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Prediction model for classification of 5G network slicing

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INTRODUCTION & AIM

5G technology represents a significant advancement over previous generations (1G-4G), offering faster speeds, greater capacity, and enabling applications like IoT, telemedicine, and autonomous vehicles. Its unique feature, network slicing, allows for tailored network segments (e.g., low latency, high bandwidth), supporting diverse uses such as AR, VR, and Industry 4.0.

Aim: Develop an efficient machine learning model for classifying 5G network slices.

Objectives:

1. Investigate value ranges of V2X slice features to enhance network performance.
2. Identify efficient features for predicting 5G slices, including V2X.
3. Propose a model to classify slices into eMBB, mMTC, URLLC, and V2X.

METHOD

- **Data Collection**: Gather relevant 5G network data, including slice attributes for eMBB, mMTC, URLLC, and V2X.
- **Feature Selection**: Employ feature selection to determine key characteristics impacting slice classification.
- **Model Development**: Create a machine learning model to classify slices accurately.
- **Evaluation**: Assess model accuracy, precision, recall and AUC across slices.

RESULTS & DISCUSSION

Table 4.1: K-fold cross validation performance analysis

Algorithm	Accuracy	Precision	Recall	F1-score	AUC
Random Forest	0.967	0.968	0.985	0.967	0.991
Gradient Boosting	0.963	0.964	0.981	0.963	0.987
Decision Tree	0.948	0.948	0.953	0.947	0.948
SVM	0.922	0.933	1.000	0.928	0.958
KNN	0.911	0.918	0.973	0.916	0.956
Naïve Bayes	0.828	0.842	0.928	0.843	0.890

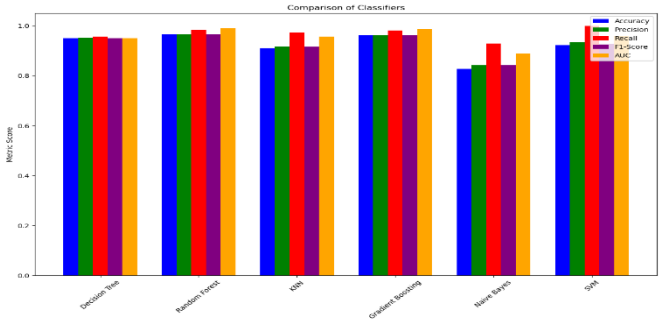

Figure 4.1: K-fold cross validation performance analysis

The results demonstrate that the Random Forest algorithm achieved the highest performance across all metrics, with an accuracy of 0.967% and an AUC of 0.991, outperforming Gradient Boosting and Decision Tree. SVM and KNN showed moderate results, while Naïve Bayes performed the lowest, indicating its limitations for this task. This highlights Random Forest's suitability for 5G slice classification.

CONCLUSION

This research explored the classification of 5G network slices, emphasizing V2X and its key attributes. Machine learning techniques revealed critical insights for accurate slice prediction, aiding resource optimization and enhancing 5G network performance.

FUTURE WORK

Future work includes real-time implementation of the model in 5G networks, expanding datasets with advanced features, and integrating edge computing for improved accuracy. Hybrid models and cross-slice optimization will enhance scalability and adaptability. Security measures will also be strengthened to ensure reliable 5G slicing.