

Review Form 3

Journal Name:	Journal of Engineering Research and Reports
Manuscript Number:	Ms_JERR_127156
Title of the Manuscript:	Leveraging Synthetic Data as a Tool to Combat Bias In Artificial Intelligence (AI) Model Training
Type of the Article	Peer- Review

General guidelines for the Peer Review process:

This journal's peer review policy states that **NO** manuscript should be rejected only on the basis of '**lack of Novelty**', provided the manuscript is scientifically robust and technically sound. To know the complete guidelines for the Peer Review process, reviewers are requested to visit this link:

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PART 1: Review Comments

Compulsory REVISION comments	Reviewer's comment	Author's Feedback <i>(Please correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)</i>
Please write a few sentences regarding the importance of this manuscript for the scientific community. Why do you like (or dislike) this manuscript? A minimum of 3-4 sentences may be required for this part.	This manuscript contributes significantly to the scientific community by addressing a critical challenge in AI: the mitigation of bias in training data. It explores the innovative use of synthetic data, specifically through generative adversarial networks (GANs), to enhance demographic inclusivity and fairness in AI models. The findings that synthetic data can improve fairness metrics—like demographic parity and equality of opportunity—without sacrificing predictive accuracy are compelling, particularly in sensitive areas like healthcare, criminal justice, and finance. The manuscript's exploration of the benefits and limitations of synthetic data, along with its ethical recommendations for enhancing generative models and incorporating human oversight, provides valuable insights into responsible AI development. I appreciate the manuscript's rigorous analysis and timely focus on a topic that holds great potential for advancing equity in AI, though it could benefit from more in-depth discussion on the practical challenges and limitations of implementing synthetic data in real-world applications.	
Is the title of the article suitable? (If not please suggest an alternative title)	The current title, "Leveraging Synthetic Data as a Tool to Combat Bias In Artificial Intelligence (AI) Model Training," is generally suitable, as it clearly reflects the primary focus of the study—using synthetic data to address bias in AI training. However, it could be refined to be more specific and engaging while also capturing the methodological approach (i.e., the use of GANs) and the outcomes (i.e., improvements in fairness and bias mitigation). However, if a more descriptive or engaging title is desired, an alternative could be: "Mitigating Bias in AI Model Training with Synthetic Data: A GAN-Based Approach", This title is more concise and highlights both the purpose (mitigating bias) and the method (GAN-based approach). It also emphasizes the connection between synthetic data and AI training.	
Is the abstract of the article comprehensive? Do you suggest the addition (or deletion) of some points in this section? Please write your suggestions here.	The abstract provided is well-written and communicates the core findings of the study clearly. It covers the methodology, results, and implications, which is essential for a strong abstract. However, a few suggestions could make it even more comprehensive and reader-friendly. Here's a more detailed breakdown: I suggest the following additions: "Synthetic data's efficacy" – While this is a clear phrase, briefly specifying what "efficacy" refers to (i.e., its ability to reduce bias, improve fairness, etc.) could make the abstract more informative. "KS tests, KL divergence, and Inception Score" – These terms are technical and may not be immediately familiar to all readers. Consider providing a brief explanation or including their purpose in the context of the study (e.g., "to measure the distribution similarity between synthetic and real data" or "for evaluating model fairness and data fidelity").	
Are subsections and structure of the manuscript appropriate?	Based on the provided excerpts, the subsections and structure of the manuscript appear to be appropriate for the topic being addressed. Here are some observations regarding the structure: Potential New Section: Ethical Considerations ; Given the focus on AI bias and fairness, it might be worth adding a short section dedicated to Ethical Considerations . This could address potential ethical concerns when using synthetic data (e.g., unintended consequences of bias in synthetic data), how to ensure transparency, and the importance of aligning AI development with ethical principles. Clarification of Fairness Metrics ; If the target audience is not familiar with fairness metrics, consider briefly elaborating on demographic parity and equality of opportunity in the introduction or literature review. This would help non-expert readers better understand the significance of the results.	

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<p>Please write a few sentences regarding the scientific correctness of this manuscript. Why do you think that this manuscript is scientifically robust and technically sound? A minimum of 3-4 sentences may be required for this part.</p>	<p>The manuscript demonstrates scientific robustness and technical soundness in several key areas. First, the study addresses a critical and timely issue in AI model training: bias mitigation. By leveraging Generative Adversarial Networks (GANs) to generate synthetic datasets, it offers a well-established, cutting-edge solution to mitigate bias in AI models, particularly in domains like criminal justice, healthcare, and finance, which are highly sensitive to fairness concerns. The methodology is scientifically rigorous, utilizing established fairness metrics such as demographic parity and equality of opportunity, and employing statistical tests (KS tests, KL divergence, and Inception Score) to assess both fairness and fidelity. This ensures a comprehensive evaluation of synthetic data's efficacy in reducing bias while maintaining model accuracy. And also the manuscript is scientifically rigorous, as it employs appropriate and well-validated methodologies to explore a pressing issue in AI ethics, backed by a thorough review of literature and contemporary case studies. It is technically sound because it uses robust statistical and fairness evaluation metrics, providing a solid foundation for its conclusions.</p>	
<p>Are the references sufficient and recent? If you have suggestions of additional references, please mention them in the review form. =</p>	<p>The references you've listed are diverse and include both recent and highly relevant works in the field of artificial intelligence (AI) with an emphasis on synthetic data, bias, fairness, and healthcare applications. Many of them are from reputable journals and cover a range of topics that align well with the subject matter you're addressing. However, a few points could be considered to ensure comprehensive and recent coverage: , I suggest the following: Recent Publications (2023-2024): The majority of the references are from 2023 and 2024, which ensures up-to-date information. For instance, works like Abramoff et al. (2023) and Adel Remadi et al. (2024) address current challenges in AI applications, data integrity, and fairness, which are critical topics in the field.</p> <ol style="list-style-type: none"> 1. Diverse Sources: The references span different facets of AI, such as ethical considerations (e.g., Aldoseri et al. 2023, Akter et al. 2022), healthcare applications (e.g., Giuffrè & Shung 2023, Murtaza et al. 2023), synthetic data generation (e.g., Miletic & Sariyar 2024, Goyal & Mahmoud 2024), and fairness in AI models (e.g., Díaz-Rodríguez et al. 2023, Pagano et al. 2023). 2. Reputable Journals: Many references are from well-known journals and publishers, such as npj Digital Medicine, Applied Sciences, Journal of Business Research, and Data & Knowledge Engineering. This adds to the credibility of the source 	
<p>Minor REVISION comments Is the language/English quality of the article suitable for scholarly communications?</p>	<p>Based on the excerpts provided, the language and English quality of the article appear to be suitable for scholarly communication. Here are some observations regarding the language quality:</p> <ol style="list-style-type: none"> 1. Clear Focus and Structure: The article is well-structured, with a clear abstract and introduction that define the scope and objectives of the study. 2. Relevance: The topic is timely, and the references to current trends, such as the increasing adoption of synthetic data, demonstrate relevance to ongoing debates in AI ethics and data science. 3. Technical Terminology: The article uses appropriate technical language related to AI, synthetic data, bias, and model evaluation, which is essential for scholarly communication in this field. 4. References to Recent Studies: The inclusion of recent studies provides context and depth to the discussion, demonstrating a solid literature base. 	
<p>Optional/General comments</p>	<p>Nil</p>	

PART 2:

	<p>Reviewer's comment</p>	<p>Author's comment (if agreed with reviewer, correct the manuscript and highlight that part in the manuscript. It is mandatory that authors should write his/her feedback here)</p>
<p>Are there ethical issues in this manuscript?</p>	<p><i>(If yes, Kindly please write down the ethical issues here in details)</i></p>	

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