The Labor of Training Artificial Intelligence: Data Infrastructure, Mobility, and Marginality

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Machine intelligence relies on Al (artificial intelligence) trainers, workers who perform labor such as data annotation and algorithm optimization. However, the promise of Al does not often benefit workers equally; instead, it puts them in precarious situations, e.g. low wages and subordination to machines. This work takes an interdisciplinary approach to draw attention to these pressing issues by exploring the sociotechnical, cultural, and economic dimensions of this emergent technology-mediated labor, in the context of large data infrastructures. Our arguments and proposed concepts (e.g., sociotechnical/algorithmic mobility) respond directly to the under-theorization of mobility research and ecologically unequal exchange theory in HCI. In this position paper, we argue that the Al trainers, who often work in developing regions of western China, are shouldering the burdens of (1) alleviating China's poverty through Al for development programs, (2) sustaining Eastern China's platform economy as key participants in large-scale data infrastructure projects, and (3) promoting global Al advancement by providing disembodied labor on products such as high-quality training datasets through repetitive and low-paying work. Using multi-sited ethnography and participatory design methods, this work describes the experiences of under-resourced and under-studied Al trainer communities and the effects of AI on them. This work also offers context-sensitive design recommendations for supporting emergent technology-mediated labor and policy interventions for ethical and sustainable Al training practices.

CCS Concepts: • **Human-centered computing → Empirical studies in HCI**; **Empirical studies in collaborative and social computing**.

Additional Key Words and Phrases: Al labor, infrastructure, data justice, mobility, marginality

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1 OVERVIEW

This work offers an ethnographic account of Al trainers, an emergent category of laborers in China, who complement, augment, and sometimes substitute for autonomous Al systems when they fall short. This is important because, despite the promise of AI, it does not benefit everyone equally, especially those contributing their labor; workers are often in precarious situations, e.g., experiencing low wages, strict surveillance, and subordination to machines routines [7, 11]. Our preliminary research also revealed some concerning aspects of this labor.

This work directly responds to the under-theorization of mobility research and ecologically unequal exchange theory in human-computer interaction (HCI). Building on preliminary fieldwork, We (1) explore Al trainers' motivation, aspirations, and experiences with this new profession through the lens of sociotechnical mobility, (2) investigate the

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role of large-scale data infrastructures in amplifying existing socioeconomic inequalities, and 3) recommend better ways to design social technologies to support trainers' needs and foster the ethical production of Al technologies.

2 BACKGROUND

On February 17, 2022, China approved the Dongshu Xisuan (DX) initiative ("data in the east, computing in the west"), a strategic large-scale infrastructure project that builds data centers in underdeveloped western regions to support the platform economy of China's wealthier east. China has one of the largest platform economies [18], which is often empowered by Al technology, requiring enormous labor and resources [3]. This initiative will significantly impact the mobility of both data and digitally-mediated labor, especially that of AI trainers in western China. They generally perform the labor of data analysis and annotation, algorithm selection and optimization, model training, and project design, work that is crucial for developing Al technologies.

Although considered "invisible" work in Western countries [5], in China AI trainers have a clearly defined career path with new professional standards. The DX initiative will likely increase the demand for AI trainers and spawn crowdsourcing companies in western China [17]. For example, the Chinese technology company Alibaba launched an AI trainer initiative, partnering with local governments in the west to train and hire thousands of low-resource individuals. Al trainer demand in China is expected to hit 2 million by December 2022 [16]. While this growth may seem auspicious, unfortunately, the promise of AI often does not benefit everyone equally, especially, technology-mediated labor like Al trainers, although their underpaid and disembodied labor benefits people locally and transnationally.

2.1 Theoretical Framework

2.1.1 Ecologically Unequal Exchange Theory. The theory of ecologically unequal exchange (EUE) explains how wealthier countries maintain high levels of consumption and technological development through net imports of resources from developing nations, "displacing a significant amount of work and environmental loads" onto them [12]. The theory has been used generally to analyze the uneven distribution of labor and resources, such as energy and labor [4, 8]. In this position paper, we argue that it can be applied as a generative sociotechnical lens for studying data justice and Al production. It can also reveal how institutions like states and technology companies extract human labor, rationalizing it as development or technological advancement. EUE theory focuses on power asymmetries between developed and developing nations. We refine this focus by arguing that the theory should examine structural inequalities between developed and developing regions within a particular state; that is, it should focus on intra-state as well as inter-state power dynamics. This work extends and responds directly to the under-theorization of EUE theory in HCI by focusing on how new forms of injustice are rooted in established structural inequalities in the area of data-driven technology, specifically Al production.

2.1.2 Sociotechnical Mobility. This work is also concerned with the mobility of labor, data, and technologies. We explore these different modes of mobility in relation to Al trainers and large-scale data infrastructure. We argue that mobility can be studied as a socio-technical construct by integrating social science and HCI scholarship. This work is guided by our human-centered definition of "sociotechnical mobility," as socially and technically produced motion that concerns both mobile physical bodies and human interactions and their representation online and offline. Furthermore, we contribute to a human-centered conceptualization of algorithmic mobility by arguing that this concept is multi-dimensional, including the logic of algorithmic systems that renders laborers' movements algorithmic. Moreover, the dominant frameworks around mobility center around mobility and immobility [1, 13]. Drawing from feminist science

and technology studies (STS) scholarship [6], We contest this dichotomous understanding of mobility and argue that mobility should be seen as a multivalent construct; that is, mobility should be refigured as a construct with multiple dimensions, such as immobility, micromobility, and hypermobility.

2.2 Research Questions

To expand these under-theorized areas, this work draws from a multi-sited ethnographic study [10] centered around digitally mediated labor in the context of the DX initiative. We focus on computing hubs in eastern China, connected computing hubs in northwest China, and Chengdu-Chongqing economic circle. This work asks:

RQ1: *Why and how does digitally-mediated labor, i.e., AI trainers perform and find meaning in their work?*

RQ2: *How do large-scale data infrastructures such as those envisioned by the DX initiative reconfigure computing work and impact China's rural economy and beyond?*

RQ3: *What are the implications for social technology design and policy intervention can be identified to better support digitally-mediated labor, i.e., AI trainers?*

3 METHODS

We will conduct a two-phase qualitative study that involves online and in-person ethnography (RQ1 and RQ2) and participatory design (RQ3).

3.1 Phrase 1: Virtual and in-person ethnography

Ethnography will capture the depth of Al trainers' experiences and reveal the complexities around their expanding communities propelled by the DX initiative. We will conduct semi-structured interviews, participant observation, and online and in-person fieldwork. We will follow approximately 40 participants who perform different types AI training work and conduct online and in-person participant observations and semi-structured interviews. Interviews last around 120 minutes. The semi-structured interview protocol includes demographic information, life before and after becoming an AI trainer, their labor, their social media use related to their work practices, obstacles, and available support.

3.2 Phrase 2: Participatory design

Building from Phrase 1's empirical work, We will be well-positioned to design social technologies to support AI trainers in managing work-related challenges (e.g., isolation and career transition difficulties). To address RQ3, We will propose community-centered participatory design sessions [14] where participants will co-design social technology with Al trainers at three to four rural locations in China. Specifically, We will conduct a series of participatory design workshops in three different Al training communities. These sessions will include design activities to elicit design guidelines for (1) evaluating existing sociotechnical systems and (2) developing innovative prototypes to support Al trainers and other similar digitally mediated labor. More importantly, the insights generated by synthesizing the results from Phases 1 and 2 with the results of the participatory design work will be used to develop context-sensitive guidelines for humane, ethical, and sustainable Al training practices and policy interventions for computing communities in China and beyond.

3.3 Data Analysis

We will conduct iterative thematic analysis, including open coding, thematic grouping of codes, and frequent memoing with all qualitative data [2, 15]. We will inductively develop a codebook that describes participant experiences.

4 IMPACT

Using an interdisciplinary approach grounded in HCI, STS, and China studies, this project contributes knowledge about how technology-mediated labor like Al trainers performs the labor that sustains regional and global economic and technology agendas. At the core of this project stands our enduring commitment to public scholarship, to understanding and designing social technologies as a positive force for social change on the local and transnational levels, and to fostering collaboration across disciplines.

4.0.1 Intellectual merit: This work responds to the urgent need to better understand under-resourced communities and the effects of AI on their work experience [3]. Through our empirical studies of Al trainers in the context of rural and global computing, this work will provide several points of departure for exploring the intersection of data infrastructure, labor, and mobility in conversation with China studies, HCI, and STS scholarship.

China studies: In respect to data and the use of artificial intelligence in China, current research focuses predominantly on surveillance [9, 19]. This work will open a new line of research on technology-mediated labor and the political economy of data (RQ1-2).

HCI and STS: This dissertation extends the interests of HCI and STS to digitally-mediated labor and infrastructure and responds to the under-theorization of mobility research and EUE (RQ1-2). Specifically, this work extends EUE theory and contributes to the concept of sociotechnical/algorithmic mobility and mobility as a multivalent construct in the context of Al labor and large-scale data infrastructure.

4.0.2 Design and policy implications: This research (RQ3) aims to influence how social technologies like data labeling systems can be better designed to support AI trainers in navigating work-related challenges with an emphasis on human-centered design implications. The proposed research (RQ1-3) will also generate empirical data to inform context-sensitive guidelines and policy for ethical, responsible, and sustainable Al training practices regarding machine learning and to reduce harm to workers.

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