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ConnectCraft – Simplifying Network Choices

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ABSTRACT

In our increasingly connected world, network quality is a fundamental concern for users. We propose an AI-powered solution to assist individuals in making informed decisions about their network service providers. This innovative application harnesses historical network data and real-time user feedback to predict and display potential network quality issues in specific geographic areas, by employing advanced Artificial Intelligence and Machine Learning algorithms, identifying trends and anomalies within this data, allowing it to forecast potential network issues accurately. Key features include predictive analytics, a visual representation of network quality problems on an interactive map, integration of real-time user feedback, provider comparisons based on historical data and reviews, personalized recommendations, and proactive alerts about potential network problems. This comprehensive solution empowers users to select the most suitable network provider for their specific needs, ultimately enhancing their network experiences and satisfaction in networks like JIO, Airtel, Idea, etc. It bridges the gap between consumers and network providers by providing transparency and data-driven insights into network quality, ensuring users can confidently make choices that align with their connectivity requirements.

Keywords— *Data Integration, ML Model Development, Predictive Analytics, User Interface, Validation, Deployment*

INTRODUCTION

In the current digital era, where connectivity is essential to modern civilization, choosing a trust worthy network providerhas become a crucial choice that affects every part of our everyday lives. The wide range of network providers, each providing different degrees of service quality and coverage, adds to the decision's complexity. The changing nature of network performance, which is impacted by variables likeuser demand, infrastructure capacity, and geographic location,

makes choosing the best provider even more difficult. We offer a novel project that aims to harness the power of artificial intelligence (AI) and real-time data analytics to anticipate and optimize network performance. We recognize the urgent need for a solution that provides users with actionable insights about location-based network performance. By using historical and real-time data to estimate network performance at particular places, our study aims to address the problem of informed provider selection and empower customers to choose a network provider with confidence.

DATA GENERATION

Android Studio's robustness and end-to-end support enables dynamic data generation for speed test application aimed at collecting comprehensive network performance metrics. The application captures geolocation coordinates, upload and download speeds, ping times, network provider information, and timestamps. These metrics are stored in Firebase and later converted from JSON to CSV format for detailed analysis.

The application is developed using Android Studio, leveraging essential functionalities and libraries to ensure precise data capture. It utilizes the device's GPS to accurately record geolocation coordinates, measures both upload and download speeds, calculates ping times, and identifies the network provider based on device settings and SIM card information with the help of given permission. Timestamps are generated using the device's internal clock at the moment each speed test is conducted.

Data transmission is streamlined through JSON formatting, enabling efficient storage in Firebase, a scalable NoSQL database. Each speed test result is stored as a structured JSON

object, facilitating organized and accessible data retrieval.

Following storage, the JSON data undergoes conversionto CSV format using scripting tools based on the Python libraries. This conversion process simplifies data analysis and modeling, ensuring that the collected network performance metrics are readily available and optimized for comprehensiveevaluation and strategic insights.

The speed test application's data generation process is designed to be efficient and effective, ensuring thorough data capture, secure storage, and seamless conversion for

insightful analysis and informed decision-making in network performance assessment.

MACHINE LEARNING APPROACH

The machine learning model employs several libraries: **pandas** for data manipulation and analysis, **numpy** for numerical computing, **scikit-learn** for machine learning algorithms and evaluation metrics, and **mlxtend** for advanced functionalities like StackingRegressor. Preprocessing involvesremoving null values and eliminating duplicates to ensuredata integrity and reduce noise, thereby improving model performance.

The computation logic involves several steps to identify relevant data rows. The cdist function from scipy calculates pairwise distances between defined input coordinates and dataset coordinates. A threshold distance set to 70% of the maximum calculated distance determines similarity. Indicesof rows within this threshold are identified and used to extract corresponding rows from the DataFrame for further analysis.

For effective model training and evaluation, the datasetis split into training and testing sets to prevent overfittingand ensure generalization. Features are standardized with StandardScaler by removing the mean and scaling to unit variance, ensuring equal contribution from each feature and enhancing model performance, especially for scaling-sensitive algorithms.

A stacking ensemble model is employed, consisting of multiple base regression models and a meta-regressor. The base models include RandomForestRegressor, GradientBoostingRegressor, and SVR, each independently learning patterns and relationships in the data. The meta-regressor, a Ridge regressor, is then used to combine the outputs of the base models. This approach is chosen for its simplicity and ability to handle multicollinearity effectively. During training, each base model is trained on the training data, and the meta-regressor is subsequently trained on the predictions made by the base models. This training process allows the meta-regressor to optimize the overall predictive performance by learning how to combine the base models' predictions best.

The prediction logic iterates over network providers, calculates the mean predicted bandwidth using the stacking model and updates the best provider if a higher predictionis found. Relevant features are selected, scaled, and used for predictions, leveraging the ensemble model to determine the optimal network provider based on predicted bandwidth.

USER INTERFACE

A Location Input Interface:
Allows users to input their geographic location to receive specific network performance predictions.

```
# Initialize variables for best provider and best prediction
best_provider = None
best_prediction = float('-inf')

# Iterate over unique network providers in similar rows
for provider in similar_rows['networkProvider'].unique():
    provider_data = similar_rows[similar_rows['networkProvider'] == provider]
    X_provider = provider_data[features]
    X_provider_scaled = scaler.transform(X_provider)

    provider_predictions = stacking_model.predict(X_provider_scaled)
    mean_prediction = provider_predictions.mean()

    if mean_prediction > best_prediction:
        best_provider = provider
        best_prediction = mean_prediction
print("Kothrud -")
print(f"The best provider for latitude={input_latitude}, longitude={input_longitude} is: {best_provider}")
```

```
Kothrud -
The best provider for latitude=18.50475181, longitude=73.82671298 is: JIO 4G
```

Fig. 1. Network performance history from Netro Test.

B Prediction Display Interface:
Shows the predicted network performance data, often in a user-friendly format like graphs or maps.

C Feedback Submission:
Enables users to provide feedback on network perfor-mance, which helps in improving the system througha feedback loop.

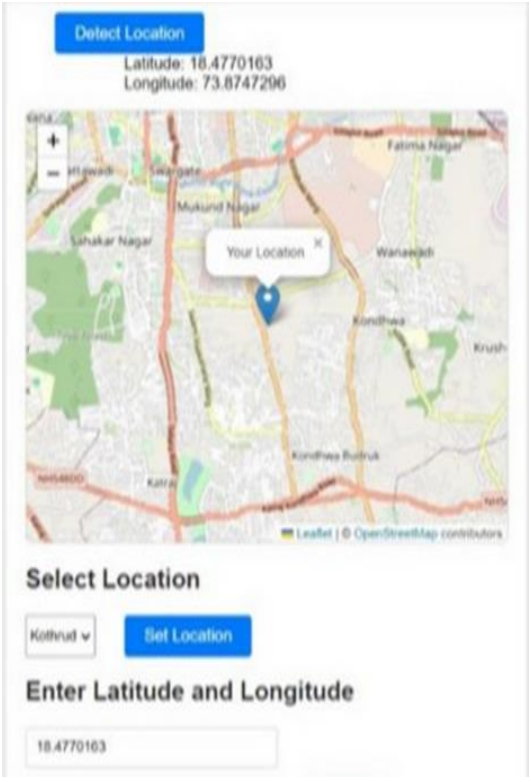

Fig. 2. User Interface for geolocation.

Fig. 3. Prediction Rsesults.

CONCLUSION

The **"ConnectCraft"** application marks a significant advancement in telecommunications, offering an AI-driven solution to predict network performance using historical and real-time data. By providing accurate, location-specific forecasts, it empowers users to make informed decisions about their network providers, enhancing satisfaction and accountability.

Leveraging advanced machine learning, "ConnectCraft" addresses connectivity challenges across diverse regions, offering real-time feedback and personalized recommendations. This ensures users can choose providers tailored to their needs. The system's commitment to data privacy, security, scalability, and continuous improvement ensures adaptability to evolving user and technologicaldemands.

In conclusion, "ConnectCraft" represents a paradigmshift in how users interact with and choose network services. By bridging the gap between consumers and providers,the project fosters a more transparent and accountabletelecommunications environment, ultimately contributing to improved network experiences and satisfaction.

REFERENCES

[1] SakthiSM, KishoreAnanthN, RoshiniRS, ThenishaS, Dharaniku- mar"Network Strength Comparison by Region," International Journal of Trendy Research in Engineering and Technology Volume 6 Issue 3 June 2022."

[2] Xiaohong Deng, Yun Feng, Thanchanok Sutjarittham, Hassan Habibi Gharakheili, Blanca Gallego, Vijay Sivaraman"Comparing Broadband ISP Performance using Big Data from M-Lab."

[3] EmmanuelBasikolo, Thomas Basikolo"TOWARDS ZERO DOWN- TIME:USING MACHINE LEARNING TO PREDICT NETWORK FAILURE IN 5GANDBEYOND",International Telecommunication Union, 2023."..

[4] Dr. Dipankar Dey, Solanki Pattanayak "Security Trends in Broadband ISP Networks: A Global Perspective".