HybridTimeNet: A Novel Approach to Proactive Load Forecasting in a Cloud Environment

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Load forecasting is the prediction of trends based on historical data. For cloud providers, these forecasts are essential for both long-term planning and immediate operational adjustments, allowing them to anticipate the resources required. The primary focus of this research is to develop an ensemble time series model specifically designed to improve the forecast accuracy in a cloud environment and ultimately improve the efficiency of the resources allocated. By combining multiple models that are commonly used for time series prediction, the strengths of each model are leveraged to capture the demand patterns as accurately as possible. HybridTimeNet is an amalgamation of Neural Prophet, LSTM and XGBoost. The predictions of the first layer are fed into a Multilayer Perceptron which gives the final prediction. To enhance resource allocation efficiency, the M/M/c queueing model was integrated, which accounts for the optimal number of servers required to handle variable loads for a given time period. HybridTimeNet is evaluated within the cloud domain using key metrics such as Service Level Agreement violations, number of unserved requests and wait time of each request as well as linear and quadratic error metrics namely mean squared error and root mean squared error. The outcome of this approach is to establish a scalable and reliable infrastructure model that balances demand fluctuations along with optimised resource utilisation.

Cloud Computing, Load Forecasting, NeuralProphet-LSTM-XGBoost Model, Predictive Model, Time-Series Analysis

Siddarth D. Pai was born in Bangalore, India on April 2, 2003. He is currently pursuing his Bachelor of Technology degree in Computer Science and Engineering from PES University, Bangalore, Karnataka, India, expected to graduate in 2025.
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