عنوان مقاله:

Datacenter Energy Optimization through Request Type Analysisand Real-time Power Consumption Prediction

محل انتشار:

چهارمین کنفرانس بین المللی مهندسی برق، کامپیوتر، مکانیک و هوش مصنوعی (سال: 1402)

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خلاصه مقاله:

Datacenters, the central hubs of modern computing infrastructure, oftengrapple with inefficiencies in managing power consumption. Thisresearch bridges this gap by harnessing workload power consumptionanalysis and a Random Forest model. The research comprises twoprimary phases: data collection and predictive modeling. During the datacollection phase, we meticulously assembled a comprehensive datasetencompassing essential datacenter elements, including CPU usage, GPUusage, memory usage, total power consumption, and user request types.This rich dataset served as the foundation for training a sophisticatedRandom Forest model, achieving remarkable accuracy with a Root MeanSquare Error (RMSE) of ۰.۰۱۶ in predicting power consumption patternsbased on the unique workload characteristics of individual datacenterelements. In the predictive modeling phase, we focused on a datasetspecific to four distinct request types: computing, collaborating,streaming, and Other. This dataset featured critical metrics such as CPUusage, memory usage, disk read/write, and network traffic. Applyingadvanced Time Series Models to this dataset enabled precise powerconsumption predictions for each request type. These predictionsunveiled crucial moments of high power consumption, empowering datacenter operators to make informed decisions regarding request type selection during peak demand periods. Our results underscore the immense potential of our approach in optimizing energy usage within datacenters. Accurate power consumption prediction, coupled with the ability to identify critical moments, empowers datacenter operators to make real-time decisions that minimize energy consumption, enhance efficiency, and ultimately contribute to sustainable datacenter operations. This research not only fills a crucial void in the field of datacenter energy optimization but also holds significant promise for practical applications. It lays the foundation for more sustainable and cost-effective datacenter operations, benefiting both operators and the environment. Moreover, it paves the way for future research in the dynamic field of datacenter management.

کلمات کلیدی:

Datacenter, energy optimization, workload Energy Prediction, Machine Learning, predictive modeling

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