

Exploring the Environmental Impacts of Bitcoin Mining

Problem statement

Bitcoin mining requires miners to solve mathematical puzzles known as the proof of work. This puzzle requires finding a specific nonce (a random number) that, when hashed with the contents of the block, produces a hash value that meets certain criteria. Solving the PoW requires significant computational power and is achieved through trial and error. Miners use specialized hardware, such as ASICs (Application-Specific Integrated Circuits) or GPUs (Graphics Processing Units), to perform the PoW calculations. These devices are energy-intensive and designed to perform hash computations quickly.

The exponential growth of Bitcoin mining, particularly its contribution to greenhouse gas emissions, is a subject of growing concern. In this research project, we aim to comprehensively analyze the environmental consequences of Bitcoin mining and its impact on the global climate.

Very interesting and unique topic!

Your SMART questions 1 and 3 are great. However, question 2 is beyond the scope of project 1. But will be perfect for project 2.

Research questions and objectives

- **Correlation of CO₂ emission intensity with other variables:** We will explore the correlations between the target variable which is CO₂ emission intensity and other important variables such as network hash rate, mining hardware efficiency, and annual electricity consumption. This will provide insights into how the variations in these variables affect the target variable.
- **Forecasting of the CO₂ emission time series:** We will attempt to forecast the CO₂ emission time series into the near future which will provide insights into the underlying trends and patterns of the data.
- **Assessing the environmental impact by regional variations in Bitcoin mining:** We seek to address, how the regional variations in power consumption affect the mining operations and the corresponding hash rates. Do regions with higher power consumption tend to have a proportionally higher hash rate, and if so, what are the environmental consequences?

Data

The data to be used in this study is taken from the **Cambridge Centre for Alternative Finance** (CCAF) website <https://ccaf.io/cbnsi/cbeci/comparisons>. The network hash rate data is taken from the NASDAQ stock exchange website <https://data.nasdaq.com/data/BCHAIN/HRATE-bitcoin-hash-rate>.

The current dataset contains 15 columns and ~4800 records from July 18, 2010, till the present date. The dataset is available at the team's GitHub repository:

https://github.com/tushar2016sharma/Bitcoin_mining.