1. **UJIIndoorLoc**
2. UJIIndoorLoc is a large dataset for multi-building and multi-floor indoor localization.

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1. RSSI Levels : -104 dBm (Signal très faible) ~ 0 dBm (très proche du point d'accès WiFi).

For the number of WAPs : 0 (where no WiFi coverage) ~ 51.

1. Real World Coordinates of the Sample Points: X(longitude), Y(latitude), Z(the floor of the building).
2. BuildingID : an integer value (0, 1, 2)

文本

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1. SpaceID : integer.

Relative position(Rel.Pos): inside –> 1, outside –> 2.

1. UserID: an integer from 1 to 18.
2. WLAN Fingerprint-based positioning systems are based on the Received Signal Strength Indicator (RSSI) value. Calibration & Operation.

(+) without additional infrastructures and costs, can use the existing WLAN infrastructure.

(-) the spread of radio signal in indoor is hard to predict.

1. The distance-based technique k-Nearest Neighbor (kNN) is used as baseline. Set k = 1, the 1NN technique in conjunction to the Euclidean Distance as a basic indoor localization system.

文本

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1. **CNN based Indoor Localization using RSS Time-Series**
2. Global Positioning System (GPS) performs poorly when used in indoor environments: demands a direct line of sight between the satellite and the receiver to obtain accurate positioning; consumes too much energy.
3. Channel State Information (CSI) data can be used to estimate node location, (-) requires modifying the device driver to be able to obtain it from some advanced WiFi network interface cards.
4. **Received Signal Strength (RSS)** fingerprints can be used with different machine learning methods to build localization models like k-Nearest Neighbors(KNN), Neural Networks, Support Vector Machines(SVM).

(-) suffer from limitations on their ability to fully benefit from the training data to learn complex features. The methods rely on WiFi RSS is the random fluctuations in RSS values: shadowing, fading, multi-path effects.

(+) Improved performance.

1. ConFi, a CNN based indoor localization system using CSI, formulates the node localization as a classification problem with labels representing reference points.

[Input] the CSI features images build from the collected CSI data

[Output] the node location, as the weighted centroid of the reference points.

1. **Convolutional neural networks(CNNs)**, consist of one or more convolutional layers & one or more fully connected layers.

1) Use of time series: By collecting multiple continuous RSS data to form a time series; and using the CNN model to analyze the changing trend in the time series(normalization), thereby reducing the impact of noise on positioning.

2) CNN structure design: The CNN model uses multiple layers of convolution and pooling layers to capture local and global features in the RSS time series. Through the convolution operation of CNN, the temporal dependency of the RSS signal can be learned, effectively improving the positioning accuracy.

1. Based on RSS and CNN, by obtaining multiple consecutive RSS reading values ​​to form a time series, the CNN model is used to analyze the time dependency between RSS values, so as to more accurately predict the user's location information.
2. [Building identification]: The model first predicts the building where the device is located.
3. [Floor identification]: Then predict the floor where the device is located.
4. [Plane position estimation]: the specific plane position (latitude and longitude coordinates) of the device is estimated by analyzing the RSS features.

图形用户界面, 文本

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1. 100% building prediction accuracy, 100% accuracy for floor prediction. 2.77 m mean localization error in estimating the node longitude and latitude. (+) achieves higher localization accuracy.

**Advantages:**

1. Time series RSS data can effectively eliminate the noise in a single RSS reading.
2. CNN models can capture the temporal dependency of RSS time series and improve positioning accuracy.

**Challenges:**

1. CNN models take a long time to train and require large computing resources.
2. Although multi-layer convolutional structures improve accuracy, they also increase the complexity of the model.
3. **Méthodes de localisation de capteurs dans le conte**
4. Received Sgnql Strength Indicator (RSSI): cette méthode estime la distance entre le capteur et une station de base connue en mesurant la force du signal reçu.
5. La méthode de fingerprinting : enregistrez les caractéristiques du signal RSSI à différents endroits de l'environnement et générez une carte du signal. Lors du positionnement, la valeur RSSI actuelle est mise en correspondance avec les valeurs connues dans la carte des signaux pour déterminer l'emplacement de l'appareil.
6. Les critères d’évaluation de performances : Précision de localisation, Intervalle de mise à jour, Coût de calcul et complexité , Infrastructure, Calcul hors ligne, Durée de localisation.

CNN：

1. Convolutional Layer 卷积层：提取空间信息，产生特征图（feature map）
2. Convolutional Layer池化层（方法：Max Pooling，Average Pooling），对卷积产生的特征图进行降采样，减少数据维度，同时保留重要的特征信息
3. Activation Function 激活函数，将线性卷积结果映射为非线性，增强模型的表达能力。
4. Fully Connected Layer 全连接层，用于将提取到的特征映射到最终的输出

GNN：

1. Message Passing Mechanism 消息传递机制：通常通过一个聚合函数（aggregation function）将邻居节点的信息进行合并。常见的聚合方法包括求和、平均或最大操作。
2. Node Update Mechanism 节点更新机制：通过聚合得到的邻居信息结合节点自身的特征，用更新函数（Update Function）更新节点的表示。常用的更新函数包括线性变换和激活函数。
3. Graph Convolution 图卷积：对图中的每个节点进行信息传递和聚合，以捕捉节点之间的关系。

DNN based localization

Baseline with which we are going to compare our GNN: Implement a DNN based localization with python using the database (only 1 floor)

1. First step: DNN based localization using the UJIndoorloc database : formulate the localization problem as a regression problem solved by DNN and then implement it
2. Second step: GNN based localization
3. Third step: comparison