

Tri-dimensional Sustainability of Artificial Neural Networks – Dilan Carsane

Research Aim

The research aim was to identify the broad economic, environmental, and social sustainability impacts of Artificial Neural Networks (ANNs).

Context

ANNs are designed to mimic human brain functionality, using multiple processors to handle large datasets with non-linear relationships (El-Shahat, 2018). Key issues include overfitting, hardware limitations, and biases in training data (Baklacioglu, Turan & Aydin, 2018; van Wynsberghe, 2021).

Research Methods

The research employed a qualitative approach, reviewing existing literature on ANN sustainability impacts. The selection of articles was subjective, and no systematic filtration was used, which may limit the accuracy of the findings.

Research Data

Data was gathered from various case studies and literature sources, focusing on the sustainability impacts of ANNs. Key metrics include accuracy, bias, energy consumption, and environmental footprint.

Analysis and Discussion

Social Sustainability: Bias in training data can lead to inaccurate and discriminatory outcomes, particularly in underrepresented areas (Kim et al., 2021). The social implications include privacy concerns and the potential for biased decision-making (Serna et al., 2020).

Economic Sustainability: ANNs can predict financial distress and bankruptcy with high accuracy (Lobeev, 2021; Gavurova et al., 2022). However, their effectiveness varies across industries and regions (Dube, Nzimande & Muzindutsi, 2023). Information

asymmetry and fraud detection are areas where ANNs show promise but require further research (Jan, 2021a).

Environmental Sustainability: ANNs have significant energy and water consumption, with carbon emissions varying by location (Lacoste et al., 2019). The environmental impact includes raw material consumption and potential increases in resource demand due to efficiency gains (Ligozat et al., 2021).

Conclusions

ANNs offer substantial benefits in data analysis, decision-making, and forecasting. However, they face significant challenges in sustainability due to biases, energy and water consumption, and unintended social consequences. The research highlights the need for more representative training data and improved transparency in ANN decision-making processes.

Implications

The findings suggest that while ANNs have the potential to enhance sustainability in various sectors, careful consideration of their environmental and social impacts is crucial. Policymakers and researchers should focus on developing guidelines for ethical and sustainable ANN implementation, ensuring that the benefits outweigh the potential drawbacks.

[Full Report and references](#)

