Artificial Intelligence in Journalism – Fact Checking with Gemini

Introduction

- Journalism is fundamental for sustainable development, human rights protection and democratic consolidation. Any deterioration in the Quality of Journalism, will reduce trust on the established institutions thereby, paving way for civil unrest & Violence.

Artificial Intelligence & Responsible Journalism

- New Technologies like Artificial Intelligence, have to be used in improving journalism, to ensure peace & prosperity.

Qualitative Analysis of Journalism

- Let's go through civil unrest events in the last five years fuelled by fake news & misinformation, to understand its impact on the society.
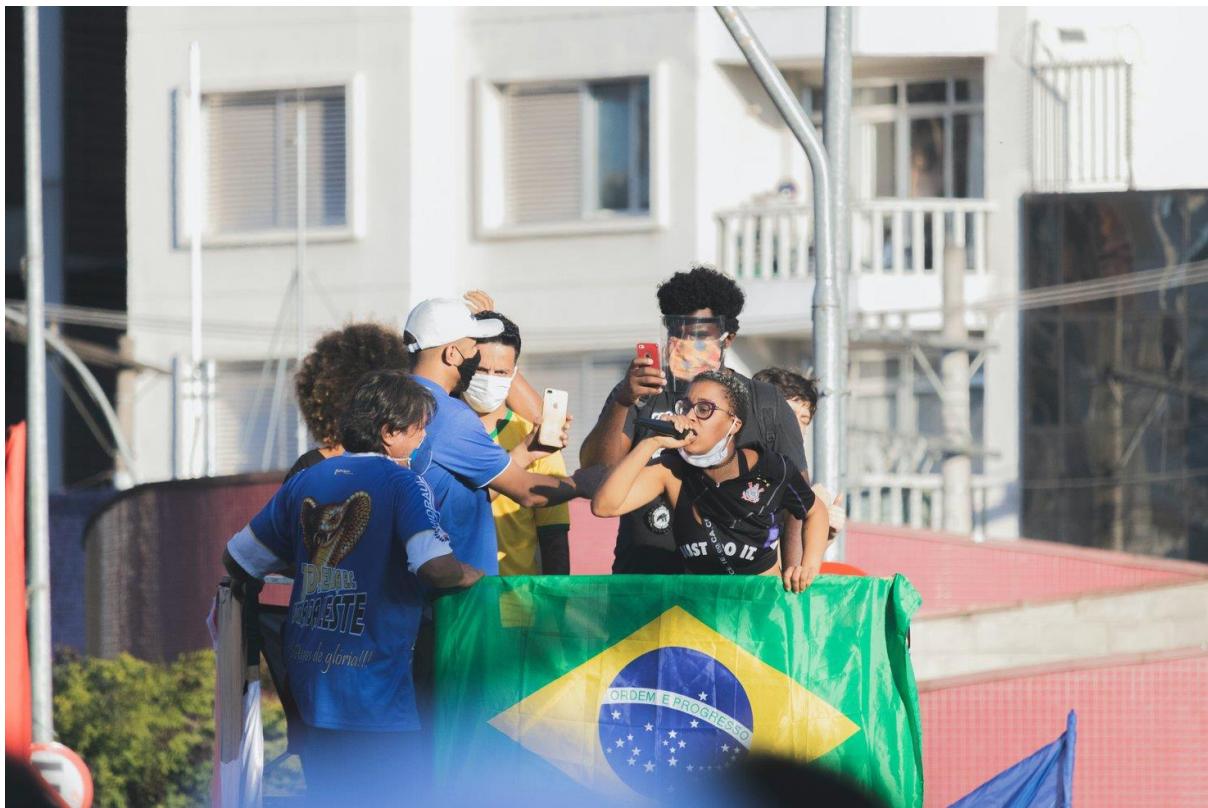
Brazil (2022): Misinformation during the presidential election intensified political divides. Fake claims about electoral fraud sparked protests and clashes between supporters of rival candidates

- Brazil has significantly improved its preparedness to combat fake news since its 2018 election. Initiatives include professional fact-checkers, partnerships with social media platforms, and tech advancements like bots and transcription tools in Portuguese. The Superior Electoral Court (TSE) has driven efforts, forming an Anti-Disinformation Committee and enacting measures against false electoral narratives. Influencers are also actively promoting accurate information. However, challenges like hate speech remain prominent. Despite the federal government's limited involvement, these efforts mark progress in protecting democracy. For details, visit Americas Quarterly

- The Reuters Institute article highlights Brazil's ongoing battle with misinformation during its elections, particularly under President Jair Bolsonaro's tenure. Despite progress, such as platform agreements to limit false content and initiatives like Democracia em Xeque, disinformation remains widespread. Claims attacking electronic voting systems and spreading conspiracy theories threaten electoral integrity. Researchers stress the increasing sophistication of misinformation and the need for stronger countermeasures. Social media remains a major channel for such activities, with platforms like YouTube facing criticism for lack of transparency. The issue poses long-term challenges for democracy. For details, visit Reuters Institute

- The ODI article discusses the pervasive impact of misinformation during Brazil's 2022 elections. Despite efforts by the judiciary, such as digital literacy programs and rapid takedown measures, the scale of disinformation—amplified through social media—remains a significant challenge. Judicial responses, while impactful, are limited in reach and face technological and societal hurdles, such as encrypted platforms and public mistrust in institutions. Broader, multi-stakeholder efforts are essential to counter misinformation globally. For details, visit ODI Global

Myanmar (2021): Misinformation played a role in inciting ethnic violence. False narratives spread on social media exacerbated ethnic tensions, particularly against the Rohingya community

- Amnesty International's report accuses Facebook's algorithms of amplifying hate speech against the Rohingya in Myanmar, fuelling violence and atrocities. The platform allegedly failed to act against harmful content, despite warnings from human rights groups. Amnesty calls for Meta to provide reparations to Rohingya communities, emphasizing corporate responsibility in preventing human rights abuses facilitated by their technologies. For details, visit Amnesty International

- The article highlights Facebook's role in enabling hate speech and incitement against the Rohingya in Myanmar, contributing to genocide. It criticizes Facebook's profit-driven algorithms for amplifying divisive content while neglecting necessary safeguards. The lack of accountability for these actions is underscored, with legal frameworks struggling to address such corporate complicity in human rights abuses. The piece advocates for stronger mechanisms to hold tech companies accountable. For details, visit Systemic Justice Project

- The article examines how misinformation and hate speech exacerbate Myanmar's ethno-religious tensions, particularly targeting marginalized groups like the Rohingya. Social media platforms are central in spreading inflammatory content, which fuels conflict and undermines peacebuilding efforts. Despite some measures to address these issues, weak governance and lack of accountability allow harmful narratives to thrive. Strengthening digital literacy, fostering accountability, and promoting inclusive narratives are critical to countering these threats to stability and peace. For details, visit US Institute of Peace

Nigeria (2020): Fake news circulated about the #EndSARS protests against police brutality, with false reports portraying protesters as violent, leading to confusion and further escalations.
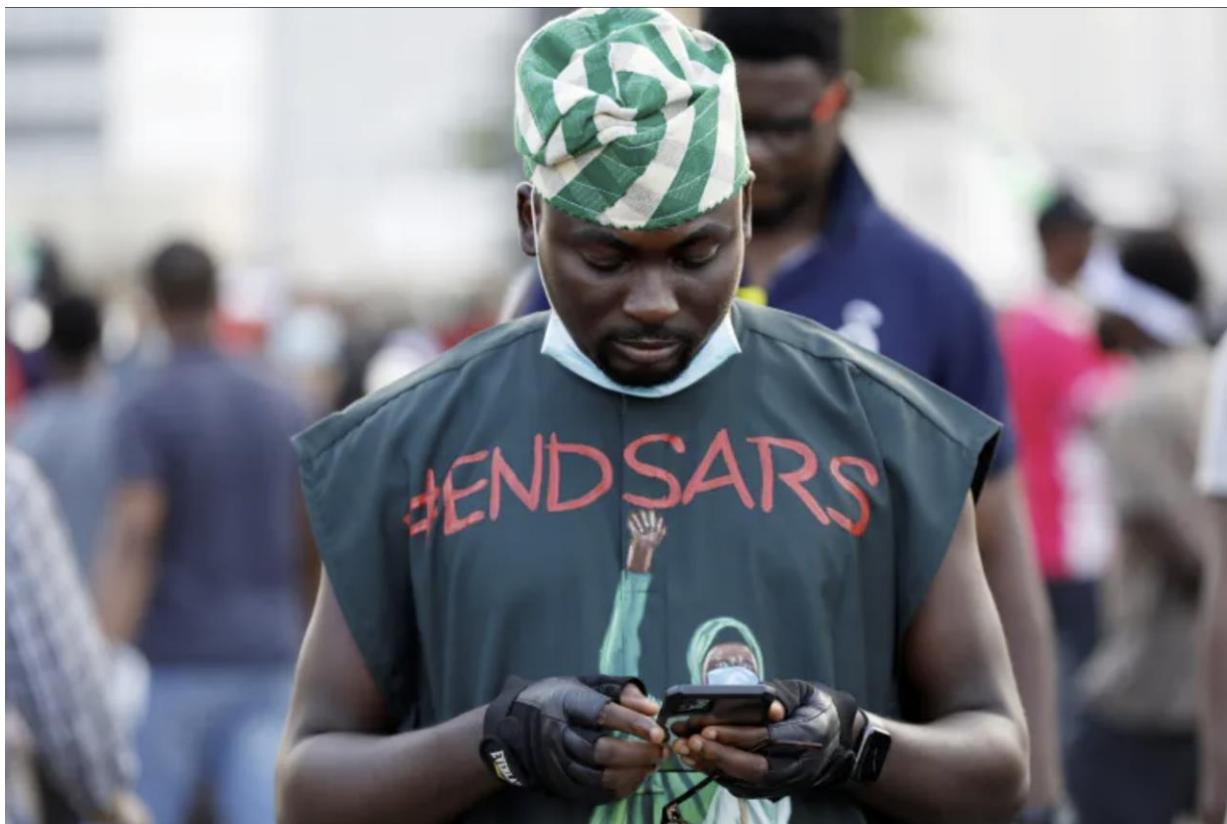
- The #EndSARS protests in Nigeria in 2020, sparked by widespread police brutality, became the subject of misinformation, with false claims that protesters were violent and engaging in criminal activities. Here's a timeline of key events:

  - October 3, 2020: The protests began after a viral video showed police brutality by the Special Anti-Robbery Squad (SARS).

  - October 6-10, 2020: Protests spread across major cities in Nigeria.

  - October 20, 2020: The situation escalated when the Nigerian Army reportedly opened fire on peaceful protesters at Lekki Toll Gate in Lagos.

  - October 21-23, 2020: Fake news spread, portraying the protesters as violent. The misinformation led to confusion and public unrest, with claims of looting and armed confrontations.

  - October 22, 2020: Reports of shootings and violent confrontations spread through social media, further escalating the situation.

  - This misinformation fuelled clashes, heightened fear, and led to violent responses from security forces, exacerbating the overall crisis.

- Social media played a vital role in organizing and raising awareness, that led to international condemnation on usage of excessive force against peaceful demonstrators. For details, visit DW

- The article highlights how Nigerians used social media to organize and amplify the #EndSARS protests against police brutality. Social media platforms like Twitter and Instagram played a crucial role in mobilizing young Nigerians, sharing firsthand accounts of police abuse, and gaining international attention. Despite government attempts to limit online communication, digital tools helped create global awareness of the issue, allowing protesters to bypass censorship and challenge authority. The protests marked a significant moment for activism in Nigeria, driven by the power of social media. For details, visit Aljazeera
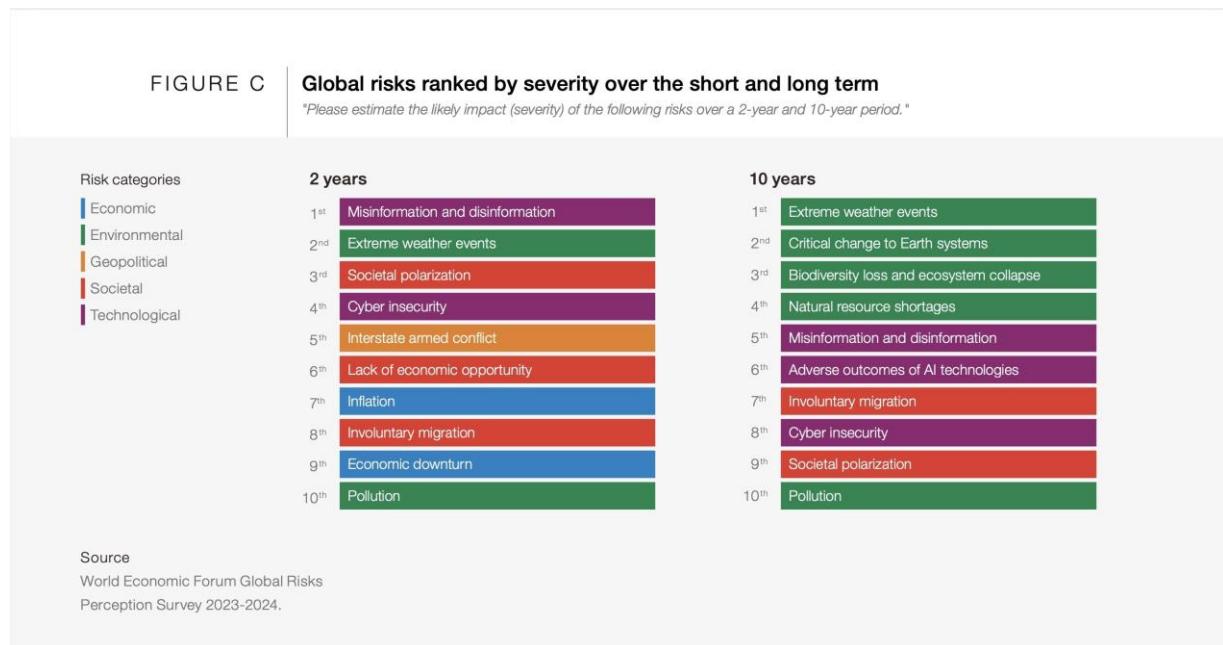

Quantitative Analysis of Journalism

- Fake news and misinformation are significant global challenges with widespread social and economic impacts. Here are key findings from global think tanks and organizations:

o Prevalence: Research by Ipsos indicates that 86% of global internet users have been exposed to fake news, with 67% encountering it on platforms like Facebook. Alarmingly, nearly 90% of those exposed to fake news believed it to be real at least once. For details, visit Ipsos CIGI.

o Health Impact: Misinformation, especially during crises like the COVID-19 pandemic, has been shown to worsen health behaviours. The WHO reported that the "infodemic" fuelled vaccine hesitancy, reliance on unverified treatments, and distrust in public health measures, leading to measurable harm. For details, visit WHO

o Political and Social Effects: According to the World Economic Forum, fake news disrupts political discourse, erodes trust in institutions, and fosters polarization. The amplification of false narratives often leads to civil unrest and undermines democracy.

o Economic Cost: Fake news also incurs significant economic costs. A 2019 study estimated the global cost of misinformation at $78 billion annually, encompassing impacts on businesses, healthcare systems, and productivity. For details, visit ZDNet

o Public Trust and Behaviour: Exposure to fake news reduces trust in media and governments. Surveys show that 40% of respondents trust traditional media less due to misinformation, and many have altered their online behaviour, such as reducing social media use or actively fact-checking news.

World Economic Forum

FIGURE C | **Global risks ranked by severity over the short and long term**
"Please estimate the likely impact (severity) of the following risks over a 2-year and 10-year period."

Risk categories	2 years	10 years
Economic	1st Misinformation and disinformation	1st Extreme weather events
Environmental	2nd Extreme weather events	2nd Critical change to Earth systems
Geopolitical	3rd Societal polarization	3rd Biodiversity loss and ecosystem collapse
Societal	4th Cyber insecurity	4th Natural resource shortages
Technological	5th Interstate armed conflict	5th Misinformation and disinformation
	6th Lack of economic opportunity	6th Adverse outcomes of AI technologies
	7th Inflation	7th Involuntary migration
	8th Involuntary migration	8th Cyber insecurity
	9th Economic downturn	9th Societal polarization
	10th Pollution	10th Pollution

Source
World Economic Forum Global Risks
Perception Survey 2023-2024.

• World Economic Forum ranked Misinformation & Disinformation as the most severe technological risk in short term with rank 1 as well as in long term with rank 5.
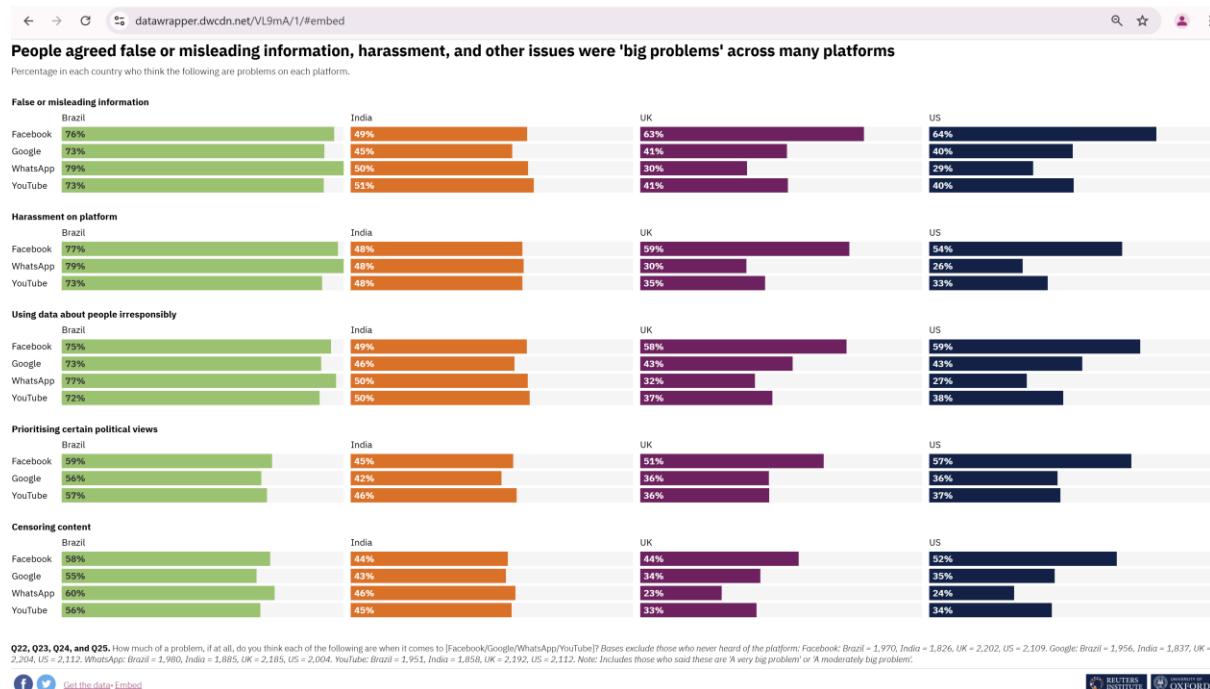
FIGURE 2.12 | **Technological power**

Risk interconnections: **Adverse consequences of AI technologies** and **Technological power concentration**
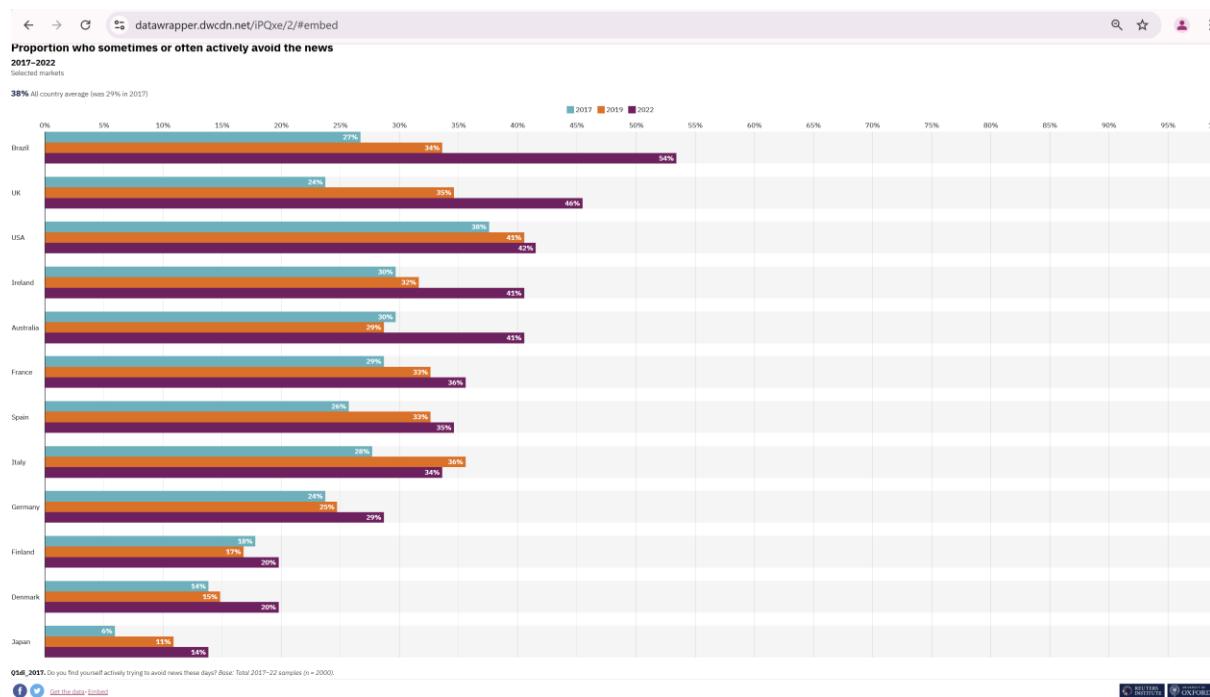
- The Current state of Misinformation & Disinformation, is poised to scale further with the help of AI, to deteriorate Journalism & democratic consolidation even more. Hence, Efforts to combat fake news include educational initiatives, stricter platform regulations, and technological solutions like AI-driven fact-checking, but challenges remain in identifying and managing misinformation across diverse digital landscapes. These findings highlight the urgent need for coordinated global actions to mitigate this pervasive issue.

Reuters - Oxford

People agreed false or misleading information, harassment, and other issues were 'big problems' across many platforms

Percentage in each country who think the following are problems on each platform.

False or misleading information

	Brazil	India	UK	US
Facebook	76%	49%	63%	64%
Google	73%	45%	41%	40%
WhatsApp	79%	50%	30%	29%
YouTube	73%	51%	41%	40%

Harassment on platform

	Brazil	India	UK	US
Facebook	77%	48%	59%	54%
WhatsApp	79%	48%	30%	26%
YouTube	73%	48%	35%	33%

Using data about people irresponsibly

	Brazil	India	UK	US
Facebook	75%	49%	58%	59%
Google	73%	46%	43%	43%
WhatsApp	77%	50%	32%	27%
YouTube	72%	50%	37%	38%

Prioritising certain political views

	Brazil	India	UK	US
Facebook	59%	45%	51%	57%
Google	56%	42%	36%	36%
YouTube	57%	46%	36%	37%

Censoring content

	Brazil	India	UK	US
Facebook	58%	44%	44%	52%
Google	55%	43%	34%	35%
WhatsApp	60%	46%	23%	24%
YouTube	56%	45%	33%	34%

Q22, Q23, Q24, and Q25. How much of a problem, if at all, do you think each of the following are when it comes to [Facebook/Google/WhatsApp/YouTube]? Bases exclude those who never heard of the platform: Facebook: Brazil = 1,970, India = 1,826, UK = 2,202, US = 2,109. Google: Brazil = 1,956, India = 1,837, UK = 2,204, US = 2,112. WhatsApp: Brazil = 1,980, India = 1,885, UK = 2,185, US = 2,004. YouTube: Brazil = 1,951, India = 1,858, UK = 2,192, US = 2,112. Note: Includes those who said these are 'A very big problem' or 'A moderately big problem'.

Get the data · Embed

REUTERS INSTITUTE · UNIVERSITY OF OXFORD

- Survey results from Reuters signifies the Trust on Online Platforms. Hence, it is important to use AI for social good by design, to shape Journalism for a better future.

Proportion who sometimes or often actively avoid the news
2017–2022
Selected markets

38% All country average (was 29% in 2017)

Legend: 2017 2019 2022

Market	2017	2019	2022
Brazil	27%	34%	54%
UK	24%	35%	46%
USA	38%	41%	42%
Ireland	30%	32%	41%
Australia	30%	29%	41%
France	29%	33%	36%
Spain	26%	33%	35%
Italy	28%	36%	34%
Germany	24%	25%	29%
Finland	18%	17%	20%
Denmark	14%	15%	20%
Japan	6%	11%	14%

Q1di_2017. Do you find yourself actively trying to avoid news these days? Base: Total 2017–22 samples (n ≈ 2000).

Get the data · Embed

REUTERS INSTITUTE · UNIVERSITY OF OXFORD

- The survey shows that the raising mistrust on news institutions from 2017 to 2022, which is uniform in several different demographics around the world.

Institute for Economics & Peace

## Percentage change in Positive Peace indicators, United States, 2009–2019

Source: IEP
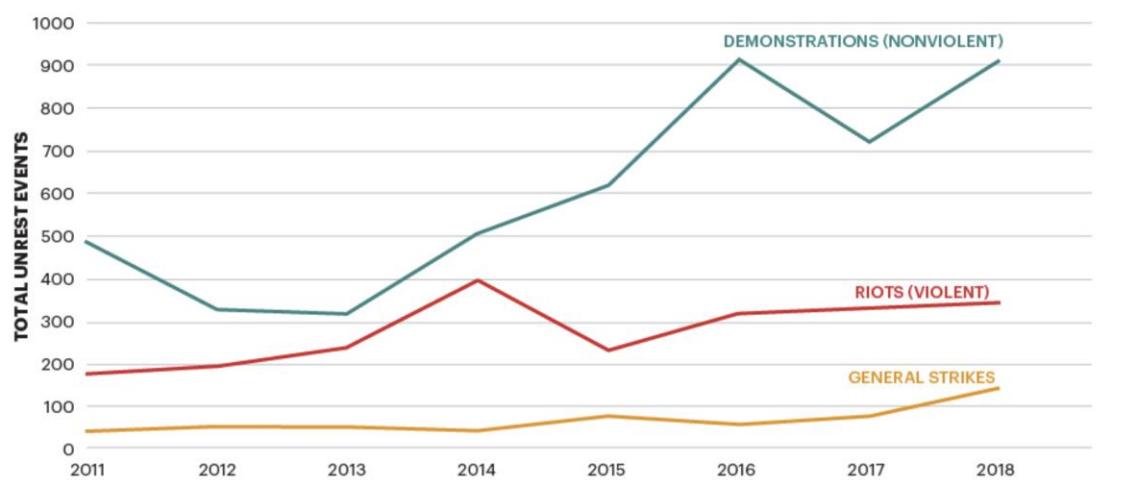
In the last decade, the **Quality of Information** indicator recorded the largest deterioration in the US. Quality of Information is one of eight Positive Peace indicators, which declined by 113.6% in the US.

- Major cause of this declining impact on peace can be derived from the rate of change of positive peace indicators of a country, when considering the extremely impacted Positive peace indicators from 2009 to 2019, Even though Percentage of population using internet has increased. Quality of information, reaching people has decreased significantly, which emphasize on the importance of streamlining information, supported by strict, consistent & robust fact-checking practices.

Civil Unrest from 2011 to 2018:

- **64%** of protests were nonviolent demonstrations
- **6%** were general strikes
- **30%** were classified as riots
- **4,700** nonviolent demonstrations
- **2,200** riots (violent demonstrations)
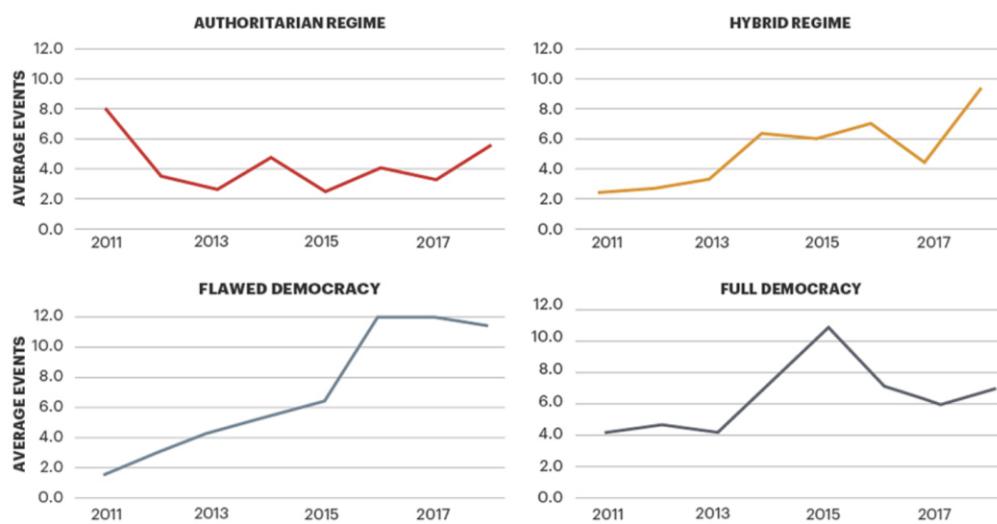
Global trends in civil unrest, 2011–2018

Source: Cross-National Time Series (CNTS), IEP calculations

IEP

Civil unrest by government type, 2011 to 2018

Source: Cross-National Time Series (CNTS), EIU, IEP calculations

IEP

The rate of civil unrest events per country increased tenfold in flawed democracies between 2011 to 2018.

- Civil Unrest Around the World has Doubled in Last Decade, Hence, restoring trust in the process of democratic consolidation is important for peace. For details, visit Vision Of Humanity

Guidelines from Analysis

- The number of civil unrest events due to Fake News & Misinformation is on the rise, Hence, it has to be handled with responsibility & wisdom, to ensure journalistic free-speech emphasizing accountability as well as firm crystal-clear fact checks emphasizing transparency. For Details, visit CNN and World Economic Forum
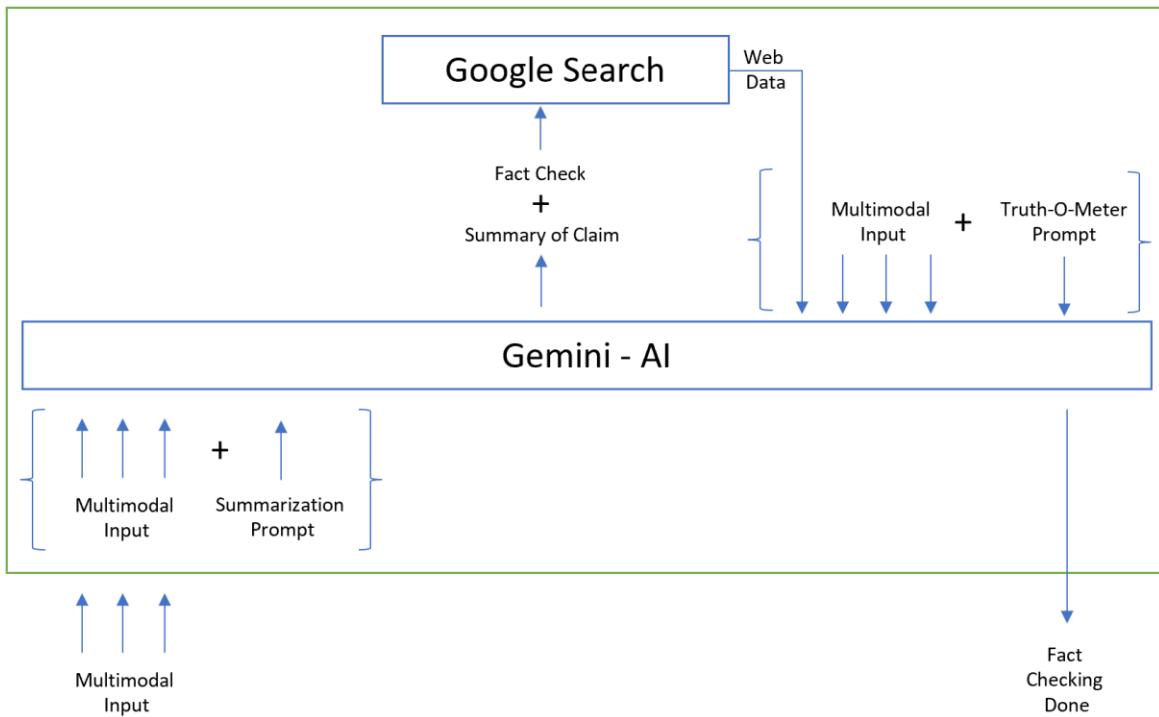
Social Good by Design

Approach

- Since AI has grown to an extend of understanding Multimodal long-context content with ease, we shall have an agentic AI tool to assist journalists for their fact checking tasks, to improve their productivity in handling multiple disinformation campaigns at once, so that instead of debunking the claims all by themselves, they have to verify the Truth-O-Meter score calculated by AI based on its reasoning capability, merely acting as moderators.

Architecture

- With Multimodal & Long-Context Capabilities of Artificial Intelligence models, like Gemini coupled with open web data, from google, an assistive tool for Fact checking is possible in reality, to help journalists in Responsible Journalism handle the surge in misinformation & disinformation campaigns, to sustain Economics & Peace.

- Let's walk through the Architecture / Process flow of Proof-Of-Concept Assistive tool developed with Gemini AI.

  - Multimodal data representing the claim is fed into Gemini AI to summarise the core of the claim to search google.

```python
# Creates Minimal Summary for Surfing the Internet
def agg_info(self, txts, imgs, vdos):

    # Preparing inventory
    multimodals = []

    if imgs:
        multimodals += imgs
    if vdos:
        multimodals += vdos

    # Detailed Summarization Query for Attachments
    multimodals.append(
        """Understand each video (frame by frame) & each image (even minute details), with great granularity on even small details, and
        generate the detailed summary of the each video & each image as individual paragraph with strictly accurate facts in less than 100 words from the files attached.
        use moderate language to do so, tone down the harassment content, if any, generalize "provocable language" using the term "not appropriate"."""
    )

    if txts:
        multimodals.append(txts)

    # Summarization Query
    multimodals.append(
        """Summarize the Core Of the claims from entire multimodal input data shared to provide a text summary with not more than 100 words."""
    )

    # print(multimodals)
    model = genai.GenerativeModel("gemini-1.5-flash")
    response = model.generate_content(
        multimodals,
        safety_settings={
            HarmCategory.HARM_CATEGORY_HARASSMENT: HarmBlockThreshold.BLOCK_LOW_AND_ABOVE,
            HarmCategory.HARM_CATEGORY_HATE_SPEECH: HarmBlockThreshold.BLOCK_LOW_AND_ABOVE,
            HarmCategory.HARM_CATEGORY_SEXUALLY_EXPLICIT: HarmBlockThreshold.BLOCK_LOW_AND_ABOVE,
            HarmCategory.HARM_CATEGORY_DANGEROUS_CONTENT: HarmBlockThreshold.BLOCK_LOW_AND_ABOVE
        }
    )
    # print(response.text)
    return response.text
```

  - Google Search returns all relevant site results for the search string input.

  - Crawl4AI curates the sites contents under fact checking sites as long-context input for further analysis.

```python
# Uses crawl4ai to get more info from google API
def crawl_for_more(self, inp):

    pages = {}
    # Create an instance of WebCrawler
    crawler = WebCrawler()
    # Warm up the crawler (load necessary models)
    crawler.warmup()
    # Run the crawler on a URL
    result = crawler.run(url=f"https://www.google.com/search?q=fact check : {inp}&num=1000")
    # Print the extracted content
    print(f"{len(result.links['external'])} links found")

    # print(json.dumps(result.links['external'], indent=2, sort_keys=True))

    # Capturing Links & Contents of Interest for Long-Context Text Input
    for page in result.links['external']:
        text = page['text']
        link = page['href']
        if "fact check" in text.lower():
            content = self.parse_page(url=link)
            if content:
                pages[link] = content

    return pages
```

- Multimodal data representing core claims, Summary Generated by Gemini Model, Long-Context Content curated by Crawl4AI, together used with a Truth-O-Meter Prompt to admit or oppose the claim with reasons.

```python
# Fact Check based on new info (long context)
def fact_check(self, txts, imgs, vdos, pages):

    # Preparing inventory
    multimodals = []
    if imgs:
        multimodals += imgs
    if vdos:
        multimodals += vdos
    if txts:
        multimodals.append(txts)
    if pages:
        multimodals.append(pages)

    # Fact Checking Query
    multimodals.append(
        """Summarize the Core Of the claims from the data shared to provide text with not more than 25 words and answer the Questions Below.
        Questions :
        - Fact Check the claim to admit or oppose it, with TRUTH-O-METER score to choose between TRUE & FALSE.
        - Generate 10 bullet points, supporting the result of the decision & TRUTH-O-METER Score."""
    )
    # print(multimodals)
    model = genai.GenerativeModel("gemini-1.5-flash")
    response = model.generate_content(
        multimodals,
        safety_settings={
            HarmCategory.HARM_CATEGORY_HARASSMENT: HarmBlockThreshold.BLOCK_NONE,
            HarmCategory.HARM_CATEGORY_HATE_SPEECH: HarmBlockThreshold.BLOCK_NONE,
            HarmCategory.HARM_CATEGORY_SEXUALLY_EXPLICIT: HarmBlockThreshold.BLOCK_NONE,
            HarmCategory.HARM_CATEGORY_DANGEROUS_CONTENT: HarmBlockThreshold.BLOCK_NONE
        }
    )

    # Print Usage Metadata
    print(response.usage_metadata)
    # print(response.text)
    return response.text
```

- Since it is designed as an assistive tool, journalists can moderate the content manually, as per need, thereby adhering to the standards of responsible journalism.

Usage

```python
#!/usr/bin/env python3
# -*- coding: utf-8 -*-
"""

Filename: fact_checker.ipynb
Author: Sathiyanarayanan Palani
Date: 2024-11-15
Python Version: Python 3.11.6
Version: 1.0
Description:
    Assistive Fact Checking Tool for responsible Journalists,
    based on Gemini AI & Crawl4AI.

License: Apache 2.0
Contact: sathiyanarayanan396@gmail.com
Dependencies: os, time, pillow, crawl4ai, google.generativeai
"""
```

- Assistive tool is available in the form of Kaggle notebook for usage, For details, visit Kaggle Notebook

Results

- The results are impressive, when we consider the accuracy & consistency of the Gemini Model, in admitting or opposing the Claim. But among the ten reasons it generates, one or two might be attributing to a different version of the same claim, since some claims exists in many versions, with unique cultural appropriations for each.

Outputs

Chinese Robots performing Indian classical dance (Fake)

- Inputs have text used in WhatsApp & Facebook posts, and some videos & images related to them.


```python
# Primary Examples [ FAKE ]
from IPython.display import display, Markdown
# Fact checking a Fake News
inventory = {
    "results": "demo-results",
    "txt_lst": [
        "Watch this Indian Classical dance carefully.",
        "The dance is being performed at Disneyland in Shanghai*.",
        "*These two are not human dancers, but two Chinese-made robots*.",
        "*The duration of the dance is only five minutes.",
        "But the waiting time to buy a ticket to watch this dance is 4 hours.",
        "The ticket price to watch this dance is 499 yuan, which is equivalent to 75 dollars*.",
        "*The facial expressions of the robots are perfect and it is difficult to distinguish them from real humans.* (sic)",
        "ROBOTS are DANCING.",
        "This classical dance was created in China and broadcast at Shanghai Disneyland.",
        "They are not dance artists, but robots made in China.",
        "The performance time is only about 5 minutes, but the waiting time for tickets is 4 hours, and the ticket price is 499 yuan.",
        "It is more complex than Japan and has perfect facial expressions. Send this video out for everyone to watch and let us enjoy it together.",
        "Both dancers are robots. They are so realistic that they cannot be distinguished"
    ],
    "img_lst": [
        "fake-dataset/001/sample-facebook-share.jpg",
        "fake-dataset/001/sample-whatsapp-forward.jpg"
    ],
    "vdo_lst": [
        "fake-dataset/001/video-footage-dance1.mp4",
        "fake-dataset/001/video-footage-dance2.mp4"
    ]
}

fc = FactCheck(**inventory)
print("===")
display(Markdown(fc.analysis))
print("===")
```

- Usage metadata: Prompt token count: 107954, candidates_token_count: 258, total_token_count: 108212

The claim is that a viral video shows Chinese-made robots performing Indian classical dance at Shanghai Disneyland.

Answers:

- **Fact Check**: FALSE
- **TRUTH-O-METER Score**: FALSE (red)
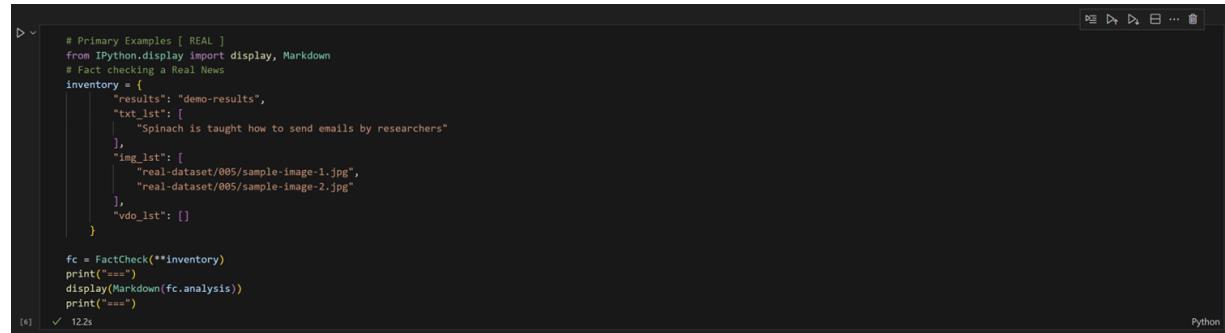
Supporting Bullet Points:

- The viral video shows two Indian classical dancers, Sophia Salingaros and Isha Parupudi, performing Bharatanatyam.
- The video was originally uploaded on YouTube in 2017 on a channel dedicated to Indian classical dance.
- The dancers are based in the US, not China.
- There's no evidence of robot dancers performing at Shanghai Disneyland.
- Shanghai Disneyland's official website lists no attractions or performances featuring robot dancers.
- The claim about the waiting time and ticket price is also unsubstantiated.
- The video has been circulating with a false claim for several years.
- The video's description clearly identifies the dancers as Sophia Salingaros and Isha Parupudi, both known Indian classical dancers.
- There are no records of robot dancers performing at Shanghai Disneyland, and the theme park's website does not list any such attraction.
- The claim about the waiting time and ticket price is unsupported by any evidence.

- Since, there is multiple versions of the fake news, in different countries, the output might not get same supporting bullet points all the time, but it is identifying the distinction between tailored fake news & true facts based on available long-context web data, to return a constant Truth-O-Meter Score.

Spinach is taught to send emails (Real)

- Inputs have couple of images & a small input text on the news, since the code can look for publicly available data, to create summaries, inputs as short as shown below, is also enough for efficient use of the assistive tool

```python
# Primary Examples [ REAL ]
from IPython.display import display, Markdown
# Fact checking a Real News
inventory = {
    "results": "demo-results",
    "txt_lst": [
        "Spinach is taught how to send emails by researchers"
    ],
    "img_lst": [
        "real-dataset/005/sample-image-1.jpg",
        "real-dataset/005/sample-image-2.jpg"
    ],
    "vdo_lst": []
}

fc = FactCheck(**inventory)
print("===")
display(Markdown(fc.analysis))
print("===")
```

- Usage metadata: Prompt token count: 611, candidates_token_count: 212, total_token_count: 823

> Researchers have taught spinach to send emails.
>
> **TRUTH-O-METER SCORE: TRUE**
>
> **Supporting Bullet Points:**
>
> - Scientists at MIT have developed a technology called "Plant Nanobionics" to enable plants to monitor their environment.
> - This technology involves inserting carbon nanotubes into the plant's vascular system.
> - These nanotubes can detect changes in the plant's environment, such as the presence of explosives or pollutants.
> - The nanotubes then send wireless signals to a nearby computer.
> - This signal can be used to trigger an alarm or even send an email.
> - The research was published in the journal Nature Nanotechnology in 2016.
> - The technology has the potential to revolutionize environmental monitoring and agriculture.
> - For example, spinach can be used to detect the presence of explosives in the soil.
> - The technology can also be used to monitor the health of crops and identify pests or diseases.
> - This research is a significant step towards creating a more sustainable and environmentally friendly future.

- Even though some minor information of how the computer reads the plant leaves with infrared camera in actual fact is replaced with nanotubes sending wireless signal in the supporting bullet points, the tool shall be able to identify such an event happening in history like when & where it took place.

New ₹2000 notes have nano chip (Fake)


```python
# Secondary Examples [ FAKE ]
from IPython.display import display, Markdown
# Fact checking a Fake News Example 1
inventory = {
    "results": "demo-results",
    "txt_lst": [
        "New notes have a GPS chip to detect black money.",
        "Demonetisation has been planned to get the new notes of 2000 rupees amongst people.",
        "The capabilities of the new notes developed by RBI, is amazing and a lot of scientists in domains from electronics to radioactive isotopes have been involved in developing it.",
        "Nano geo-positioning system (GPS) tracking device embedded in the new Rs 2,000 notes, would alert authorities if black money was hoarded",
        "Nano-GPS chip does not need any power source, as it only acts as a signal reflector.",
        "When a satellite sends a signal requesting location the NGC reflects back the signal from the location, giving precise location coordinates, and the serial number of the currency back",
        "every chip-embedded currency can be easily tracked & located even if it is kept 120 meters below ground level. The NGC can't be tampered with or removed without damaging the currency n",
        "If the 2000 rupee notes are hoarded in side a large metal container, that replicates faraday-shield, there is a possibility that It might hinder satellite signals, hence radioactive is",
        "radioactive isotope of phosphorous (P32), which has 15 protons and 17 neutrons, is used to trace large quantities of cash held at a particular spot, but is is not harmfull to humans"
    ],
    "img_lst": [
        "fake-dataset/002/sample-infographic.jpg",
        "fake-dataset/002/sample-nano-gps.jpg",
        "fake-dataset/002/sample-gps-spec.png",
        "fake-dataset/002/sample-rupee-notes.jpg"
    ],
    "vdo_lst": [
        "fake-dataset/002/sample-gps-chip.mp4"
    ]
}

fc = FactCheck(**inventory)
print("===")
display(Markdown(fc.analysis))
print("===")
```

- Usage metadata: Prompt token count: 24855, candidates_token_count: 390, total_token_count: 25245

> A new 2000 rupee note with an embedded nano-GPS chip has been introduced to combat black money. This chip does not need any power source, and can be used to track the location of the note, even if it is buried 120 meters underground.
>
> - **TRUTH-O-METER: FALSE**
>
> Here are 10 bullet points supporting the TRUTH-O-METER decision:
>
> - **No Independent Verification:** There is no independent scientific or technical verification to support the claim that the new 2000 rupee notes have an embedded nano-GPS chip.
> - **No Official Confirmation:** The Reserve Bank of India (RBI) or the Indian government has not officially confirmed the existence of such a chip.
> - **Scientific Challenges:** Tracking a nano-GPS chip from 120 meters underground would require extraordinary signal penetration capabilities, exceeding current technological limits.
> - **Power Source:** Nano-GPS chips typically require a power source to operate, making it implausible for them to function passively in a currency note.
> - **Signal Reflection:** While signal reflection is possible, it wouldn't provide accurate location information, especially from deep underground.
> - **Privacy Concerns:** Such a tracking capability would raise significant privacy concerns for citizens.
> - **Implementation Challenges:** The widespread implementation of nano-GPS tracking in currency notes on a national scale would be a massive logistical and technical undertaking.
> - **False Information Spread:** This claim appears to be a fabricated story, likely spread for sensationalism or political purposes.
> - **Similar Claims in the Past:** Similar claims about GPS-enabled currency notes have surfaced in other countries in the past, but none have been verified.
> - **Focus on Digital Solutions:** The Indian government's focus on digital payment systems like BHIM app suggests they are prioritizing more effective methods to combat black money.

China makes plastic rice (Fake)

```python
# Secondary Examples [ FAKE ]
from IPython.display import display, Markdown
# Fact checking a Fake News Example 2
inventory = {
    "results": "demo-results",
    "txt_lst": [
        "China making plastic pellets to be mixed with genuine rice. But Even though India does not import rice from China.",
        "We have once again taken samples from several places in Delhi and we will have to wait for the lab results to arrive at any further conclusion",
        "A few weeks back, a video went viral where a man named Mandeep Singh,",
        "claiming to be living in Oslo, Norway alleged that the India Gate brand of rice he cooked can be rolled into a ball and bounced on a hard surface and called it plastic rice.",
        "This video had generated nearly 3 million views in two weeks until India Gate's parent company KRBL limited obtained an injunction from Patiala House Court, Delhi against Facebook, You",
        "plastic recycling unit reportedly in China which can be seen converting plastic waste into pellets that look similar to grains.",
        "It is important to note that this video does not mention anywhere that these pellets are being manufactured to mix with actual rice.",
        "plastic rice, made from potatoes, sweet potatoes with synthetic resin was said to have made its way into countries with large rural populations like India, Pakistan and Vietnam.",
        "The country's Customs team \"confiscated 2.5 tonnes of plastic rice smuggled into the country by unscrupulous businessmen\".",
        "102 bags of the fake rice were seized with the customs office then suspecting that the rice was smuggled or illegally shipped in from China through Lagos port.",
        "But more than a week later on December 30, 2016, following lab tests, Nigeria's National Agency for Food and Drug Administration and Control (NAFDAC) said the suspected fake rice is no",
        "but rice contaminated with microorganisms. The rice was termed as unfit for consumption.",
        "Plastic Cabbages & Eggs From China In India is also been seen in the video."
    ],
    "img_lst": [
        "fake-dataset/003/sample-plastic-rice.jpg",
        "fake-dataset/003/sample-fake-eggs.jpeg",
        "fake-dataset/003/sample-infographic.png"
    ],
    "vdo_lst": [
        "fake-dataset/003/sample-plastic-cabbage.mp4"
    ]
}

fc = FactCheck(**inventory)
print("===")
display(Markdown(fc.analysis))
print("===")
```

- Usage metadata: Prompt token count: 26599, candidates_token_count: 344, total_token_count: 26943

The video claims that plastic rice is being manufactured in China and smuggled into countries with large rural populations like India.

Truth-O-Meter: FALSE

- There is no evidence that plastic rice is being manufactured in China or smuggled into India.
- The video does not mention that the plastic pellets are being mixed with actual rice.
- The video shows a plastic recycling unit converting plastic waste into pellets, not plastic rice.
- The claim about plastic rice being seized in Nigeria was later debunked by the country's food and drug administration.
- The video does not provide any evidence to support the claim that plastic rice is being sold in India.
- The claim about plastic cabbages and eggs is also not supported by any evidence.
- The video is likely a hoax, and there is no reason to believe that plastic rice is a real threat.
- The video's claim about India Gate rice being plastic is also false.
- India Gate's parent company KRBL limited obtained an injunction from Patiala House Court, Delhi against Facebook, You Tube and WhatsApp that restricts anyone from distributing this video on the internet.
- The video has generated nearly 3 million views in two weeks until India Gate's parent company KRBL limited obtained an injunction from Patiala House Court, Delhi against Facebook, You Tube and WhatsApp that restricts anyone from distributing this video on the internet.

Conclusion: The video is a hoax, and there is no evidence to support the claim that plastic rice is a real threat. It's important to be critical of information you see online and to verify claims with reputable sources.

Delhi teen finds place on UN green list (Real)

```python
# Secondary Examples [ REAL ]
from IPython.display import display, Markdown
# Fact checking a Real News Example 1
inventory = {
    "results": "demo-results",
    "txt_lst": [
        "Delhi teen finds place on UN green List, turns glass into sand",
        "the converted sand is used for construction purpose",
        "he is listed in forbes for this achivement"
    ],
    "img_lst": [
        "real-dataset/001/sample-image-1.jpg",
        "real-dataset/001/sample-image-2.jpg"
    ],
    "vdo_lst": []
}

fc = FactCheck(**inventory)
print("===")
display(Markdown(fc.analysis))
print("===")
```

- Usage metadata: Prompt token count: 634, candidates_token_count: 253, total_token_count: 887

A Delhi teenager has been recognized by the UN for his innovative method of turning glass into sand for construction purposes.

Questions:

- **Fact Check the claim: TRUE**
- **TRUTH-O-METER Score:** 9/10

Supporting Bullet Points:

- The image shows a young man interacting with a recycling machine for glass.
- The text clearly mentions the Delhi teenager's achievement and his method of turning glass into sand.
- The use of the converted sand for construction purposes is stated explicitly.
- The teen being listed in Forbes for this achievement further validates the claim.
- The UN Green List recognition is a significant honor, indicating the validity of the achievement.
- The existence of a complete glass recycling line implies a viable and scalable solution.
- The image of the sand produced from glass supports the claim of successful conversion.
- The presence of a company logo in the image suggests potential commercial viability.
- The mention of the teen's achievement being recognized on a global platform (Forbes) adds credibility.
- The consistent use of "he" and "his" in the text further reinforces the fact that the teen is a real person and not a fictional character.

NASA is installing internet on the moon (Real)

```python
# Secondary Examples [ REAL ]
from IPython.display import display, Markdown
# Fact checking a Real News Example 2
inventory = {
    "results": "demo-results",
    "txt_lst": [
        "Nasa is installing internet on the moon"
    ],
    "img_lst": [
        "real-dataset/002/sample-image-1.jpeg"
    ],
    "vdo_lst": [
        "real-dataset/002/sample-news-footage.mp4"
    ]
}

fc = FactCheck(**inventory)
print("===")
display(Markdown(fc.analysis))
print("===")
```
```
[10]   ✓ 45.3s                                                                    Python
```

- Usage metadata: Prompt token count: 43717, candidates_token_count: 239, total_token_count: 43956

Nokia has announced plans to launch a 4G mobile network on the Moon. The service is expected to provide critical communication capabilities for NASA's Artemis 1 mission.

- **TRUTH-O-METER: TRUE**
- Nokia has indeed partnered with NASA to build the first-ever cellular network on the Moon.
- The network will be launched in late 2023 via a SpaceX rocket.
- The network will be powered by an antenna-equipped base station stored in a Nova-C lunar lander.
- The lander will be accompanied by a solar-powered rover.
- An LTE connection will be established between the lander and the rover.
- The infrastructure will land on the Shackleton Crater, which lies along the southern limb of the Moon.
- The technology is designed to withstand the extreme conditions of space.
- The service will be used for NASA's Artemis 1 mission.
- The mission intends to establish humans on the Moon for the first time since the Apollo 17 mission in 1972.
- The aim is to show that terrestrial networks can meet the communication needs of future space missions.

Eight-year-old girl pulls medieval sword from lake (Real)

```python
# Secondary Examples [ REAL ]
from IPython.display import display, Markdown
# Fact checking a Real News Example 3
inventory = {
    "results": "demo-results",
    "txt_lst": [
        "Eight-year-old girl pulls medieval sword from lake"
    ],
    "img_lst": [
        "real-dataset/003/sample-image-1.jpg",
        "real-dataset/003/sample-image-2.jpg"
    ],
    "vdo_lst": [
        "real-dataset/003/sample-footage-1.mp4"
    ]
}

fc = FactCheck(**inventory)
print("===")
display(Markdown(fc.analysis))
print("===")
```

- Usage metadata: Prompt token count: 23033, candidates_token_count: 179, total_token_count: 23212

An eight-year-old girl found a sword in a Swedish Lake.

TRUTH-O-METER: TRUE

- This story was featured in a news report from Eurovision.
- The sword was found in the lake in Sweden.
- The sword is estimated to be from the 5th or 6th century.
- The girl found the sword while playing in the water.
- The girl told her father about the sword.
- Archeologists are searching for more artifacts in the lake.
- An ancient brooch was found in the lake.
- The story of the sword finding is being compared to the legend of King Arthur.
- There is speculation that the sword may have been part of a water burial.
- There is no indication that this story is false, it is being reported by multiple sources.

German street covered in chocolate (Real)

```python
# More Examples [ REAL ]
from IPython.display import display, Markdown
# Fact checking a Real News Example 3
inventory = {
    "results": "demo-results",
    "txt_lst": [
        "German street covered in chocolate after leak from chocolate factory"
    ],
    "img_lst": [
        "real-dataset/004/sample-image-1.jpg"
    ],
    "vdo_lst": [
        "real-dataset/004/sample-video-footage.mp4"
    ]
}

fc = FactCheck(**inventory)
print("===")
display(Markdown(fc.analysis))
print("===")
```

- Usage metadata: Prompt token count: 5959, candidates_token_count: 260, total_token_count: 6219

A chocolate factory leak in Werl, Germany, resulted in a street being covered in chocolate.

- **TRUTH-O-METER: TRUE**
- **Supporting Points:**
  - **Visual Evidence:** Video footage clearly shows a street covered in chocolate, along with firefighters working to clear the mess.
  - **News Source:** The video is attributed to Euronews, a reputable international news organization.
  - **Location Confirmation:** The video includes a location pin indicating Werl, Germany.
  - **Incident Reports:** Multiple news outlets reported on this incident, confirming its occurrence.
  - **Expert Testimony:** The video features firefighters, who are likely to be knowledgeable about such incidents.
  - **Credibility:** The video doesn't appear to be staged or fabricated, reinforcing its authenticity.
  - **Consistency:** The narrative presented in the video aligns with reports from other credible sources.
  - **Lack of Contradiction:** No reputable sources have refuted the claims presented in the video.
  - **Common Sense:** A chocolate factory leak is a plausible scenario that could result in chocolate flooding a street.
  - **Public Interest:** The incident garnered significant public interest, further validating its legitimacy.

Benchmarks

Quantitative demonstration : Benchmarking results for the selected data

S.No	Claim	Fact	Total Token Count	Truth-O-Meter	Truth-O-Meter Accuracy	Truth-O-Meter Consistency	Reasons Accuracy	Reasons Consistency	Benchmarks Total	Justifications
1	Chinese Robots performing indian classical dance	Fake	108212	FALSE	1	1	0.7	0.6	0.825	Consistency is low as it confuses with other versions of the claim with different cultural appropriation.
2	Spinach is taught to send emails	Real	823	TRUE	1	1	0.8	0.9	0.925	logical info is missed out, yet gets the subjective aspects of the event like place & year.
3	New ₹2000 notes have nano chip	Fake	25245	FALSE	1	1	0.9	0.9	0.95	Accurate & Consistent
4	China makes plastic rice	Fake	26943	FALSE	1	1	0.9	0.7	0.9	Lacks Consistency, in generating reasons
5	Delhi teen finds place on UN green list	Real	887	TRUE	1	1	0.9	0.9	0.95	Accurate & Consistent
6	NASA is installing internet on the moon	Real	43956	TRUE	1	1	0.9	0.9	0.95	Accurate & Consistent
7	Eight year old girl pulls medieval sword from lake	Real	23212	TRUE	1	1	0.9	0.9	0.95	Accurate & Consistent
8	German street covered in chocalate	Real	6219	TRUE	1	1	0.9	0.9	0.95	Accurate & Consistent

Variation in Total Token Count is based on the attachments of the files as images & videos, For the POC, It is limited to be maximum of 3 images & 3 videos, but it can be scaled to make use of long-context feature, as per need. The very first claim in the dataset consist of two videos to demonstrate the possibility of long-context feature under use.

Note : Dataset designed to showcase usage of tool for claims across a spectrum of Total token count

Conclusion

- Overall, the accuracy & consistency of Gemini in producing the Truth-O-Meter Score, is startling, when we compare it with the reasons that it enlists as bulletin points.

- Even though there is some inconsistency with the bulletin points listed between different attempts of fact checking the same claim, the Proof-Of-concept is qualified to adopt AI as an assistive tool (with human supervision) in fact-checking tasks as early as possible.

- Technology Readiness Level: Proof-Of-Concept Validation [PASSED].