

## Radio Signal Based Indoor Localization with Histogram-based Gradient Boosting Classifier with LoRa

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### Abstract

Indoor localization has gained significant importance in the context of smart cities, driven by the need for accurate positioning and navigational solutions. This research focuses on the application of long range (LoRa) wireless technology and Received Signal Strength Indicator (RSSI) ensemble approaches to address the challenges of indoor localization. While RSSI-based approaches offer simplicity and cost-effectiveness, they suffer from variability and poor accuracy. On the other hand, Machine Learning (ML) techniques hold promise for improving accuracy by leveraging past data and adapting to changing environments, but they require extensive training data and computational resources. Combining multiple technologies, such as RSSI and machine learning, can enhance the accuracy and robustness of indoor localization systems. However, the choice of technique should be based on the specific application requirements, considering factors such as accuracy levels, cost constraints, and system complexity. In this work, an ensemble machine learning based approach is proposed for LoRa based indoor localization systems. Where ML algorithms Extra-trees classifier, Gradient Boost classifier, Random forest classifier, Stacking Classifier, Soft Voting /Majority Rule classifier, Hist Gradient Boosting Classifier and it observed that Hist Gradient Boosting Classifier algorithm is outperforming by providing 99% localization accuracy.

**Keywords:** *Machine learning, Received signal strength indicator, Pre-processing, Model training, Accuracy*