WiFi LOCATIONING PREDICTIVE MODELS

September 10, 2020

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Re: Predictive Models for WiFi Locationing

Dear Ms. Narim-Nomstrom,

The goal of the assignment is to build models that predict the physical location of a phone based on RSSI levels/WiFi Access Points. The data, received from the Institute of New Imaging Technologies (Spain), was processed and multiple predictive models have been built. Please find the summary of our findings below.

Pre-processing
The data represents 2 datasets with 529 attributes each. Most of the attributes are the RSSI levels detected by specific Android devices and linked to different WiFi Access Points. The first dataset was used to build/test predictive models. The second dataset was used to predict physical locations based on the tested models. Building ID/Floor/Space ID (office, lab, etc.)/Relative position with respect to Space ID (inside or outside of front door) were combined into a single variable to create a unique identifier for each physical location. This identifier is our target variable. The algorithms were selected based on the ability to process a large number of predictors (520).

Model evaluation
During testing the models showed the following performance:

MODELS	PERFORMANCE METRICS	
	ACCURACY	**KAPPA**
KNN	0.6671	0.6666
C5.0	0.6423	0.6418
CART	0.6957	0.6952
Random Forest	0.7214	0.7210

Accuracy and Kappa scores are similar for each model. Random Forest has the higher score compared to other models. The file containing predictions for the second dataset will be submitted to you shortly.

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Summary

The approach in WiFi based indoor localization of a device consists in determining the position of client devices with respect to access points. Four main types are received signal strength indication (RSSI), fingerprinting, angle of arrival (AoA) and time of flight (ToF) based techniques.

In most cases the first step to determine a device's position is to determine the distance between the target client device and a few access points. With the known distances between the target device and access points, trilateration algorithms may be used to determine the relative position of the target device, using the known position of access points as a reference. Alternatively, the angle of arriving signals at a target client device can be employed to determine the device's location based on triangulation algorithms.

A combination of these techniques may be used to increase the accuracy of the system.

Please let me know if you have further questions.