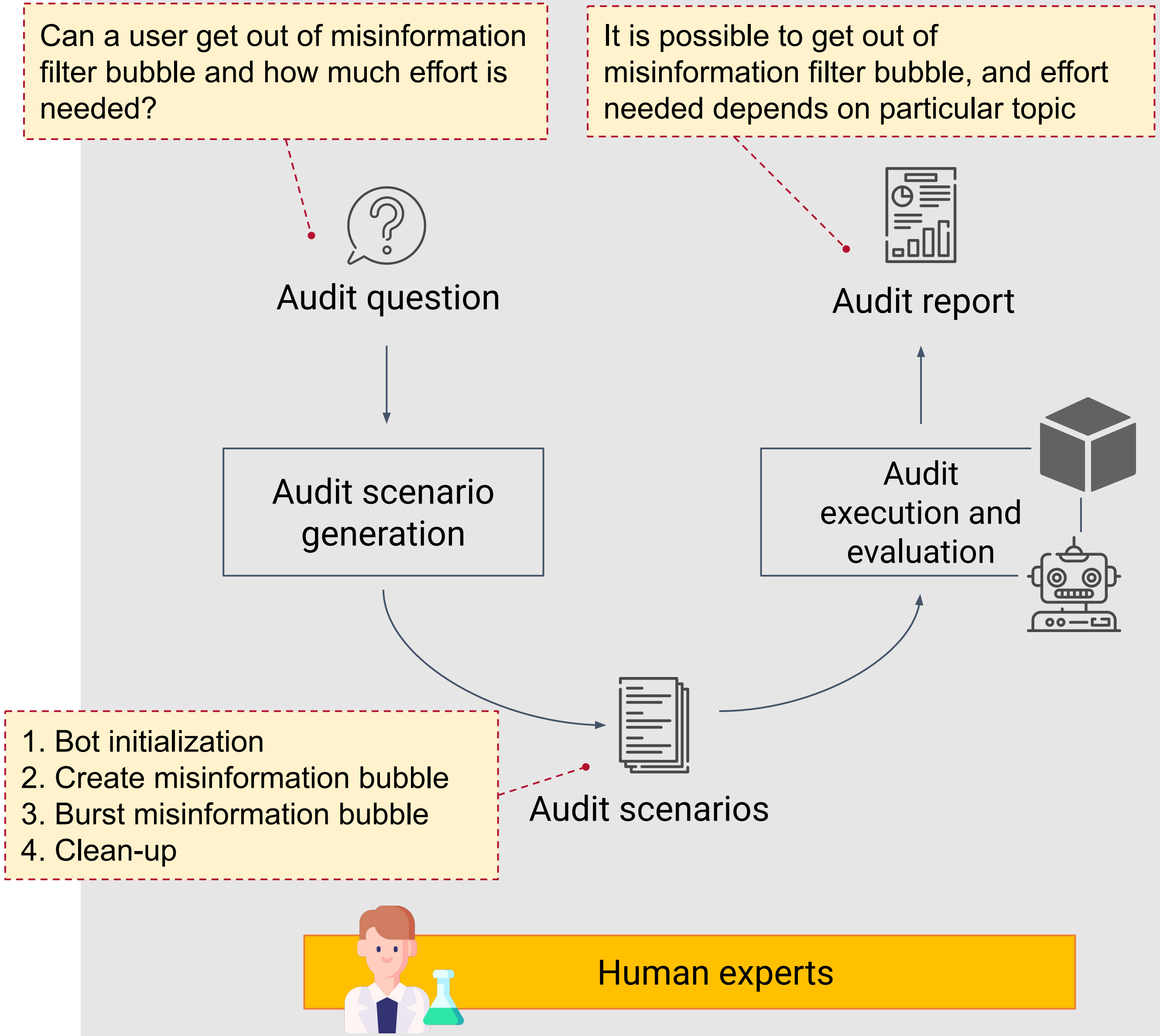
**Best Paper Award**
at prestigious A-ranked
RecSys 2021 conference



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# Challenges and open problems

# Several challenges prohibit audits from providing more extensive and up-to-date evaluation

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Require extensive manual tasks
(scenario generation, content annotations)

→ **Automated audits**

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**Our idea on continuous and automated audits was introduced at UMAP conference** (Simko, 2021)

# Additional open problems

### Benchmarking algorithms across multiple platforms

To objectively compare the audited phenomenon on multiple platforms

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To achieve more reliable results

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### Optimization of audit scenarios

To decrease the computational costs and needed time

...

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Algorithmic audits can reveal what is hidden from us inside black-box AI-based algorithms

Among many use cases, auditing of political biases already revealed many interesting results

We argue towards continuous automatic audits, done ethically

**We continue to combat disinformation also by means of algorithmic audits within vera.ai project**

vera.ai

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Additional funding from Innovate UK grant No 10039055 and the Swiss State Secretariat for Education, Research and Innovation (SERI) under contract No 22.00245

# List of references

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2. Simko et al.: Towards Continuous Automatic Audits of Social Media Adaptive Behavior and its Role in Misinformation Spreading, 2021
3. Tomlein et al.: Auditing YouTube's Recommendation Algorithm for Misinformation Filter Bubbles, 2021
4. Srba et al.: Auditing YouTube's Recommendation Algorithm for Misinformation Filter Bubbles, 2023

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