Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 5, No.6, May : 2024

ELECTRICITY PRICE FORECASTINGUSING AN ENHANCED MACHINE LEARNING MODEL

Mr. PEDAKOTA VINOD MCA Student, Department of Master of Computer Applications, Vignan's Institute of Information Technology(A), Visakhapatnam-530049.
Mr. V.RAJENDRA PRASAD , Assistant Professor, Department of Information Technology, Vignan's Institute of Information Technology(A), Visakhapatnam-530049.

ABSTRACT
The internet of things has truly transformed the IT sector by reducing the need for enterprises to spend money on physical gear and instead depending on firms that provide cloud services. However, the energy-intensive nature of online data centers, which are primarily reliant on power, presents considerable issues, particularly given recent increases in electricity rates. To solve this issue, a unique method called Extreme Gradient Boosting (XG Boost) is presented. The XG Boost model is used to improve data placement and node scheduling, which effectively offloads or moves storage inside data centers. It also anticipates power prices, which are an important element in data center running expenses, allowing for more effective resource allocation. The performance evaluation for this project is based on a real-world dataset given by Ontario, Canada's Integrated Electricity Systems Administrator .The purpose of using machine learning techniques is to reduce energy consumption, enhance network efficiency, and ultimately reduce operational costs. The XG Boost strategy, which splits data 70% for training and 30% for testing, shows promise in reducing energy consumption in present storage facilities while also supporting an environmentally responsible and responsible and cost-effective server architecture.
Keywords: Data storage, lowering energy consumption, price of energy forecasting, XG boost.

I. Introduction
Electronic processing is increasingly being employed as collecting systems, which reduces hardware and purchase costs. As information consumption increases rapidly, so does the demand for information centers (DCs). Data facilities (DCs) use a substantial amount of power, accounting for 2% of global power consumption. It is anticipated to grow at a 12% yearly rate. Nearly 39% of electricity is required for cooling, 45% for IT infrastructure operation, and 13% for lighting. Businesses incur enormous costs as a result of this level of usage. In general, electric administrator install a few lymphocytes across many sites to ensure reliability via replication. Being close to the clients will assist to meet the latency requirements.
However, because power markets are volatile, dispersed DCs in diverse geographical regions may result in cost uncertainty. These electrical markets may experience big cost changes. As a result, electric suppliers would place DCs in low-temperature locations with low power rates. It is rapidly gaining acceptance in the information technology industry because it simplifies computing by eliminating the need to acquire physical equipment for computations; instead, these services are managed by cloud service providers. These businesses have a high number of computers and servers whose primary source of power is electricity; hence, the design and operation of these businesses are dependent on the availability of a continuous and low-cost electrical power supply. Data processing facilities consume a great deal of power. With recent rises in power costs, one of the fundamental challenges in establishing and operating these types of facilities is reducing their electricity use and conserving energy. Efficient data placement and node scheduling to unload or transfer storage are two of the key strategies for dealing with these difficulties. In this study, we provide an XG Boost, or extreme gradient booster, model for offloading or transferring storage, forecasting power prices, and reducing energy consumption costs in information centers.

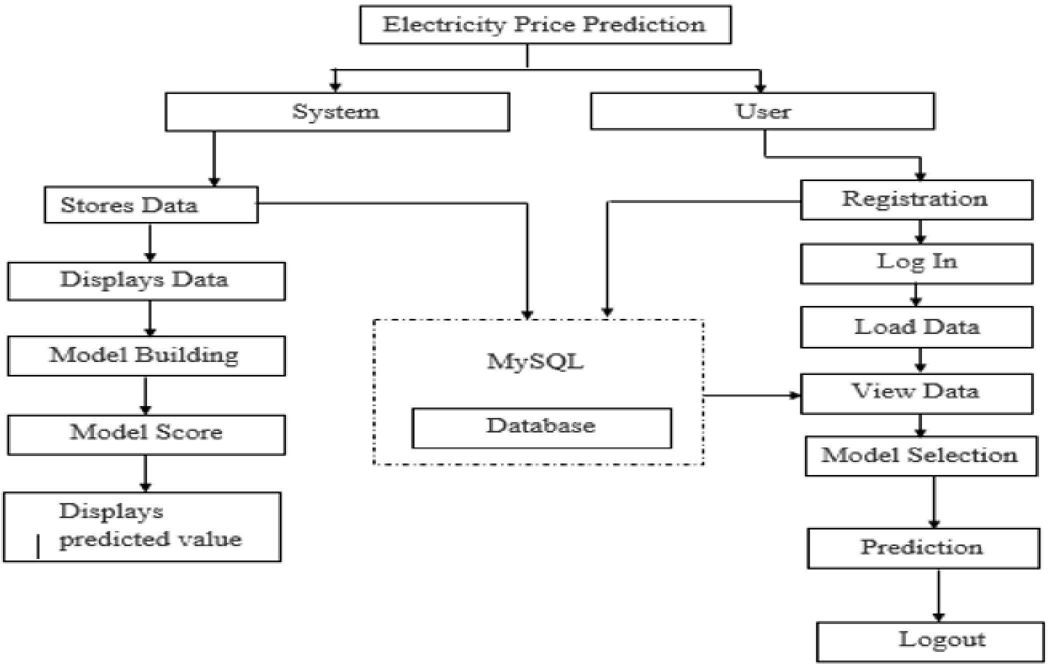

Figure 1: Architecture

Our suggested solution uses machine learning techniques such as the XG Boost Regressor, Random Forest Regressor, and Support Vector Regressor to reduce energy usage in online servers amid a major increase in power prices. The task is developing an advanced machine learning model for estimating electricity prices on the web. The model must accurately anticipate future power costs so that internet service providers and customers may make informed decisions regarding resource allocation, budget planning, and pricing strategies. The revised strategy aims to address the issue of fluctuating electricity costs by streamlining web-based operations and ensuring cost-effective and efficient service delivery.

II. Literature

The burgeoning growth of the information technology market is increasingly driven by the adoption of cloud computing services. This paradigm shift simplifies computing processes by obviating the necessity to procure physical hardware for computational tasks. Instead, these services are outsourced to specialized firms that offer computing resources over the internet. These firms, commonly referred to as cloud service providers, maintain vast arrays of computers and servers within their data processing facilities. However, the seamless operation of these facilities heavily relies on the availability of a consistent and affordable supply of electrical power.

Electricity stands as the lifeblood of data centers, powering the multitude of servers, cooling systems, and networking equipment that comprise these facilities. Consequently, the design and maintenance of these organizations are intricately entwined with the accessibility and cost-effectiveness of electrical power. As such, one of the foremost challenges faced in the development and sustenance of data processing centers pertains to the optimization of energy consumption and the preservation of energy resources.

Data processing facilities are notorious energy consumers, accounting for a significant portion of global electricity usage. The exponential growth in data generation and consumption, coupled with the proliferation of internet-connected devices, has propelled the demand for computing resources to unprecedented levels. Consequently, data centers have emerged as voracious consumers of electrical power, exerting considerable strain on power grids and contributing to environmental concerns associated with energy consumption.

In recent years, the escalation of power rates has exacerbated the economic burden borne by data center operators. The burgeoning cost of electricity not only impacts operational expenses but also poses a significant deterrent to the scalability and profitability of data processing facilities. In light of these

challenges, the imperative to mitigate electricity usage and enhance energy efficiency has assumed paramount importance within the realm of data center management.
Efforts to curtail electricity consumption and minimize energy wastage encompass a multifaceted approach encompassing technological innovation, infrastructure optimization, and operational best practices. Data center operators are increasingly investing in energy-efficient hardware solutions, such as low-power servers, advanced cooling systems, and power distribution units with higher efficiency ratings. Furthermore, the implementation of virtualization technologies enables the consolidation of server workloads, thereby maximizing resource utilization and reducing idle power consumption.
Moreover, the deployment of sophisticated monitoring and management systems facilitates real-time tracking of energy usage patterns and enables proactive interventions to optimize power utilization. These systems leverage advanced analytics and machine learning algorithms to identify inefficiencies, predict potential failures, and dynamically adjust resource allocation to align with workload demands.
Beyond technological interventions, the design and construction of data processing facilities are being reimagined to prioritize energy efficiency and sustainability. Concepts such as modular architecture, free cooling techniques, and renewable energy integration are increasingly being embraced to minimize environmental impact and reduce reliance on traditional power sources.
In conclusion, the imperative to reduce electricity usage and preserve energy resources constitutes a critical challenge in the development and maintenance of data processing centers. By embracing a holistic approach encompassing technological innovation, operational optimization, and sustainable infrastructure design, data center operators can mitigate their environmental footprint while simultaneously enhancing operational efficiency and cost-effectiveness.

Conclusion :
In this project, we successfully developed ML models to decrease pricing spikes in data warehouses. This is built in a user-friendly environment utilizing Flask and Python programming. We found that XG Boost Regressor outperforms Random Forest Regressor and Support Vector Regressor, with a r2_score of 91%. This technology predicts electricity prices, which saves time and labor while also reducing price surge changes.

References
[1] S. Albahli et al.: Electricity Price Forecasting for Cloud Computing Using an Enhanced Machine Learning Model
[2] IEEE TRANSACTIONS ON SMART GRID, VOL. 9, NO. 6, NOVEMBER 2018
[3] C. Canali, L. Chiaraviglio, R. Lancellotti, and M. Shojafar, ‘‘Joint minimization of the energy costs from computing, data transmission, and migrations in cloud data centers,’’ IEEE Trans. Green Commun. Netw., vol. 2, no. 2, pp. 580–595, Jun. 2018.
[4] R. Birke, M. Mellia, M. Petracca, and D. Rossi, “Underdtanding VoIP from backbone measurements,” in IEEE INFOCOM, 2007.
[5] Z. Song, X. Zhang, and C. Eriksson, ‘‘Data center energy and cost saving evaluation,’’ Energy Procedia, vol. 75, no. 1, pp. 1255–1260, Aug. 2015.
[6] M. Zahid, F. Ahmed, N. Javaid, R. Abbasi, H. Z. Kazmi, A. Javaid, M. Bilal, M. Akbar, and M. Ilahi, ‘‘Electricity price and load forecasting using enhanced convolutional neural network and enhanced support vector regression in smart grids,’’ Electronics, vol. 8, no. 2, p. 122, Jan. 2019.
[7] 2018). IESO. [Online]. Available: https://www.ieso.ca
[8] K. Florance. (Mar. 2016). How NetFlix Works With ISPS Around the Globe to Deliver a Great Viewing Experience. [Online]. Available: https://media.netflix.com/en/company-blog/how-netflix-works-with-ispsaround-the-globe-to-deliver-a-great-viewing-experience
[9] P.-H. Kuo and C.-J. Huang, ‘‘A high precision artificial neural networks model for short-term energy load forecasting,’’ Energies, vol. 11, no. 1, p. 213, Jan. 2018.
[10] G.-F. Fan,L.-L.Peng,And.-C.Hong,‘‘Short-Term loadforecastingbased on phase space reconstruction algorithm and bi-square kernel regression model,’’ Appl. Energy, vol. 224, pp. 13–33, Aug. 2018.