Cluster Innovation Centre
University of Delhi

CryptoCarbon Insight: Predictive Analysis of Bitcoin Emissions Using LSTM

Mentored by: Dr. Sanjeewani Sehgal
Submitted by: Dhruv & Shivam Saini

Introduction

Bitcoin's rise has sparked environmental concerns due to the significant energy consumption of its mining processes, which contribute to large-scale carbon emissions. As Bitcoin's adoption increases, so does its environmental impact, posing a serious threat to sustainability.
To address this issue, we predicted future carbon emissions using a Long Short-Term Memory (LSTM) model, a type of recurrent neural network ideal for time series forecasting. Our goal is to provide insights into Bitcoin's potential environmental impact and inform strategies for more sustainable cryptocurrency practices.

Objective

The objective of this study is to predict the future carbon emissions of Bitcoin using a Long Short-Term Memory (LSTM) model. By accurately forecasting these emissions, we aim to:

1. Highlight the potential environmental impact of Bitcoin's continued growth.
2. Provide data-driven insights to inform policymakers and stakeholders.
3. Encourage the development and adoption of more sustainable practices within the cryptocurrency industry.

Data & Methodology

The raw data for this study, sourced from the Cambridge Blockchain Network Sustainability Index (CBECI), spans from 18/07/2010 to 25/04/2024 and includes 5030 days of CO2 emissions data from hydroelectric power, coal power, and mixed energy sources. We focused on Bitcoin due to its high market cap and significant electricity consumption. The data was categorized into three scenarios: Best Case (hydroelectric power), Best Guess (mixed sources), and Worst Case (coal power), with emissions measured in Mt CO2e. Using a Long Short-Term Memory (LSTM) neural network for time series prediction, we prepared and cleaned the data, then split it into 70% for training and 30% for testing. We trained the LSTM model using the Adam optimizer and mean squared error loss function across 200 epochs in Keras, predicting future emissions for May, June, and July 2024. While a Transformer model could offer better accuracy, data limitations led us to use the LSTM model, enabling us to predict Bitcoin's future carbon emissions and inform strategies to mitigate its environmental impact.

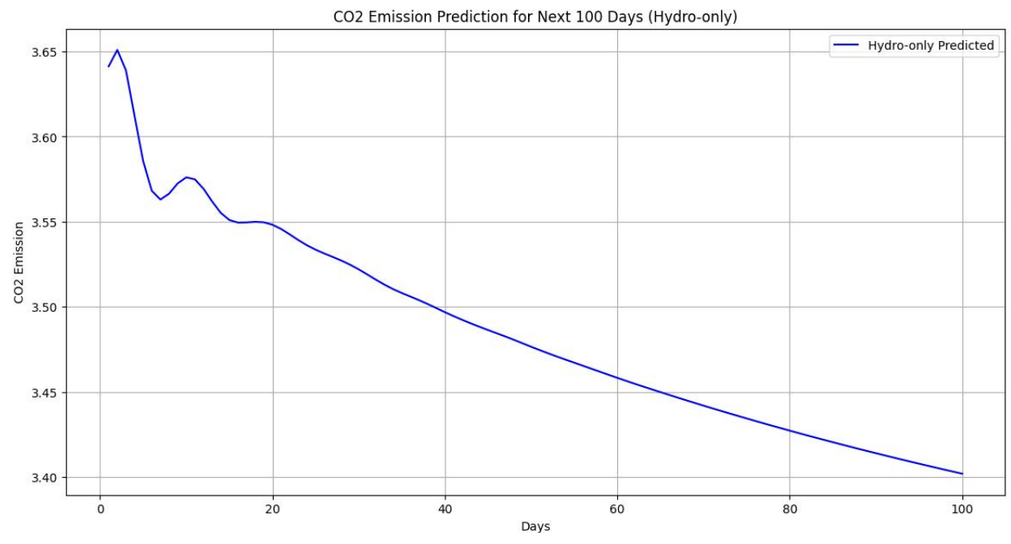
Discussion

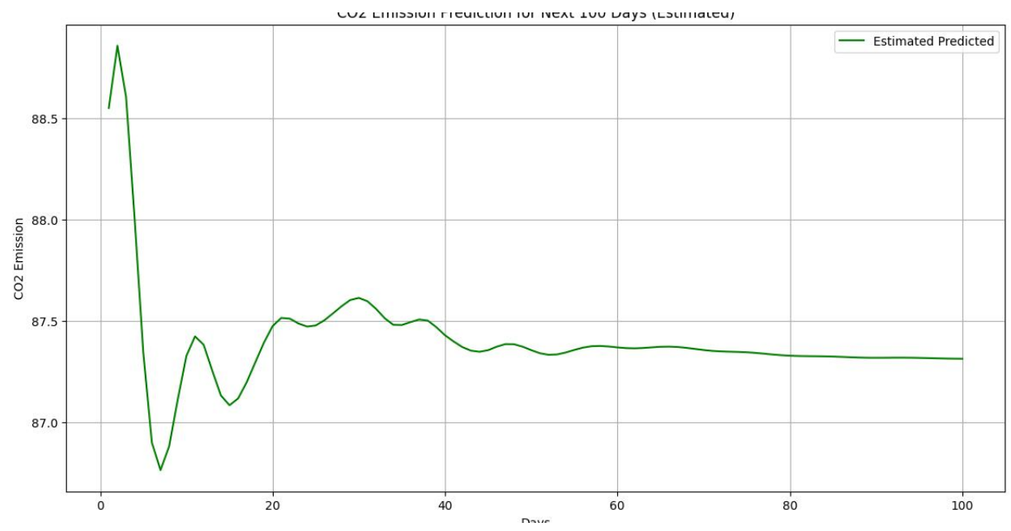
Cryptocurrencies like Bitcoin pose a significant environmental threat due to their high energy consumption and carbon emissions. Bitcoin mining demands substantial computational power, often relying on non-renewable energy sources like coal, which exacerbates global greenhouse gas emissions and climate change.
To mitigate these impacts, it's essential to shift Bitcoin mining to green energy sources such as hydroelectric, solar, and wind power. This transition would drastically reduce the carbon footprint of Bitcoin mining, aligning the cryptocurrency industry with global efforts to combat climate change and promoting long-term sustainability. Prioritizing green energy is crucial for minimizing the environmental impact of cryptocurrencies and ensuring their responsible growth.

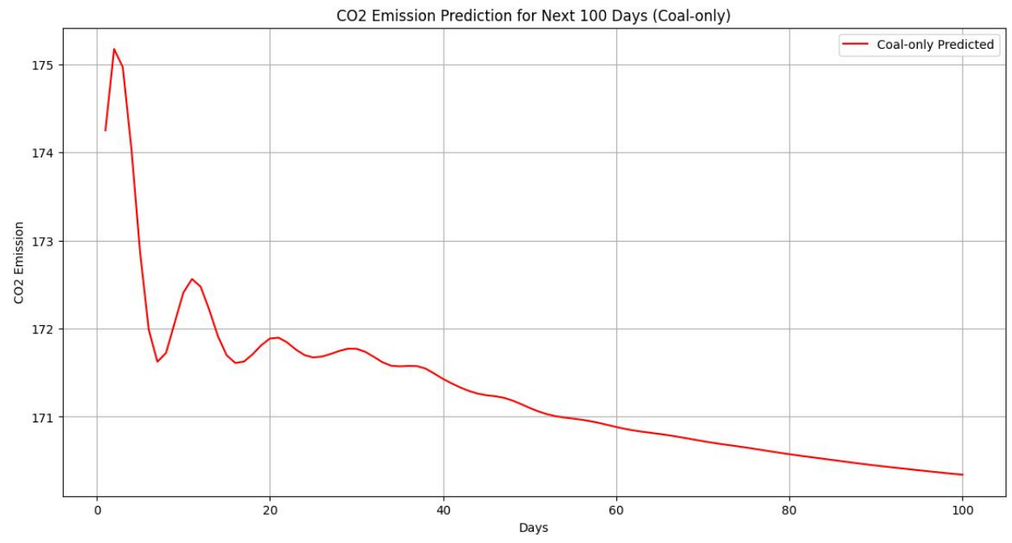
Conclusion

Despite graphs suggesting a decrease, Bitcoin's rising value, now around $69,000 per coin, has spurred mining activity, making the process more resource-intensive and increasing energy consumption and carbon emissions. The speculative nature of cryptocurrency investments encourages diversification, reflecting an ecological model where no single cryptocurrency dominates. However, the introduction of new cryptocurrencies often undermines the dominant ones, highlighting market competitiveness.
Furthermore, the surge in mining contributes to e-waste as obsolete hardware is discarded, posing environmental threats. While cryptocurrency technology holds promise, addressing these environmental concerns is crucial for long-term sustainability. The findings emphasize the need for policymakers, technology creators, and crypto miners to tackle escalating CO2 emissions, promote diversified energy sources, and implement sustainable practices to ensure the future of cryptocurrencies aligns with zero carbon emission goals.

Results







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