Abstract

Ahmed H. Salama

An enhanced WiFi indoor localization system based on machine learning

The Global Navigation Satellite Systems (GNSS) suffer from accuracy deterioration and outages in dense urban canyons and are almost unavailable for indoor environments. Nowadays, developing indoor positioning systems has become an attractive research topic due to the increasing demands on ubiquitous positioning. WiFi technology has been studied for many years to provide indoor positioning services. The WiFi indoor localization systems based on machine learning approach are widely used in the literature. These systems attempt to find the perfect match between the user fingerprint and pre-defined set of grid points on the radio map. However, Fingerprints are duplicated from available Access Points (APs) and interference, which increase number of matched patterns with the user's fingerprint. In this research, the Principle Component Analysis (PCA) is utilized to improve the performance and to reduce the computation cost of the WiFi indoor localization systems based on machine learning approach. All proposed methods were developed and physically realized on Android-based smart phone using the IEEE 802.11 WLANs. The experimental setup was conducted in a real indoor environment in both static and dynamic modes. The performance of the proposed method was tested using K-Nearest Neighbors, Decision Tree, Random Forest and Support Vector Machine classifiers. The results show that the performance of the proposed method outperforms other indoor localization reported in the literature. The computation time was reduced by 70% when using Random Forest classifier in the static mode and by 33% when using KNN in the dynamic mode.