

Title : Aquila Optimizer-Based Hybrid Predictive Model for Traffic Congestion in an IoT-Enabled Smart City

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Abstract: Effective traffic congestion prediction is need of the hour in a modern smart city to save time and improve the quality of life for citizens. In this study, AB_AO (ARIMA Bi-LSTM using Aquila optimizer), a hybrid predictive model, is proposed using the most effective time-series data prediction statistical model ARIMA (Autoregressive Integrated Moving Average) and sequential predictive Deep Learning (DL) technique LSTM (Long Short-Term Memory) which helps in traffic congestion prediction with a minimum error rate. Also, the Aquila optimizer (AO) is used to elevate the adequacy of the AB_AO model. Three road traffic datasets of different cities from the “CityPulse EU FP7 project” are used to implement the proposed hybrid model. In a time-series dataset, two components need to be handled with care, i.e., linear and nonlinear. In this study, the ARIMA model has been used to manage linear components and Bi-LSTM is used to handle nonlinear components of the time-series dataset. The Aquila Optimizer (AO) is used for hyperparametric tuning to enhance the performance of Bi-LSTM. Error measurement parameters like the Mean Absolute Error (MAE), Mean Squared Error (MSE), and Mean Absolute Percentage Error (MAPE) are used to validate the results. A detailed mathematical and empirical analysis is given to justify the performance of the AB_AO model using an ablation study and comparative analysis. The AB_AO model acquires more stable and precise results with MSE as 18.78, MAE as 3.18, and MAPE as 0.21 than other models. It may further help to predict the vehicle count on the road, which may be of great help in reducing wastage of time in traffic congestion.

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Keywords: Traffic Congestion Prediction, Smart City, Time-Series Forecasting, ARIMA, Bi-LSTM, Aquila Optimizer (AO), Hybrid Predictive Model,

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