Human Comprehension of Fairness in Machine Learning

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ABSTRACT

Bias in machine learning has manifested injustice in several areas, with notable examples including gender bias in job-related ads [4], racial bias in evaluating names on resumes [3], and racial bias in predicting criminal recidivism [1]. In response, research into algorithmic fairness has grown in both importance and volume over the past few years. Different metrics and approaches to algorithmic fairness have been proposed, many of which are based on prior legal and philosophical concepts [2]. The rapid expansion of this field makes it difficult for professionals to keep up, let alone the general public. Furthermore, misinformation about notions of fairness can have significant legal implications.[1]

Computer scientists have largely focused on developing mathematical notions of fairness and incorporating them in fielded ML systems. A much smaller collection of studies has measured public perception of bias and (un)fairness in algorithmic decision-making. However, one major question underlying the study of ML fairness remains unanswered in the literature: *Does the general public understand mathematical definitions of ML fairness and their behavior in ML applications?* We take a first step towards answering this question by studying non-expert comprehension and perceptions of one popular definition of ML fairness, *demographic parity* [5]. Specifically, we developed an online survey to address the following: **(1)** Does a non-technical audience comprehend the definition and implications of demographic parity? **(2)** Do demographics play a role in comprehension? **(3)** How are comprehension and sentiment related? **(4)** Does the application scenario affect comprehension?

We present participants ($n = 147$) with one of three simple, but realistic, decision-making scenarios where fairness plays a role – **Art Project (AP):** distributing awards for art projects amongst primary school students, **Employee Awards (EA):** distributing employee awards at a sales company, and **Hiring (HR):** distributing job offers to applicants. Each scenario is accompanied by a *fairness rule* (corresponding to demographic parity), expressed in each scenario's context. We ask several questions related to the participants' comprehension of and sentiment towards this rule. Tallying the number of correct responses to the comprehension questions gives us a *comprehension score* for each participant.

We find that this comprehension score is a consistent and reliable indicator of understanding demographic parity. Exploratory analysis reveals that education level is an important predictor for comprehension, and that *negative* sentiment is associated with *greater* comprehension of demographic parity. Moreover, the nature of the scenario (AP, EA, or HR) does not appear to influence comprehension. These findings inspire several areas for future work. Moreover, our work could be extended to similar investigation of other fairness definitions such as equal opportunity [6], equalized odds [6], calibration [8], and causal fairness [7].

[1] https://www.cato.org/blog/misleading-veritas-accusation-google-bias-could-result-bad-law

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CCS CONCEPTS

• **Human-centered computing → Human computer interaction (HCI)**; • **Applied computing →** *Law, social and behavioral sciences.*

KEYWORDS

human-computer interaction, algorithmic bias, fair machine learning, empirical study

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