

Proposed Project Title: Predictive Modelling of Signal Strength and Handover Events Using ML Techniques

This project investigates the use of machine learning techniques to predict mobile network handover events based on signal strength, user location, and network conditions. The aim is to enhance connectivity and energy efficiency by anticipating handovers before they occur, thereby reducing unnecessary transitions and battery drain. A simulation environment is being developed using the Okumura-Hata propagation model, which estimates received signal strength (RSSI) from multiple base stations as a mobile user moves through a defined grid.

Synthetic datasets are generated to capture variations in RSSI, tower connectivity, and battery consumption, and will be augmented with manually collected real-world data using Android-based signal tracking tools such as Network Cell Info Lite and G-NetTrack. The collected data includes GPS coordinates, RSSI values, tower IDs, and handover events, enabling a comprehensive analysis of signal behaviour in dynamic environments. *(if Possible/successful as it will be quite difficult to prove the correlation between battery drain and tower handover in a modern cell phone)*

Classification models including Random Forest and Logistic Regression are being trained to predict handover events, with a focus on improving recall for underrepresented handover cases. Techniques such as SMOTE (Synthetic Minority Over-sampling Technique) and class weighting are employed to address class imbalance and enhance model robustness. Preliminary results show promising accuracy, with further optimization underway to improve recall and reduce false negatives.

This work builds on recent advances in predictive handover modelling, such as the machine-learning-based handover strategies proposed by Masri et al. (2021) for 5G networks, and the handover failure prediction framework developed by Zhang et al. (2023) using XGBoost classifiers. Additionally, the adaptation of the Okumura-Hata model to urban environments by Osei et al. (2019) provides a valuable reference for signal modelling in mobile networks.

The broader goal of this project is to demonstrate how predictive analytics can support smarter handover decisions and contribute to more resilient mobile network performance in real-world environments

References:

- Masri, A., Veijalainen, T., Martikainen, H., Mwanje, S., Ali-Tolppa, J., & Kajó, M. (2021). Machine-Learning-Based Predictive Handover. 2021 IFIP/IEEE International Symposium on Integrated Network Management. IEEE Xplore
- Zhang, Y., et al. (2023). Machine Learning-Based Handover Failure Prediction Model for Handover Success Rate Improvement in 5G. 2023 IEEE Consumer Communications & Networking Conference (CCNC). IEEE Xplore
- 3. Osei, R., et al. (2019). Adaptation of the Okumura-Hata Model to the Environment of Accra. 2019 International Conference on Communications, Signal Processing and Networks (ICCSPN). IEEE Xplore

