**XJTLUIndoorLoc: A New Fingerprinting Database for Indoor Localization and Trajectory Estimation Based on Wi-Fi RSS and Geomagnetic Field**

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### Agenda

**Introduction**  
- Background  
- Dataset Introduction  
- Experiment Result

**Methodology**  
- WiFi & Geomagnetic Field Measurement  
- Data Processing  
- Training Model

**Result**  
- Database  
- Training Result

**Conclusion**  
- Discussion  
- Future Work
Introduction

Background

At indoor environment:

I. Global positioning system (GPS) ✗
II. Wi-Fi, geomagnetic field ✓

Dataset Introduction

Popular databases:

I. UJIIndoorLoc: WiFi fingerprinting, largest, first publicly-available. (933 reference points)
II. UJIIndoor-Mag: based on magnetic field. (281 reference points)
III. IPIN 2016: Wi-Fi fingerprinting, geomagnetic coordinates and Inertial measurement units (IMU) data. (325 reference points)

XJTLUIndoorLoc:

I. RSS values, geomagnetic coordinates, IMUs (969 reference points,)
Introduction

Experiment Result

Ratio of Training data: 75% of total dataset (25,000 points)

Overall mean error: 0.75 m

Methodology

WiFi & Geomagnetic Field Measurement

APP: WiGeoLoc (Android)

Measure: Wi-Fi (RSS, mac address, time stamp, brands)
IMUs(Geomagnetic field intensity, Acceleration, Orientation)

Optimization: Kalman Filter (KF)
Methodology

WiFi & Geomagnetic Field Measurement

Euler Angles:
- X: Pitch
- Y: Roll
- Z: Yaw

Aim:
- Coordinate transformation

Methods:
- Rotation Matrix
- Quaternion
Methodology

WiFi & Geomagnetic Field Measurement

5th floor, IBSS
Space: 7.2m X 30m

4th floor, IBSS
Space: 3.6m X 30m

Methodology

Data Processing – Data Interpolation

Fig. Geomagnetic field map of the fourth and the fifth floor in the IBSS Building at XJTLU.
Methodology

Data Processing – Random Waypoint Model (RWM)

Training Model --- Convolutional Neural Network (CNN)
Methodology

Training Model --- Convolutional Neural Network (CNN)

One reference point: Image input structure

Training Model --- Long Short Term memories (LSTM)

Time step: 30
One trace: 30 continuous points
Results

Database

Total reference points: 306 (4th) + 663 (5th) = 969

<table>
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<th>WAP00</th>
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<th>Loc.y</th>
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<th>Building</th>
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Results

Training Result --- CNN

![Graph showing training and validation accuracy and loss over epochs]

Total reference points: 306 (4th) + 663 (5th) = 969
Results

Training Result --- LSTM

<table>
<thead>
<tr>
<th>LSTM Parameter</th>
<th>Value</th>
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<td>Ratio of Training Data to Overall Data</td>
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<td>Number of Epochs</td>
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<td>Batch Size</td>
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<td>Time Steps</td>
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<td>Optimizer</td>
<td>ADAM [15]</td>
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<td>Loss</td>
<td>Mean Squared Error (MSE)</td>
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<td>Dropout Rate</td>
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</table>

Localization accuracy of training data in terms of Time steps & Batch size
Results

Training Result

Localization accuracy of training data in terms of Hidden nodes

Results

Training Result

Localization error of validation data in terms of Hidden nodes
Conclusion

Discussion --- Measurement due to different postures

Future Work

- Combine RSS and Geomagnetic field
- Coordinate Transformation
- Bidirectional RNN
- Multi-floor & Multi-Building
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Questions?
Thank You