**PROJECT CODE: 2024-P08**

**Title: Machine Learning-Based Cellular Traffic Prediction Using Data Reduction Techniques**

**Abstract**

Effective estimation and analysis of traffic patterns are paramount in managing Quality of Service (QoS) metrics within cellular networks. Network planners traditionally utilize diverse methodologies to predict network traffic, yet these approaches frequently encounter significant challenges related to data security and time complexity, especially when dealing with multi-dimensional datasets. To address these issues, this paper proposes an Adaptive Machine Learning-based Cellular Traffic Prediction (AML-CTP) framework. The primary goal of the AML-CTP framework is to streamline and expedite the selection of an appropriate machine learning model for predicting network traffic load, ensuring both accuracy and efficiency.

The proposed framework leverages the potential of machine learning algorithms to enhance traffic prediction in cellular networks. It integrates two density-based clustering algorithms to group similar traffic patterns into distinct clusters based on data similarity and convergence. This clustering approach not only simplifies the dataset but also enhances the homogeneity and quality of the data, making it more manageable and insightful for predictive modelling.

Subsequently, the AML-CTP framework evaluates the quality and homogeneity of the clustered data by training models using data samples from each cluster. This step is crucial in determining the most suitable machine learning algorithm for each cluster, thereby optimizing the predictive accuracy. The framework considers four supervised learning algorithms for traffic prediction: **Linear Regression,** **Random Forest,** **Support Vector Machine (SVM),** and a **Neural Network model**. By evaluating these models, the framework identifies the optimal algorithm for each traffic cluster, thus reducing training time and hardware complexity.

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