Frontline-Grounded AI Futures

Supporting Environmental and Climate Justice Communities Navigating AI Tools, Technologies, and Infrastructures

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Frontline communities, often described as those who face the "first and worst" impacts of environmental harm exacerbated by climate change, hold a unique positionality within sociotechnical systems. In this workshop paper, we discuss preliminary insights from our ongoing interview study exploring how frontline communities and community-based organizations (CBOs) interact with, engage with, and perceive AI technologies, how AI systems impact frontline communities both digitally and infrastructurally, and how frontline stakeholders utilize, engage with, or refuse AI tools and technologies within their work. We conclude with insights for how researchers and practitioners can best collaborate with community-based, frontline organizations to envision AI systems grounded in frontline realities.

CCS CONCEPTS • Human-Centered Computing • Collaborative and social computing

Additional Keywords and Phrases: Frontline communities, AI, data centers, participatory design

1 INTRODUCTION

Frontline communities are those globally who face the "first and worst" impacts of climate change and environmental degradation due to a combination of intersectional marginalization [4] and coproduction [10] in innovation. These communities experience disproportionate environmental harms caused by climate change, like sea-level rise, land loss, natural disaster, pollution, and industrial transition [18, 24]. The resulting environmental harms are often exacerbated by global extractive economies, industrial systems, and preexisting vulnerabilities. In our previous work, we have discussed four types of frontline communities, as commonly described in literature: sensitive ecosystem, infrastructure transition, sacrifice zones, and fenceline communities, as shown in Figure 1 [18].

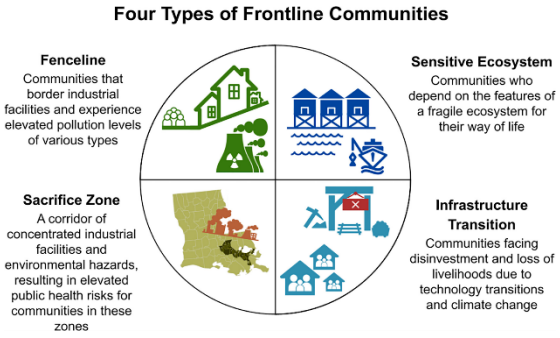

Figure 1: Four types of frontline communities as defined in literature; reproduced with permission from Marston et al., 2025 [18].

Sensitive ecosystem frontline communities often practice traditional or community-specific cultural, economic, land-based, or health-based practices threatened by rapidly-changing ecosystems. For example, Scandinavian Saami communities are facing threats to traditional reindeer herding practices due to climate change and resource extraction [3]. Additionally, some frontline communities are experiencing decarbonization-related infrastructural transitions and associated technological shifts, leading to cultural, social, political, occupational, or health-related effects [18]. Notably, Copenhagen's Copenhill waste-fired energy plant exemplifies this process, replacing aging incineration infrastructure with a waste-to-energy plant with built-in recreational infrastructure [13]. Other infrastructure transition communities contend with the effects and risks of nuclear technologies, nuclear waste disposal, and related land-use, like the wine-producing region Grignan-Les Adhemar in France, which changed its name in 2008 after a uranium leak at the nearby Tricastin Nuclear Power Plant [22]. Fenceline communities are a type of frontline community near an industrial facility, often literally "on the fence-line", creating exposure risk to high levels of industrial pollution [29]. For instance, the Navajo Nation in North America faces increased oil and gas development with insufficient tribal consultation [2]; additionally, in November, Ineos's under-construction plastic plant in Antwerp prompted Europe's largest plastics lawsuit, claiming underestimated environmental and health impacts [14]. Lastly, Sacrifice Zones are created when polluting facilities are consolidated in specific regions, creating significant health impacts for residents [12]. Examples include the Lobito Corridor in Angola [23] and Cancer Alley in the United States [9].

We have previously identified the importance of resistance and self-determination as key aspects of frontline identity; using organizational structures like community-based nonprofits, NGOs, and CBOs, many seek to proactively resist environmental harms within their communities and create sustained joy, well-being, and health for their communities [18]. Supporting these communities is a key environmental and climate justice aim; however, even within mainstream climate movements such as NetZero, institutions, governments, and organizations have not historically shown significant support for frontline causes [11, 28].

1.1 AI, User-and-Community-Centered Needs, and Frontline Communities

Within the ACM sphere, an awareness of the importance of centering user and community needs within AI design processes, AI ethics, and the AI sphere overall is emerging, alongside the effects of positionality and identity on AI. For example, scholars have discussed the pervasiveness of racism and anti-blackness within socio-technical systems [20]; others have documented the assimilative nature of algorithmic visual curation within queer communities [26]. Further, HCI researchers have noted how AI systems and algorithms deal variously with transness and transphobia [5, 25]. Fourth wave

HCI stresses the importance of positionality and the social implications of technology–for example the algorithmic experience of Latinx users on TikTok [15], or how LGBT+ individuals use social media platforms [5, 26] to curate visual cultures and shared spaces. Considering the needs of frontline communities and the individuals within—which occupy both marginalized individual and community positionalities—reveals an important area for emergent HCI scholarship and practice.

Our previous work has shown that frontline communities occupy an important positionality at the individual user level as well as at the organizational level, particularly related to scoping and designing future technologies and processes, such as storytelling [16, 17, 19]. Within the ACM space, scholars have highlighted the value of early involvement from frontline environmental advocates in the design of AI tools [6], the importance of community-based participatory design [8], and the ways ethnic community-based organizations utilize technology within their work [27]. Frontline communities can shape the ways in which social, technological, and infrastructural processes proceed; through organizing, activism, lawsuits, and advocacy campaigns, frontline stakeholders can alter the terms of innovation, making it imperative to engage these communities early, authentically, and in good faith within design processes.

Further research is necessary to understand how frontline communities and CBOs within the environmental and climate justice spaces use, interact with, or resist AI tools and interfaces within their work; how these communities interact with AI systems as a whole, both digitally and physically; and how designers, researchers, and practitioners can best support frontline CBOs in their work for a more sustainable, just future. Our ongoing work considers questions such as:

1. How are AI tools, technologies, and infrastructures impacting frontline communities? What are frontline perspectives on AI systems broadly?
2. Why do frontline stakeholders engage or refuse AI technologies and tools in their work? How are frontline stakeholders engaging with, using, and encountering AI, both digitally and physically?
3. How does AI infrastructure (data centers, power plants, water supply, critical minerals) impact frontline perspectives and practices on AI?
4. How can researchers, practitioners, and frontline stakeholders collaboratively envision AI systems that benefit frontline communities and community-based organizations?

To address these questions, we are conducting an interview study engaging with frontline organizations globally on these issues. We have currently recruited over 30 organizations into the study, and interviews and analysis are ongoing. Herein, we share preliminary results from our ongoing study examining the aforementioned questions. We hope this presentation of preliminary findings and our provocations around studying frontline communities in HCI will initiate important conversations at this workshop.

2 FRONTLINE STAKEHOLDERS AND AI: PERSPECTIVES AND IMPACTS

We find that AI tools, technologies, and infrastructures impact frontline stakeholders both digitally and physically. From an infrastructural standpoint, some frontline stakeholders contend directly with AI-supporting data centers, mines, and power plants sited within their communities; interviewees articulate several concerns with siting processes including: lack of profit sharing and tax benefits, lack of transparency on both procedure and environmental impact, lack of community involvement, lack of exit plan, and absorption of facility costs by communities. Interviewees also discuss experiencing increased energy prices, noise pollution, and air pollution, among other impacts. Many communities perceive they are

being targeted for data centers due to existing marginalized or frontline status. To minimize negative impacts of siting AI infrastructure, frontline stakeholders emphasize due process, monetary equity, environmental impact data transparency, and increased infrastructural capacity that provides tangible community benefit. Those actively resisting AI infrastructures on-the-ground call for stronger regulations and boundaries around AI development, and support in tracking the rapid development of facilities.

Digitally, we find frontline stakeholders exhibit a range of perspectives, reactions, and perceived impacts regarding engagement with AI tools and technologies. Many interviewees view AI as ubiquitous, and are not generally AI adversarial, but hold concerns that the technology is moving too quickly for meaningful community input, leading to overwhelm when engaging with AI interfaces. Interviewed stakeholders felt a range of emotions when interacting with AI tools: apprehension, excitement, and even shame.

3 FRONTLINE ENGAGEMENT AND REFUSAL IN THE AI REALM

We find that frontline stakeholders engage with AI in various ways, both intentionally and unintentionally, and for various reasons; some frontline stakeholders refuse AI altogether. Frontline AI users, often representing capacity-constrained CBOs, utilize off-the-shelf tools to supplement low organizational capacity in a number of different ways: offloading administrative labor, building communications capacity, and generating content related to their work. For example, stakeholders discussed using AI tools like ChatGPT and Claude to write grants, develop strategy documents, and generate reports; others use organizational tools with AI integrations, like CRM software. Efficiency and speed are key motivators for frontline AI use; many interviewees view AI as a way to "keep up" with a constant flow of organizational tasks, grant applications, and reporting requirements. Frontline users are generally aware that these tools are neither transparent in how data and resources (such as water and land) are used, nor are they specific to their communities' needs, pushing many to seek limited use of the tools. We find some frontline AI users desire AI tools built specifically with frontline needs in mind; interviewees, particularly those from BIPOC organizations, expressed a need for tools built to support environmental justice goals within their local, organizational, and community contexts.

While some frontline stakeholders actively use AI within their environmental and climate justice work, others seek to refuse AI tools and technologies altogether. A primary concern revolves around surveillance and data privacy. For example, many stakeholders within the United States expressed concern about surveillance, community safety, data security, and AI use given the prevalence of ICE raids and targeting of frontline immigrant communities. Particularly when organizing around sensitive issues within marginalized communities, data security was raised as a top concern; this sentiment often connects to historical disenfranchisement of BIPOC communities within STEM sectors. Additionally, frontline AI refusers also express concern that regular AI use reduces literacy. Fundamentally, these stakeholders believe in the power of the human brain, and fear the brain atrophy that regular AI use, particularly for complex tasks like writing and data analysis, may create. Another motivator for AI refusal revolves around morality: many frontline stakeholders lament the adverse impacts of AI systems on both the environment and other communities. Some stakeholders discussed the effects of individual AI use in terms of wasted water and energy, while others felt solidarity with communities affected by data centers. Lastly, other frontline CBOs are beginning to intentionally consider the positionality-laden aspects of AI use and refusal, exhibiting a desire to think critically about when, where, and how to use AI tools in their organizational tasks, if at all, leading to the development of organizational norms for AI use.

4 DATA CENTERS, INFRASTRUCTURE, AND PERCEPTIONS OF AI

As discussed in Section 2, many frontline communities are directly impacted by the physical infrastructure underpinning AI systems, particularly data centers. This is an emergent environmental justice issue, particularly in infrastructure transition frontline communities; this discourse affects frontline perspectives on AI, contributing to the overwhelm discussed in Section 2. Interviewees expressed an inability to keep up with the amount of new data centers cited in their communities, leading to an overall sense of helplessness. Other interviewees felt a sense of AI nihilism. When working in solidarity with infrastructure transition communities dealing with data center siting, they felt that utilizing AI was hypocritical, yet, in some cases, seemingly required, particularly when using apps with AI-integrated features. This poses a moral quandary for many frontline AI users: how can one use AI tools, when AI infrastructure is harming other communities? In dealing with this moral quandary, frontline stakeholders feel overwhelmed and frustrated by the mis- and dis- information regarding the impacts of data centers on communities.

5 CONCLUSION AND PROVOCATIONS

We conclude with implications for how researchers, practitioners, and frontline stakeholders can envision, build, and support AI systems and futures that are grounded in frontline community needs, priorities, and realities, surfacing the following insights:

1. Frontline users seek locally-bounded, human-centered AI tools prioritizing integrity as a core value [1, 7]. Researchers and practitioners should support the design and development of tools that prioritize community needs.
2. Frontline users desire AI tools that are bounded, private, contextual, and sovereign. HCI can prioritize the building of tools that support capacity building efforts of frontline CBOs, and/or facilitate connection and advocacy within the unique cultural, social, or ecosystem-based features of a given frontline community.
3. Transparency on environmental impacts and data security is critical for frontline AI users. Rendering an AI system's impacts visible—from how sensitive data is used to how data centers affect electricity prices and local pollution—is necessary to build trust with community stakeholders. HCI researchers and practitioners can seek opportunities to design platforms and systems that make the environmental and data impacts of AI transparent and accessible, and work to normalize environmental transparency within the AI sector.
4. For existing tools and platforms, HCI should seek to strengthen user autonomy and self-determination, privacy, and safety within AI systems. Centering frontline community priorities within the design process is critical, as well as throughout the entire life cycle of a tool, technology, or interface.
5. Infrastructurally, researchers and practitioners should support community, state, or provincial rights relating to AI development, contrasting the current approach of streamlined permitting, relaxed regulations, and co-sited polluting infrastructure.

These insights contribute directly to several of the five thematic directions identified by the HCI-TERRA workshop organizers [21]. Frontline users desire accountability and transparency regarding the impacts of AI systems and infrastructures, surfacing a keen desire for collaboratively designed, accessible tools for Eco-feedback. Additionally, this work surfaces a suite of varied and often nuanced frontline perspectives and experiences on AI, particularly in relation to the way researchers can best support these communities, on the *terms* of these communities—whether through resistance, community involvement in design processes, or in building collective agency and sovereignty within AI systems. Accordingly, this work raises a critical need for participatory design approaches accessible to frontline users, and a desire for frontline-built, community-centered AI technologies that can achieve tangible community benefit.

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