

A Vision for Reinventing Credible Elections with Artificial Intelligence

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Abstract

In this blue sky paper, we seek to stimulate the research community to pursue important new as well as existing (unsolved) AI problems in the context of a challenging, often ignored, socio-sensitive application domain. We outline the key challenges in conducting elections credibly in leading democracies around the world today and identify our vision of a path forward with an overarching goal to increase voter participation with a two-pronged approach of AI-lead technological innovations and interdisciplinary community building. On the technology front, we envisage the need to transform Collation and Distribution of election information, and promote its Comprehensibility for users understanding and trust (CDC). On the community front, we need to invigorate the multi-disciplinary community consisting of, but not limited to, researchers in AI, security, journalism, political science, sociology, and business, to PROMote AI's Safe usage for Elections (PROMISE) with best-practices. This work is informed by our interdisciplinary research as well as experience in conducting three workshops at leading AI conferences and the AI Magazine special issue on *AI and Elections*.

Introduction

The success of any democracy depends on the ability of participants to vote in regular elections and the ability of the government to implement the subsequent orderly transfer of power. Although there are other stakeholders in a democracy beyond voters, including candidates contesting in elections and election commissions conducting them, traditionally, the act of voting has been conceptualized as the preeminent indicator of political participation (Norris 2017; Verba and Nie 1972; PewResearchCenter 2018) and commonly measured by voter participation rates. A vibrant democracy relies on engaged voters making informed decisions about their representatives and keeping them accountable based on reliable information and secure election infrastructure. Democracy at a practical level means empowering the voter with a right to choose and providing all relevant and reliable information including knowing about candidates, campaign finance, voting procedure, processing of votes, and declaration of results.

With 2024 being the year of elections as almost half the world's population is experiencing elections (Ewe 2023),

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the need for accurate information for voters, candidates and other stakeholders could never have been greater. However, around the world, stakeholders are struggling to find accurate information, which is now especially acute in the age of generative Artificial Intelligence (AI). They include, as examples, (a) Voters wanting to know about - voting logistics, candidate information, and issues (b) Candidate wanting to know about - what voters care about, how can the candidate best position themselves to a group of voters. (c) Election Commissions wanting to know about: what machines to buy, how to recruit and train poll workers. These queries should only be seen as illustrative of the stakeholders and information gaps that they face today.

In the United States, not only is it hard to find the right information but also the election infrastructure supporting the democratic process is under increasing threat from challenges like security attacks and *information disorders*, a term which covers misinformation, disinformation and malinformation (Norris 2017; Carroll et al. 2023; Rossetti and Zaman 2023; Shu et al. 2020; Kandel 2020). In terms of concrete metrics, researchers have tried to estimate the effort needed to vote (interpreted as barrier to participate) in different states in the United States using COVI, a cost of voting index (Schraufnagel, Pomante II, and Li 2020; COVI June 2022). Based on this index, Oregon ranks as the top state, where it is the easiest to vote in while New Hampshire ranks the last (50th). Within this spectrum, the region of the Southern US is generally considered as one of the hardest with South Carolina (SC) and Mississippi (MS), the two states where we have worked (Muppasani et al. 2023; Lakkaraju et al. 2024; Narayanan et al. 2021), ranked 43rd and 49th costliest states for citizens to vote in, respectively.

State of Global Decision Support for 2024 Elections

OpenAI declared that ChatGPT will defer election questions to human-curated Frequently Asked Questions (FAQs), even though it has one of the best performance in question-answer (QA) settings.

Within this wider societal context, Artificial Intelligence (AI) as the data-driven technologies that researchers have been working for over five decades to provide information may have been considered the right tool to rise to occasion

and address the needs. But just having the methods is no guarantee that it can be engineered into an effective solution for a problem. The situation is so bad with information gap and disorders that whenever AI is referenced in connection with elections, it often draws negative reactions due to the fear of bots, misinformation, and hacking. As a baseline and illustration of the current situation, for elections, OpenAI declared that ChatGPT will defer election questions to human-curated Frequently Asked Questions (FAQs) (OpenAI 2024), even though it has one of the best performance in QA settings while other large language model (LLM) based chatbots do not fare any better (Rozado 2024). This is particularly disappointing for AI, and especially chatbots, or bots, for short, since they are multi-modal collaborative assistants which have been studied since the early days of AI to help people complete useful tasks (McTear 2021; Juniper 2017; Srivastava et al. 2020). For elections, people could have overcome voting complexity by accessing information such as voting dates, jurisdiction, locations, and issues (propositions) on the ballot; and be informed on the voting process, equipment, and facilities at voting sites, conveniently in their own language or words through their smartphones, computers, and home devices like Alexa.

We note here that beyond elections, there are many other trust-sensitive domains where information gaps and disorders exist and where chatbots hold the promise to be an effective solution like health, finance, manufacturing and sustainability. However, such potentials remain just that - unless, the identified gaps are worked upon from the ground up. For example, during COVID19, we have articulated that chatbots could not fulfill their full potential due to systemic issues around data handling and privacy, system evaluation, user studies and legal liabilities (Srivastava 2021). Therefore, in the case of elections, we seek the AI community to not repeat the mistake.

Goal and an Ambitious Vision

In the backdrop of stagnant or dropping voter participation globally (Our-World-In-Data 2024), our main objective is to increase voter participation by at least 5%, where 1-2% seems feasible with current mobilization approaches (Mann 2021). To achieve such a simple, yet overarching goal, we envisage AI to play the role of safely engaging voters by increasing their awareness about elections (using a suitable baseline) with reliable information. This is called addressing the **information deficit model** (Ecker et al. 2022) in science communication which is considered a necessary step towards forming trustworthy narratives.

Overarching Goal

We want to increase voter participation by at least 5%, where 1-2% seems feasible with current approaches.

Our vision, thus, seeks to tackle an ambitious challenge - how to address information gap by increasing user's (voter's) information awareness in the election domain apolitically with a two pronged approach illustrated in Figure 1. On the technology front, one can use AI for **CDC** (i)

Collating frequently anticipated questions and their authoritative answers primarily using official (election) data made publicly available by election organizations and allowing its combination with secondary sources under user control, (ii) **D**istributing reliably by modeling multi-dimensional opinion networks with official information and discovering strategies to control them, and (iii) helping people **C**omprehend official information using decision support from chatbots, *with provable guarantee of preserving content accuracy* - all in the service of reducing information gap for increasing voter participation. On the community front, we need to invigorate the multi-disciplinary community to **P**ROMote AI's Safe usage for Elections (**P**ROMISE) with best-practices on AI testing, publishing and consuming official election data, and safe use of generative AI - an online forum we have created is at (AI4CE 2024). By achieving these objectives, one would reinvent elections for credibility using official information that is sourced from election commissions mandated by laws to provide accurate information, promote their use reducing scope for information disorders, and assisting people, especially vulnerable sections of society. The long-term impact is envisioned in both new methodologies and platforms for data, broader understanding and control of official opinion networks, and design and deployment of chatbots for information understandability with user trust. The CDC approach will be a win-win for voters, election agencies trying to fulfill their constitutional mandates, candidates trying to draw voters with accurate election information, and democracy at large while keeping AI relevant for critical societal needs.

Lessons from Recent Academic Activities

In elections, we - a group of interdisciplinary researchers in AI, security, journalism, law and political science, started exploring how AI may have a positive impact in elections out of academic interest in apolitical academic settings. We have organized three workshop at major AI conferences (Neurips 2021, AAAI 2023, AAAI 2024 - see reports: (Srivastava et al. 2023b, 2024)) and a special issue of the AI Magazine (Srivastava, Nikolich, and Koppel 2023) on how AI may help run credible elections with use-cases across global democracies. Multi-disciplinary researchers, government officials (bureaucrats, election officials), journalists, stakeholders from non-profits and even a researcher-turned-politician have participated in these activities from leading democracies including - Brazil, Canada, Estonia, India, Ireland, Kenya, Nigeria, Switzerland, United States (US), and United Kingdom (UK). The countries represent a diverse range from one of the world's oldest democracies (US), the largest democracy (India) to using digital technologies extensively for governance and elections (Estonia). Some key takeaways from these activities are below.

People choose their leaders using diverse processes, yet no election system is considered ideal: Election processes are diverse with only very few unifying factors like winners are chosen by people and there has to be more than one choice of candidate (or party) for a fair election. Despite diversity, there is no widely accepted, ideal, election system. Furthermore, all stakeholders globally agree that their

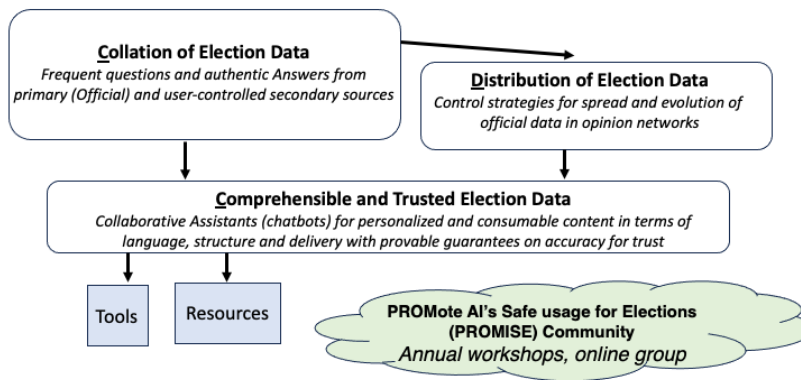


Figure 1: Proposed two-pronged PROMISE approach: (a) On the technology front, transform Collation and Distribution of election information, and promote its Comprehensibility for users understanding and trust (CDC). They will answer RQs 1, 2 and 3, respectively. (b) On the community front, invigorate the multi-disciplinary PROMISE community to with best-practices like publishing official election data, AI testing, and safe use of generative AI. Online forum is at (AI4CE 2024).

prevalent election processes need a multi-pronged approach to improve the state-of-affairs involving election processes, people training and technology.

Potential for learning from one another: Many problems are already tackled at scale satisfactorily in one part of the world and can be easily reused in other geographies. Prominent examples are voter identification (routinely handled in India but subject to significant questioning in the US) and voting technologies (stable in Estonia and India but subject to variability and frequent challenges in the US).

Freedom of choosing election process and the challenge of technology testing: Most leading democracies have a central election commission that standardizes election process, except the US. The different jurisdictions (states, counties) in the US have a lot of freedom in choosing the way they hold elections, but as a result, this feature raises challenges due to non-uniform procedures and equipment. Consider testing - although well developed for years for voting machines (NCSL 2021), they can still be controversial due to lack of a uniform election stack. So, for newly introduced data-driven information systems like chatbots, the situation is even worse. It is an open question whether freedom of process is desirable for a credible election.

Design for user trust: How a technology is designed and how issues around their usage are handled can affect voter's trust in them. For example, electronic voting has the problem of transparency and a paper trail helps mitigate it somewhat. For AI, participants have similarly shown concerns about: the increasing trust issues lack of explanations, information leakage and inappropriate content.

AI evokes fear of misinformation but much AI potential to improve elections: There is genuine apprehension about misinformation (risk as well as real) among researchers and public, and this impacts public trust in genuine information as well (Ecker et al. 2022; Rossetti and Zaman 2023). When information cannot be secured, hoping to use AI for

voting advice or recommendations is even more unsafe despite its emergence (Gemenis 2024). But there are many promising positive avenues too like detecting gerrymandering (Vagnozzi 2020), design of easy-to-understand ballots and selecting polling locations to promote voting access. AI can specifically help elections by disseminating official information (e.g., about candidates, electoral process and candidates) personalized to a voter's cognitive needs at scale, in their language and format (Muppasani et al. 2023). When AI helps with information gap and can prevent or even intervene to counter information disorders like mis- and disinformation, the impact can be far reaching (Hoes et al. 2024; Muppasani et al. 2024).

Illustrative Complex Election Ecosystem: US

As the oldest modern democracy, the United States (US) has frequent elections to choose officials at federal, state and local levels. Since the situation changes from state to state, we describe the scenario in two states which have been our main focus due to our location and of key collaborators noting that our observations are easily generalizable across the country.

Voters, Digital Literacy and Target Groups - Among US voters, first-time voters (ages 18-21) are among the lowest participants in elections (Center 2018). They have, according to Pew Research, 100% access to cellphones and 97% access to smartphones (Center 2024; Anderson and Jiang 2018). At the other end of the spectrum are senior citizens (individuals 65+) who exhibit some of the highest levels of voter turnout (Center 2018), but many potentially willing voters are unclear about disability accommodations at election sites (Rankings 2022), and some are uncertain about the basics of where and how to register to vote and to vote (Brandon 2020). While government entities have online resources to educate voters, senior citizens are still disproportionately prone to believe and share false information. A recent study suggested that seniors are seven times more likely to share articles from misleading or false websites than individuals

under 29 (A. Guess, Nagler, and Tucker 2019; Narayanan et al. 2021). While our work will be applicable to all voters, to date, we have focused on first-time voters and senior citizens to drive reduction in information gap.

Elections in South Carolina (SC) - In South Carolina, nearly 20% of the population in the state is age 65 and older (Census.gov, 2021). Elections are held in South Carolina to fill a number of municipal, state, and federal positions. These positions include Governor, Lieutenant Governor, Secretary of State, Attorney General, Treasurer, Comptroller General, Superintendent of Education, and Commissioner of Agriculture, as well as State Senate, State House of Representatives, State Delegation to the U.S. Senate, and State Delegation to the U.S. House of Representatives (Ballotpedia, 2022). The state’s election commission oversees voter registration, candidate certification, and elections (South Carolina Elections Commission, 2022). South Carolina’s election commission uses its website to share frequently asked questions (FAQs) on its official website (South-Carolina 2022).

Elections in Mississippi (MS) - In Mississippi, nearly 17% of the population in the state is aged 65 to 74 (Census.gov, 2021) but 76% vote. In Fall 2022, Mississippi’s four House congressional races were all on the ballot. The governor and the state’s two U.S. senators were not on the ballot, making this an “off” year with few big names. Voter turnout was only 31.1%, lower than the 2018 midterms (42.7%) and the 2020 general election (59.9%). Mississippi lacks some voting options available in many other states, including online voter registration. Mississippi’s official website has question-answer pairs available from its website (Mississippi 2022).

Finding Information about Elections and the Information Gaps

Consider the following common situations that a prospective voter planning to participate in an upcoming election may face: (a) Wanting to register and looking for the relevant procedure, (b) Wanting to find the address of their polling place, (c) Wanting to find the time polling booths will be open, (d) Wanting to know about a candidate. There is no authoritative resource in the US that compiles this information. The closest is online resource by NASED - National Association of State Election Directors (NASED 2024) but it is a non-profit and thus does not have requisite constitutional mandate. Another is Vote411 by the non-profit League of Women Voters (LWV) (of Women Voters 2024). but they also have the same issues. Besides, even the questions are fragmented by states and not uniformly available, let alone having answers for them accurately. Election commissions of states, which are constitutional organizations to conduct elections, do maintain FAQs (SC(South-Carolina 2022), MS(Mississippi 2022)) but the datasets are minuscule (≤ 30), the process of collating them is unclear, and they do not cover common questions and consequently, answers (See Table 1).

Querying a FAQ - We now model a FAQ which is the election data representation we will focus on. A *FAQ* consists of data items d_i where each consists of $\langle q_i, a_i, m_i \rangle$ corre-

sponding to a question, its answer and associated metadata, respectively. The metadata captures any additional information about the data item - e.g., question’s source or answer provenance, trustworthiness, etc. and can be represented as a list of variables and their values. We will refer the set of all questions in *FAQ* by Q and the set of all answers by A . The quality (e.g., readability) of Q and A need to be improved, and for every i , the information should not be missing, i.e., be complete for $\langle q_i, a_i, m_i \rangle$.

Information Gaps and Beyond Disorders - Rumors, Manipulation - Information gap is a well studied concept in business and measures the gap between the information people have and what they want (McEwen 1978). Connected to it are the concepts of rumors(Spiro and Starbird 2023) and manipulations(Carroll et al. 2023). However, these are hard to characterize formally and even harder to test computationally. Hence, we begin with FAQs whose structure is easier to study in the setting of humans seeking answers to their information needs.

The PROMISE Research Approach

Research Questions and Core Idea: The technological research challenges and questions we seek to tackle are:

1. *About data organization* - RQ1a: How should an organization or system organize primary, trusted *official* data and how should it integrate them with any secondary data, when primary data is not sufficiently available, to improve system usefulness ? RQ1b: What mechanisms should a system use to maintain information provenance as the primary data is spread in opinion networks, to support transparency?
2. *About creation of consumable trustworthy answers* - RQ2a: How should a system use election data and AI methods in creating consumable answers that can maintain user trust ? RQ2b: If answer is created by mixing primary and secondary data, how should the result be presented to users to prominently convey the risks of such a data mixing?
3. *About handling user interaction transparently* - RQ3a: how should (an AI chatbot) system respond to questions based on answer trust quality, its own confidence and estimated impact on users? RQ3b: When and how should the system adopt deflection (i.e, *do-not-answer* (DNA)) strategies to control its response for user safety without losing user trust? Furthermore, the community challenge we seek to tackle is how to create a multi-disciplinary environment that fosters creation and deployment of other AI techniques beyond the scope of our proposal. For example, we envisage the research community wanting to help other stakeholders, especially candidates and election officials. This includes methods for *voter intelligence* like to gauge the pulse (sentiment) of voters on topics so that candidates can make their manifesto, or helping officials in drafting easy-to-understand ballots and propositions.

	South Carolina		Mississippi
	2022	2024	2022
Number of Q/A pairs	30	23	12
Avg question length	10.9	7.58	7.75
Avg answer length	80.9	51.29	119.5
Number of topics	10	8	5
Last updated	Oct 25, 2022	Sept 10, 2024	Nov 11, 2022

Table 1: Statistics about FAQ data. Question and answer lengths are measured in words.

Core Idea - Anchor AI Using Official Data Sources

Create robust decision support AI tools leveraging currently neglected official data and selectively allow mixing of secondary content when they do not adversely impact user trust. Collate, Distribute and improve Comprehension of trusted content (CDC). Debunk misinformation effectively and manage narratives. Leverage upcoming research - all within an empirical framework.

We now discuss how these challenges may be addressed by the AI community with some examples from our ongoing work. Our idea is to leverage data provided by government agencies mandated to provide accurate information by law. These are currently neglected in current AI tools. Furthermore, a system may allow user to selectively mix content from other data sources (called secondary) if they trust their content. We now elaborate this further as a CDC framework.

Collating Election Data - The FAQ information we use to bootstrap our work are from SC and MS. Key statistics about them are shown in Table 1. For 2022, South Carolina’s official website had 30 FAQs (South-Carolina 2022), with average length of the questions being 10.9 words. The average answer length for the questions present in FAQs is 80.9 words. A total of 10 different topics are covered in the FAQ question-answer pairs. The topics include voting information, candidature information, absentee voting, polling information, ballot information, campaign, polling results, recounting, complaints, and general information. 2024 results were similar. Mississippi’s official website, updated in 2022, has 12 question-answer pairs available both in the website (Mississippi 2022). The average length of the questions present in question-answer pairs is 7.75 words, with average length for the answers being 119.5 words (highly verbose). The number of topics covered in the FAQs is 5, belonging to absentee voting, voter registration, voting, information update, and candidature information (few topics).

Since official data is limited, to build a usable system with large coverage of topics, one would need to consider other data sources. One could performing information extraction from open data sources from non-profits like NASED(NASED 2024) and LWV(of Women Voters 2024), and even crowd sourcing, but be cautious about content contamination. Eventually, we expect to build a repository of election FAQs, on the lines of *Wikipedia*, which have general data items as well as region specific. We have created an initial repository along these lines but with a global focus (Lakkaraju et al. 2024). More significantly, enhancement to the repository would be community contributed and moni-

tored, supported by data curation tools. Furthermore, anyone could use data for building new applications for voter engagement under a generous license.

Distribution of Election Information in Opinion Networks - Our motivation here is to understand how election data spreads and evolves in opinion networks so that we can incorporate the insights when organizing, retrieving and presenting data to users promoting trust. Furthermore, users (election officials) can generate and evaluate collaborative human-AI plans to systematically disseminate authentic information via autonomous information-bots or infobots to counter mis/disinformation. Here, we have humans agents (election officials) and AI-enabled simulation models for autonomous agents, called the infobots, embedded with other agents, called the passive agents - replicating a human population, a set of news or media source, physical events, adversarial agents, and an interface through which human users can interact with this virtual information environment.

Our solution would consist of : (Step 1) Modeling official and information disorders (mis/dis information) as topics and time varying opinions; Agent-based modeling for human-bot collaboration incorporating social identities - <affiliation, beliefs, sentiments> , and < sense, perceive, act> , frameworks; Building realistic agents by introducing belief structures and stubbornness in opinion dynamic models. (Step 2) Formulating official information steering on opinion networks as sequential decision problems (SDPs); Solving SDPs for effectively steering information spread using model-based and data-driven methods from planning, reinforcement learning, using and enhancing LLMs for supporting infobots; (Step 3) Simulating large-scale opinion evolution and infobot effectiveness in the presence of human induced physical events, investigating and supporting human-AI interaction for trusted control by developing structured concept models of localized information landscape, and visualizing opinion dynamics over time and intervention strategies.

Improving Comprehension and Trust in Election Data with Chatbots - Regardless of how a system receives election information - from the official (primary) source or by merging primary and secondary data sources or by retrieving them from a social network - we want to help users (voters) get answers to their frequent questions and promote its understanding with trust so that users can make informed decisions. Here, one can promote answer comprehension by many techniques that do not change their meaning - converting their mode (e.g., text to voice), translating them into simpler words or popular slangs, repeating them slowly, changing fonts, generating extractive summaries, etc. To do so, we want to use chatbots that have shown tremendous potential to personalize information at scale. Our hypothesis is that with better information awareness, we will have higher voter participation, especially from the target population.

However, relying on just the popular LLM-based chatbots is not safe. For example, consider the example shown in Figure 2 where the chatbot cites its source (right) when using secondary source. Albeit simple, such answer provenance is not available in LLM-based chatbots. Even worse, they cannot focus on returning just the answers to questions in a list

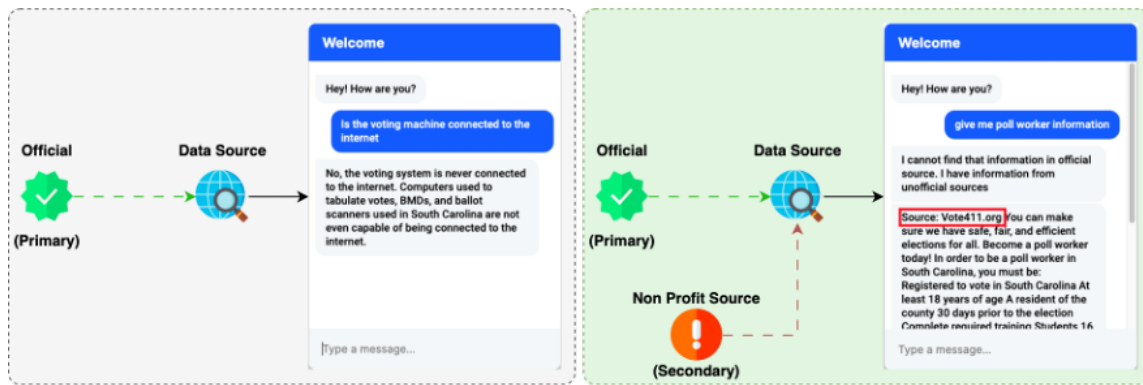


Figure 2: ElectionBot for SC, built using the SafeChat approach, answering a question using the primary data source (left) but needing a secondary data source (right) for another. Merging content increases question coverage but may make the chatbot less trustworthy for some voters. Such a system will improve our understanding of content coverage v/s AI trust trade-off.

reliably as we shown for ChatGPT and Bard in the context of personal finance (Lakkaraju et al. 2023). That is, let a user interact with a chatbot by giving utterance u_i at conversation turn i , and the full conversation be the set U . Given FAQ_α , we want the system response at turn i , s_i to be $\in AUADNA$, where A is the set of all answers in the FAQ and $ADNA$ represents the do-not-answer responses.

Hence, a new approach to building chatbots is needed which combines the strengths of rule-based processing and the generality of learning. We have been working on one such approach called SafeChat (Muppasani et al. 2023) which we built on the open-source Rasa platform (Bocklisch et al. 2017) with following unique properties: a) Organizing questions/ answers from primary sources and maintaining traceability of chatbot response to them, b) Supporting Do-Not-Respond Strategy to promote safety, c) Allowing generalization of intent via language models, d) Supporting automated dialog’s validation of answers, e) Automated rating of chatbot to communicate its expected behavior (Srivastava et al. 2023a), f) A low-programming design pattern that reuses and auto-generates key chatbot building blocks including handling common utterances and providing auditing capabilities. In the context of finance (Lakkaraju et al. 2023), we have showed that a mixed approach can be more reliable with answers and unbiased with respect to gender compared to LLM-based ChatGPT and Bard. But the challenges in elections are unprecedented in objective, data type, scale and societal implications necessitating more innovations at the intersection of neuro-symbolic methods.

Discussion and AI Research Opportunities

Elections officials often define election success as enabling all willing and eligible voters to participate in elections. However, this goal is not tracked today and broadly believed to have been not achieved. Our vision would promote voter literacy and lead to informed voter participation in a world with abundant information but little that a voter can trust. We also need to broader participation by allowing data crowd-sourcing, social audit, and inclusion that will empower and grow the technical community, including technology and

social scientists, to collaborate with government officials and nonprofits in enhancing the election process preferring the existing official information, backed by legal statutes, as the primary source obviating the need for other sources that could introduce information disorders. Now, apart from CDC, we identify two additional AI research challenges that will improve the electoral information ecosystem.

Treating Misinformation Without Loosing Trust in Factual Information: Recent studies have shown that intervening to tackle misinformation may have lasting impact on people’s perception of factually correct information (Ecker et al. 2022). Specifically, intervention methods range in their **continued influence effect** impacting how people view misinformation even after it is corrected and how people view other true information (skepticism) (Hoes et al. 2024). More research is needed to discover safe and effective ways to address misinformation while reducing the information gap.

Narrative Intelligence: Individual pieces of information lead to narratives – an account of connected events, real or fictitious, as stories - circulating in everyday life. We see the need for automated ways to understand and evaluate the meaning and implications of narratives that we call *narrative intelligence* (NI). Once identified, they can be managed as any other information and subject to CDC challenges. Note that NI is complementary to existing challenges in propaganda processing (Ng and Li 2023) which focuses more on multimodal and adversarial aspect of messages rather than NI which does on relational and temporal aspects.

In summary, we presented a vision to stimulates the interdisciplinary research community to consider the unprecedented global societal challenge of conducting credible elections. We raised research questions about data organization, creation of consumable trustworthy answers and handling user interaction transparently. We articulated how tackling them will require the AI community to overcome research challenges that span improving information reliability, improving intervention techniques, characterizing robustness of foundation models and improving user perception of competing narratives, and presented our initial steps along CDC dimensions.

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