

## Intelligent Indoor Localization Using WLAN Fingerprinting

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**Abstract :** The ability to localize mobile devices is quite important, as some applications may require location information of these devices to operate or deliver better services to the users. Although there are several ways of acquiring location data of mobile devices, the WLAN fingerprinting approach has been considered in this work. This approach uses the Received Signal Strength Indicator (RSSI) measurement as a function of the position of the mobile device. RSSI is a quantitative technique of describing the radio frequency power carried by a signal. RSSI may be used to determine RF link quality and is very useful in dense traffic scenarios where interference is of major concern, for example, indoor environments. This research aims to design a system that can predict the location of a mobile device, when supplied with the mobile's RSSIs. The developed system takes as input the RSSIs relating to the mobile device, and outputs parameters that describe the location of the device such as the longitude, latitude, floor, and building. The relationship between the Received Signal Strengths (RSSs) of mobile devices and their corresponding locations is meant to be modelled; hence, subsequent locations of mobile devices can be predicted using the developed model. It is obvious that describing mathematical relationships between the RSSIs measurements and localization parameters is one option to modelling the problem, but the complexity of such an approach is a serious turn-off. In contrast, we propose an intelligent system that can learn the mapping of such RSSIs measurements to the localization parameters to be predicted. The system is capable of upgrading its performance as more experiential knowledge is acquired. The most appealing consideration to using such a system for this task is that complicated mathematical analysis and theoretical frameworks are excluded or not needed; the intelligent system on its own learns the underlying relationship in the supplied data (RSSI levels) that corresponds to the localization parameters. These localization parameters to be predicted are of two different tasks: Longitude and latitude of mobile devices are real values (regression problem), while the floor and building of the mobile devices are of integer values or categorical (classification problem). This research work presents artificial neural network based intelligent systems to model the relationship between the RSSIs predictors and the mobile device localization parameters. The designed systems were trained and validated on the collected WLAN fingerprint database. The trained networks were then tested with another supplied database to obtain the performance of trained systems on achieved Mean Absolute Error (MAE) and error rates for the regression and classification tasks involved therein.

**Keywords :** indoor localization, WLAN fingerprinting, neural networks, classification, regression

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