

# AraraIPS

IPIN 2017 Track 3 competition

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Sapporo, September 2017



# I. Introduction

## The reference measurement problem

- SPATIALLY INVARIANT
- DETERMINISTIC BEHAVIOR

TRIANGULATION,  
PATH LOSS

REFERENCE MEASUREMENTS  
(WIFI, BLUETOOTH, ETC.)

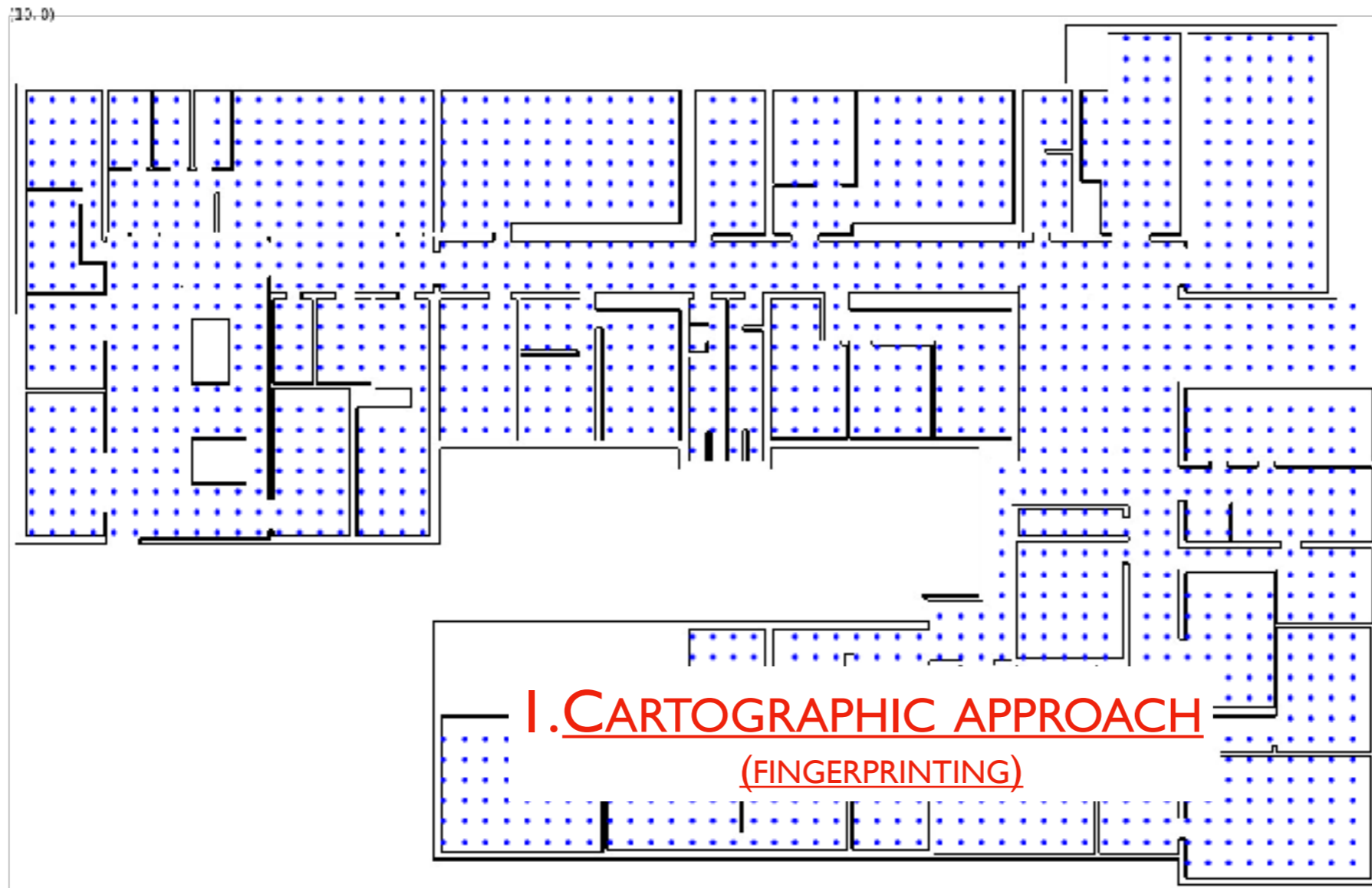
- SPATIALLY DEPENDENT
- STOCHASTIC, NOISY BEHAVIOR

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I. CARTOGRAPHIC APPROACH  
(FINGERPRINTING)



## 2. Fundamental features



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## 2. Fundamental features

Probabilistic approach



## 2. PROBABILISTIC APPROACH

ABSTRACT PROBABILISTIC MEASUREMENT MODEL CAN ADAPT TO ANY MEASURED QUANTITY (WIFI, BLUETOOTH, PRESSURE, OTHER RADIO, ETC.)



## 2. Fundamental features

Spatio-temporal correlation between measurements

HOWEVER, THE MEASUREMENT MODEL ALONE MAY NOT DISCRIMINATE ENOUGH!



IT IS EASIER TO DISCRIMINATE BETWEEN SEQUENCES OF MEASUREMENTS

- MAKE USE OF STRONG TEMPORAL CORRELATION BETWEEN MEASUREMENTS



### 3. RANDOM WALK MODEL



## 2. Fundamental features

Spatio-temporal correlation between measurements



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Spatio-temporal correlation between measurements

### 3. RANDOM WALK MODEL

(10, 0)



THIS ALSO ALLOWS TO IMPROVE PREDICTIONS USING MEASUREMENT INFORMATION ABOUT THE FUTURE

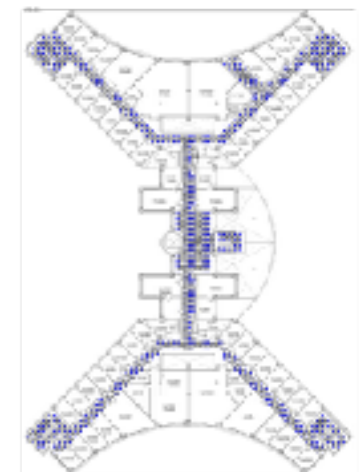
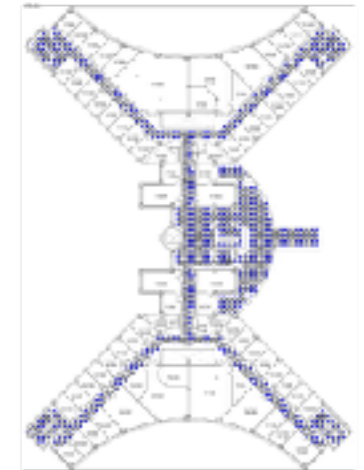
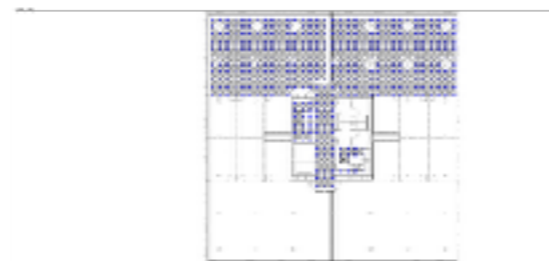
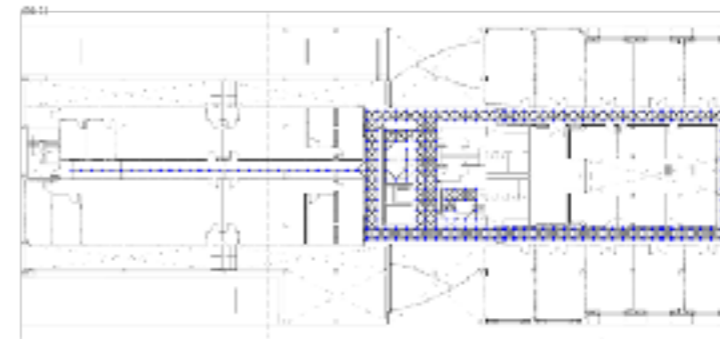
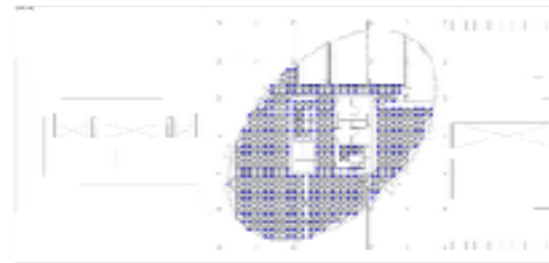
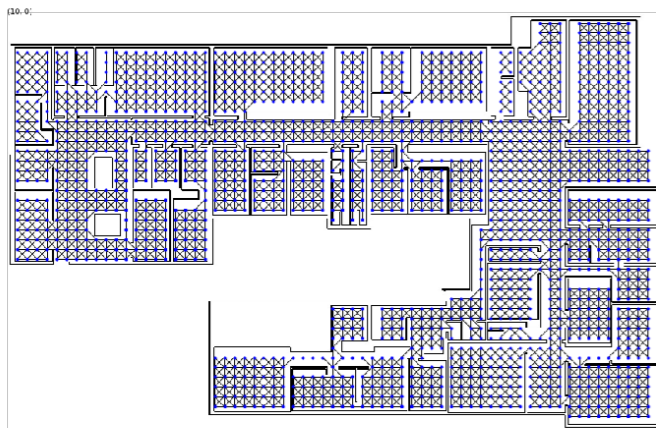




# 3. Conclusion

## Remarks about the competition

- EARLY DEVELOPMENT STAGE BUT FULLY FUNCTIONAL
- PREDICTIONS USING **WIFI EXCLUSIVELY** (WHEN INDOORS)
- PREDICTIONS INTERPOLATED (TO 0.5 s TEMPORAL RESOLUTION) WITH SHORTEST PATH LINEAR INTERPOLATION OR BASIC DEAD RECKONING
- ONE PREDICTION SET WITH (EXPERIMENTAL) **FUTURE INFORMATION** FEATURE (7 NEXT MEASUREMENTS, ~28-40 s)



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