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Enhancing the Efficiency of 5G Network Services using Artificial Neural Network (ANN) Algorithm in Comparison with Random forest Algorithm

INTRODUCTION

- Introduction of 5G networks signifies a pivotal moment in digital connectivity.
- Challenge: Ensuring effective delivery of 5G services necessitates innovative solutions.
- Utilizing Random Forest algorithms and Artificial Neural Networks (ANN) for 5G network performance enhancement.
- Objective: Compare algorithm effectiveness in maximizing key performance indicators for smooth 5G connectivity.
- Need for optimizing network efficiency in the era of ultra-low latency and massive data throughput.
- Traditional methods may not meet dynamic 5G network needs, prompting exploration of cutting-edge machine learning techniques.
- Importance of ANN algorithms for simulating complex brain functions and maximizing network performance adaptively.
- Random Forest algorithms offer resilience and scalability, but their effectiveness in 5G network optimization requires examination.
- Study conducts thorough comparison analysis to clarify ANN and Random Forest algorithm effectiveness.
- Findings aim to inform telecom stakeholders on improving performance metrics and enhancing network provisioning techniques for informed decision-making.
- Rigorous testing and analysis aim to clarify the effectiveness of ANN and Random Forest algorithms in improving 5G network services.

5G NETWORK SERVICES

MATERIALS AND METHODS

DATA COLLECTION
Improving the Efficiency of 5G Network Services has various sources 5G Network Performance Metrics, Network Parameters, User Behavior Data, Environmental Factors, Algorithm Training Data, Baseline Data, Feedback Mechanism Data, Comparative Analysis Metrics.

DATA PREPROCESSING
Gather and Preprocess the dataset(E.g., handling missing values encode categorical, scale features)

Random forest
Using the Random forest involves collecting and preprocessing 5G networks data, training the classifier, and evaluating its performance.

Artificial Neural Network(ANN)
Applying ANN algorithm to anticipate Improving the Efficiency of 5G Network Services encompasses initial data collection and preprocessing steps.

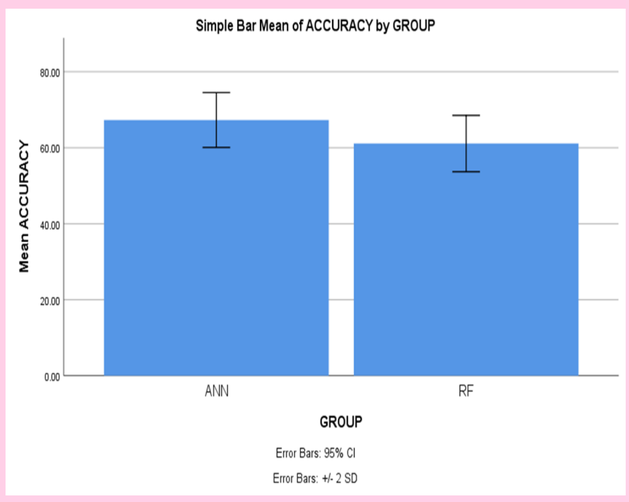
5G Network Services

MODEL ASSESSMENT
The efficacy of both the ANN and RF models was assessed on the testing set using suitable metrics to ascertain Improving the Efficiency of 5G Network Services.

COMPARISON OF THE MODELS
The ANN and Random forest model performances were compared based on the chosen assessment metrics to ascertain which model generated superiority in predicting the Enhancing the Efficiency of 5G Network Services.

MODEL INCORPORATION
The incorporation of ANN and Random forest for a combined detection was considered, along with enriching RF using external data sources to improve the detecting Efficiency.

RESULTS



ANN And RF

S. No	Test Size	ACCURACY RATE	
		Artificial Neural Networks	Random forest
1	Test 1	69.75	63.98
2	Test 2	63.52	57.08
3	Test 3	64.56	56.28
4	Test 4	72.18	64.87
5	Test 5	67.39	64.28
6	Test 6	72.38	65.38
7	Test 7	69.27	61.18
8	Test 8	68.23	60.71
9	Test 9	63.75	55.40
10	Test 10	64.75	61.92
Average Test Results		71.40	64.26

Group Statistics

	Group	N	Mean	Std. Deviation	Std. Error Mean
Accuracy	Artificial Neural Networks	10	67.2980	3.60554	1.14017
	Random forest	10	61.1080	3.70662	1.17214

❖ Mean, Standard Deviation, and Standard error mean with an accuracy rate comparison of Artificial Neural Network over Random forest .

Independent Variables

		Levene's test for equality of variances		T-test for equality means with 95% confidence interval						
		f	Sig.	t	df	Sig. (2-tailed)	Mean difference	Std.Error difference	Lower	Upper
Accuracy	Equal variances assumed	0.002	0.962	3.785	18	0.002	6.19000	1.63520	2.75456	9.62544
	Equal Variances not assumed			3.785	17.986	0.003	6.19000	1.63520	2.75438	9.62562

✓ A significant Threshold value of an Accuracy rate comparison of Artificial Neural Network, and Random forest Algorithm.

- In the present work Artificial Neural Network is compared with Random forest and it depicts that the proposed algorithm gives more accuracy when Compared with the rest.

DISCUSSION AND CONCLUSION

- Based on T-test Statistical analysis, the significance value of p=0.001 (independent sample T - test p<0.05) is obtained and shows that there is a statistical significant difference between the group 1 and group 2.
- Overall , the accuracy of the Artificial Neural Network (ANN) and it is better than the other algorithms.
  - Artificial Neural Network (ANN) - 71.40%
  - Random Forest (RF) - 64.26%
- From the work , it is concluded that the Artificial Neural Network attains the high accuracy when comparing with other Machine Learning Algorithms in 5G Network Services.
- Edge Computing Integration: Investigating the integration of ANN and Random Forest algorithms into edge computing frameworks could enable distributed intelligence, optimizing network services closer to the end-users and reducing latency in latency-sensitive applications.
- Security and Privacy Considerations: Addressing security and privacy concerns associated with the deployment of advanced machine learning algorithms in 5G networks will be crucial, necessitating research into robust encryption methods and privacy-preserving techniques to safeguard sensitive data and network integrity.
- Real-time Adaptability: Future studies may focus on enhancing the real-time adaptability of ANN algorithms in dynamic 5G network environments, enabling proactive decision-making and responsiveness to fluctuating network conditions and user demands.

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