Introduction to my bachelor thesis

RSSI & Magnetometer Based Fingerprinting Localization In Indoor Wireless Environments

Otline

- Basics
- The current localisation approach
- Main goals
- Preliminary results
- To-Do’s

Basics

RSSI (Received signal strength indicator)

- Strength of wireless signal (dbm)
- Depends on
    - Distance
    - Environnement (walls)

➡ WiFi module

Magnetic field

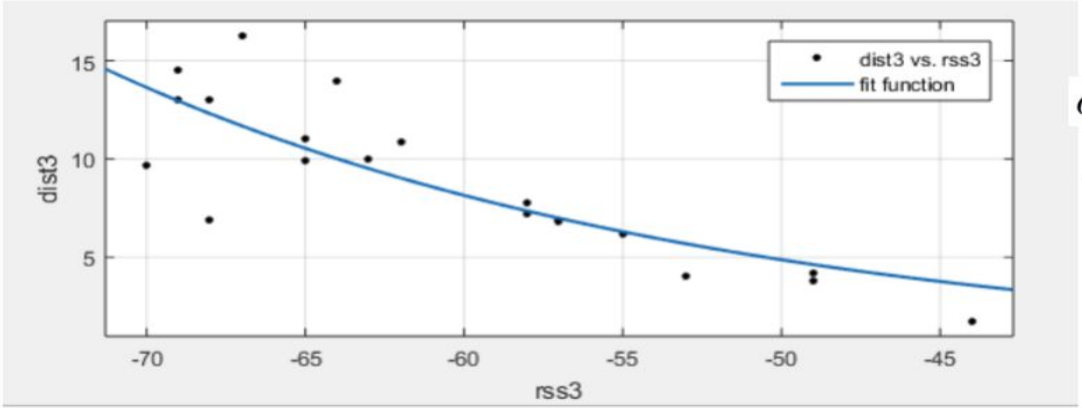
- Earth's inherent magnetic field
- Outdoor case:
    - Mostly undisrupted
- Indoor case:
    - Disrupted by electronics and metal objects

➡ Magnetometer sensor

The current localisation approach

Training

$$\hat{d}_i = \alpha_i \cdot e^{\beta_i \cdot \mathrm{RSS}_i}$$



$\alpha_3 =$ 0.37

$\beta_3 =$ -0.05

Production

RSSI → regression model → Distance to AP → triangulation → Location

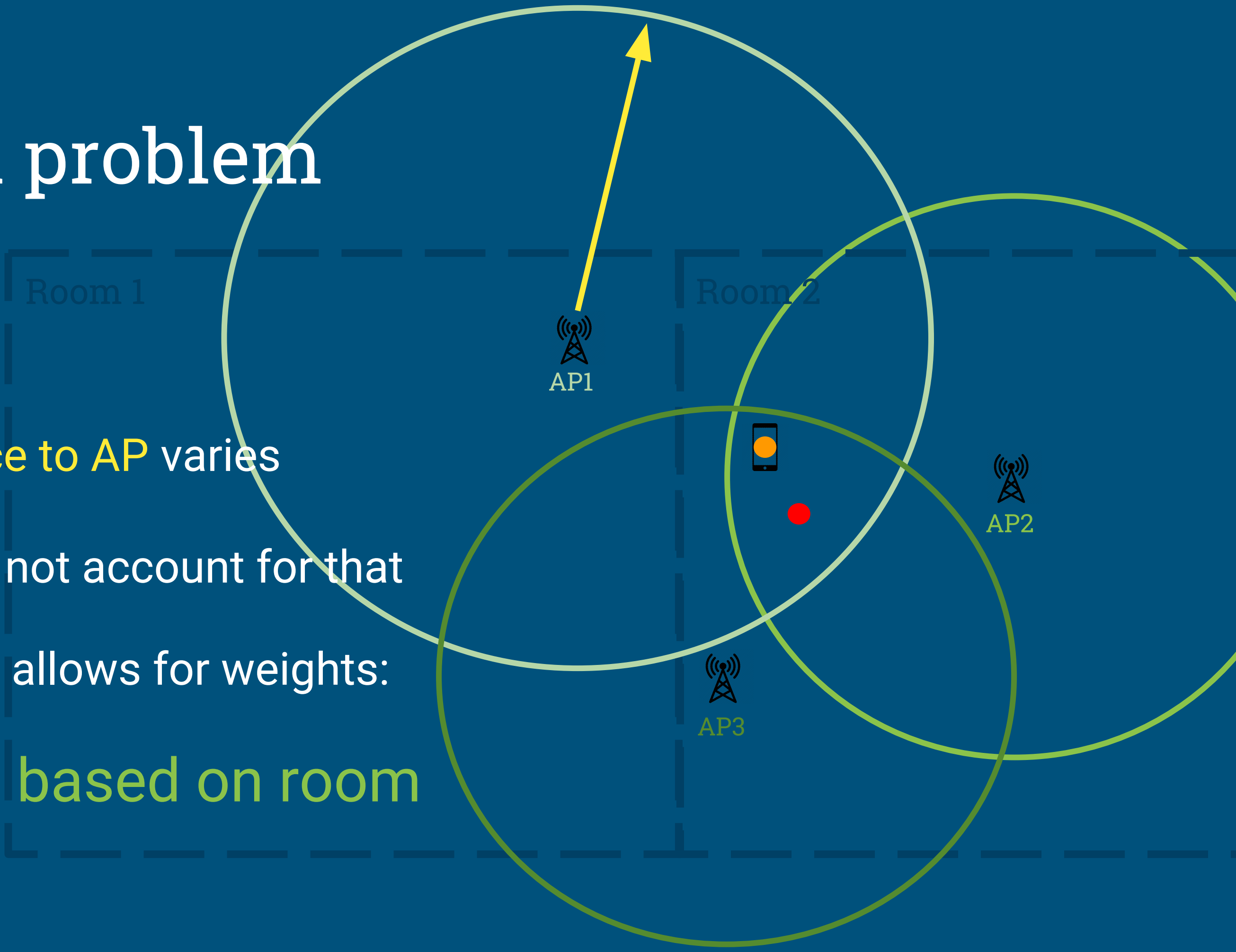
Triangulation problem

Problem

- Accuracy of distance to AP varies
  - due to walls etc.
- LLS algorithm does not account for that

WLS (weighted least squares) allows for weights:

➜ Define weights based on room



Main goals

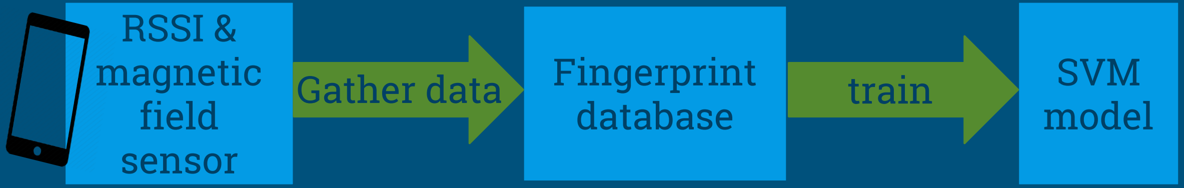
- Room recognition
  magnetic field & RSSI fingerprint
- Improve current localisation approach
  Adjust triangulation weights based on room

Room recognition - fingerprinting

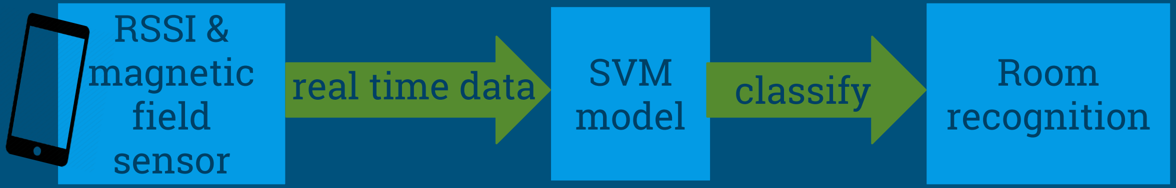
Assumption

- RSSI & magnetic field data can be used to recognize the room

Training Phase



Testing/production Phase



Improve localisation - define weights for WLS

Prerequisites

- Room recognition
- Regression model for distance to AP

Assumption

- Defining different weights for each room improves the accuracy of WLS

Question

- How do we determine the optimal weights?

Room recognition - methodology

Feasibility

Questions

- Does it work?
- What infrastructure is needed?
- What data is important?
  - Effect of magnetic field data
  - Density of measurements

Methodology

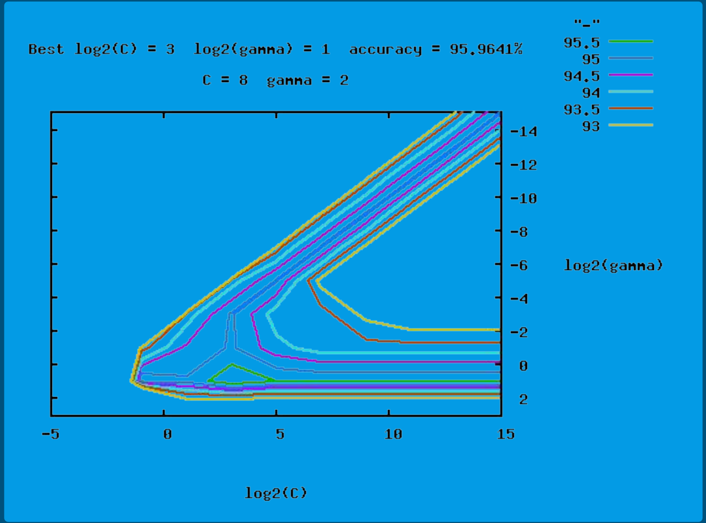
- Testbed: My Apartment
- AP’s: my own & neighbours
- Gathering different datasets
- Comparing results of SVM classifier

Room recognition - findings

Feasibility

- It works with high accuracy (89%)
- No special infrastructure needed
- Magnetic field data is important
  - 40% increase in accuracy
- Data-density affects accuracy

  Best Results:
  - Very high density at borders
  - Low density in room center



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ToDo's

- Build a testbed at uni ✓ can use existing testbed
- Build fingerprint database for the testbed ✓
- Test the room recognition ✓ 91% accuracy in early tests
- (maybe) improve the room recognition → Neural Networks
- Regression model for distance to AP
- Define weights for each room
- Compare the accuracies of LLS and WLS

Q&A

Thank you for your attention