PAPER-2 SUMMARY

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CSC 500, Research Methods

Title: **Amazon EC2 Spot Price Prediction Using Regression Random Forest**

Summary

A popular cloud computing service offered by Amazon Web Services (AWS), Amazon Elastic Compute Cloud (Amazon EC2) enables users to quickly construct and control scalable virtual servers in the cloud. Because it provides a flexible and adaptable computing environment, companies and developers can run apps, host websites, process data, and carry out a variety of computational functions without having to make a hardware investment. To support a variety of workloads, from small-scale applications to high-performance computing requirements, EC2 offers a wide range of instance types. Its on-demand provisioning and pay-as-you-go pricing mechanism, which enables cost-efficiency by scaling resources based on demand, are the main reasons for its appeal [2]. Additionally, EC2 smoothly connects with other AWS services, providing a whole cloud computing ecosystem for organizations, start-ups, and people looking to make use of cloud infrastructure [3].

The Amazon EC2 Spot Instances, which are idle EC2 instances that may be rented for less money than On-Demand instances, are the subject of this study. Spot Instances have low usage despite their low prices because to their complex bidding and changeable pricing. In this study, regression random forests (RRFs) are used to develop a model for forecasting spot prices one week and one day in advance. In order to minimize execution costs and the likelihood of an out-of-bid failure, cloud customers are encouraged to plan when to buy spot instances, estimate execution costs, and make bid decisions.

The problem and the solution are introduced at the start of the paper. The related research on machine learning and ensemble approaches for resolving prediction issues is presented in Section 2. To increase user trust in choosing spot instances, Section 3 examines a year's worth of compute-optimized spot instance price history traces. In Section 4, Support Vector Regression, Random Forests, and Gradient Boosting are compared with other non-parametric machine learning methods for spot price prediction [1].

In Section 5, various methods, such as feature selection, bagging, and the random subspace method, are discussed for reducing prediction bias and variance in RRFs. Additionally, the cross-validation method (out-of-bag error) and RRFs' prediction algorithm and parameters are given. In order to improve the model's predictive accuracy, Section 6 shows multiple RRFs model parameters tailored to match the model to the spot instance pricing dataset [1].

Section 7 examines the accuracy and speed of the RRFs prediction model and gives experimental spot price prediction findings. The findings demonstrate that the suggested model performs better than other models in terms of forecast precision and speed. Speed, Mean Absolute Percentage Error (MAPE), Mean Cumulative Percentage Error (MCPE), Out-of-Bag (OOB) Error, and others are used as evaluation measures. The conclusion is presented in Section 8, which summarizes the paper's contributions and talks about future research.

Overall, the paper offers a thorough examination of Amazon EC2 spot price prediction using RRFs and shows the efficiency of the suggested method in terms of forecast precision and speed. The suggested approach can help cloud users with planning and decision-making to reduce execution costs and the likelihood of out-of-bid failure [3]. Additionally, the research advances the use of ensemble methods and machine learning to resolve prediction issues.

Good points

This paper makes several strong points. Regression Random Forests (RRFs), which surpass existing non-parametric machine learning models in terms of forecast accuracy and speed, are first proposed as a unique method for forecasting Amazon EC2 spot prices. Second, to strengthen the accuracy of the results, the study simulates future spot prices using 12 months of actual Amazon EC2 spot history traces. Thirdly, the accuracy and speed of the suggested model are measured using a variety of evaluation metrics, including Mean Absolute Percentage Error (MAPE), Mean Cumulative Percentage Error (MCPE), Out-of-Bag (OOB) Error, and speed. Fourthly, in order to contextualize the suggested strategy, the paper offers a thorough overview of related work on ensemble methods and machine learning for tackling prediction problems. Fifthly, the paper offers a thorough explanation of the RRFs prediction algorithm, parameters, and cross-validation method (out-of-bag error), as well as several methods to lessen the bias and variance of the RRFs' predictions. The final section of the study illustrates how the suggested model may be used in practice by cloud users. This includes anticipating when to buy spot instances, calculating execution costs, and placing bids to reduce execution costs and out-of-bid failure risk [1].

Bad points

The research offers a regression random forests-based predictive model for the Amazon EC2 Spot Price and shows its effectiveness in predicting spot prices one week and one day in advance. This predictive capability is recognized for its potential to help cloud users decrease execution costs and lower the likelihood of out-of-bid failure. However, some important restrictions and factors demand attention. Notably, if the training dataset is small or noisy, there may be a risk of overfitting, a common worry with Random Forest models. A more thorough investigation of how overfitting was reduced in the suggested model would be beneficial to the paper. Furthermore, it's important to recognize how sensitive the model is to the characteristics that are selected because poor or pointless features may have a negative impact on predicted accuracy. Given the potential fluctuation and volatility of spot pricing, it is critical that the study address the representativeness and quality of the previous Amazon EC2 spot price data utilized for training. Another noteworthy area of concern is scalability; the report makes no mention of how the model performs as dataset size or computing complexity rise. Additionally, there is a dearth of knowledge regarding the hardware or computational resources needed to deploy the model at scale, an essential practical factor for real-world application. The model's capacity to be generalized to different situations may be constrained by the assumptions made about the underlying dynamics of Amazon EC2 spot prices. A more thorough examination undertaken under various usage patterns, workloads, and market conditions could offer a more nuanced view of the model's performance because the evaluation appears to have been conducted under specific scenarios. Finally, the model's long-term maintenance and update procedure, which is necessary to ensure its applicability to changing market dynamics, has not been taken into account. These important points highlight areas that could use improvement and additional study to strengthen the suggested model's robustness and practical usefulness.

References

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[2] S. Cao, K. Deng, K. Ren, X. Li, T. Nie and J. Song, “An Optimizing Algorithm for Deadline Constrained Scheduling of Scientific Workflows in IaaS Clouds using Spot Instances”, in 2019 IEEE Intl Conf on Parallel and Distributed Processing with Applications, Big Data and Cloud Computing, Sustainable Computing, Social

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[3] A. C. Zhou, J. Lao, Z. Ke, Y. Wang and R. Mao, “FarSpot: Optimizing Monetary Cost for HPC Applications in the Cloud Spot Market”, in IEEE Transactions on Parallel and Distributed Systems, vol. 33, issue:11, pp. 2955-2967, 01 November 2022.