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Bias in AI-Driven Diagnostic Tools in Dentistry

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Artificial intelligence (AI) is transforming the landscape of dentistry by enhancing the accuracy and efficiency of diagnostic processes. Through technologies such as machine learning and natural language processing, AI is increasingly being used to interpret radiographs, predict disease progression, and identify patients at risk of developing dental conditions. However, while AI offers immense promise, its integration into healthcare—particularly dentistry—also raises critical concerns about bias embedded in data and algorithms. These biases can perpetuate existing disparities, especially among marginalized and underserved communities.[1]

One of the primary sources of bias in AI stems from the use of homogeneous datasets that do not adequately represent the diversity of the general population. AI tools trained on data lacking representation across key demographic variables—such as age, gender, ethnicity, and socioeconomic status—often perform unequally across different groups. This can lead to diagnostic tools that deliver more accurate results for some populations while producing misleading outcomes for others. Addressing this issue is essential for ensuring that AI-driven tools in healthcare are both effective and equitable. For instance, AI tools trained on data that do not represent the broader population—across dimensions such as age, gender, race, and socioeconomic status—may perform well but exhibit biased outcomes favoring specific groups. Addressing such biases is essential to enhance the effectiveness and equity of AI applications in diverse healthcare settings.[2]

Biased AI technologies pose risks to diagnosis and patient care, particularly when unbalanced datasets or flawed training systems are used—or worse, when bias is embedded intentionally. Unchecked biases can lead to overdiagnosis or undertreatment of conditions such as caries, periodontal diseases, and oral malignancies. These conditions may present differently depending on a patient's genetics and lifestyle. Using such imbalanced data not only preserves but may amplify existing health inequities. A promising solution is the application of generative AI to create synthetic datasets that reflect the broad variability found in real-world populations. These datasets enable the development of more universally generalizable models.[3]

AI models built predominantly on data from privileged institutions may not generalize well to underserved or low-resource communities, where untreated dental conditions are prevalent. This dataset bias can result in unequal care, as AI systems might overlook critical diagnostic markers specific to certain demographics. Moreover, algorithmic bias—such as misrecognition of culturally specific traits or non-sensitive feature selection—can further aggravate health disparities. The "black box" nature of AI complicates this issue, as it becomes difficult to understand or trace the decision-making process, limiting a clinician's ability to detect or correct such biases.[4]

Ultimately, addressing these challenges requires collaborative efforts between software developers, dental researchers, and public health professionals. These stakeholders must focus on expanding and diversifying datasets to accurately reflect real patient populations. By prioritizing diversity, transparency, and continuous evaluation, we can optimize the potential of AI to provide equitable dental diagnoses and care for all individuals, regardless of background.

REFERENCES

1. Sribala, Vidyadhari, Chinta., Zichong, Wang., Xingyu, Zhang., Thang, Doan, Viet., Ayesha, Kashif., Monique, Antoinette, Smith., Wenbin, Zhang. 2. AI-Driven Healthcare: A Survey on Ensuring Fairness and Mitigating Bias. (2024). doi: 10.48550/arxiv.2407.19655
2. Zaid, H., Khoury., Allyson, Ferguson., Jeffery, B., Price., Ahmed, S., Sultan., Rong, Wang. 2. Responsible artificial intelligence for addressing equity in oral healthcare. Frontiers in oral health, (2024). doi: 10.3389/froh.2024.1408867
3. Emma, A., M., Stanley., Raissa, Souza., Anthony, Winder., Vedant, Gulve., Kimberly, Amador., Matthias, Wilms.,

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Nils, D., Forkert. 4. Towards objective and systematic evaluation of bias in artificial intelligence for medical imaging. Journal of the American Medical Informatics Association, (2024). doi: 10.1093/jamia/ocae165

4. Kan, Yekaterina. 5. Challenges and Opportunities for AI in Healthcare. International journal of law and policy, (2024). doi: 10.59022/ijlp.203

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