Unit 2 Case Study – Real-Time Location Systems

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1. Introduction

Due to the surge in growth of wireless networking, being able to dependably track people and things has become a subject of high interest. Such tracking has abundant uses, such as tracking merchandise in stores to prevent theft, recording the location of a medical patient who may have a flight risk, or logging item locations in a warehouse to efficiently ship products. Not only should the movements be recorded, but locating these objects in real-time is often of utmost important. Therefore, real-time location systems (RTLS) have understandably become a substantial topic of research. Specifically, indoor positioning systems (IPS) are the subject of this investigation, as they improve upon the shortcomings of GPS systems and are made possible via now-ubiquitous WiFi signals.

A statistical IPS system was developed for research in a building at the University of Mannheim, and the experiment has been described and analyzed in detail in the Nolan and Lang textbook, *Data Science in R*. We were tasked with expanding the analysis found there to explore possible improvements to the RTLS system. Specifically, we examined their decision to remove a redundant router from the training data, and we also implemented a weighted k-Nearest Neighbors approach to supplement their conventional k-NN method.

Our analysis found that excluding the access point with MAC address ending in c0/cd (TODO) yielded better results than excluding the point ending with c0/cd (TODO). Using both access points in conjunction did/did not (TODO) yield better results. We then found that a weighted k-Nearest Neighbors approach did/did not (TODO) yield increased performance as opposed to an ordinary k-Nearest Neighbors method.

1. Background

Discuss the data and IPS setup

1. Methodology

Discuss knn and weighted knn algorithms, metrics used, the algorithms in the context of the RTLS system

1. Results

State findings

A close up of a map

Description automatically generated

|  |  |  |
| --- | --- | --- |
| **Model** | **MSE** | **Optimal k** |
| Excluding cd | 1038.5 | 6 |
| Excluding c0 | 935.6 | 6 |
| Keeping both | 1100 | 4 |

TODO get weighted knn results

1. Conclusion

Summarize findings and make business recommendations

1. References

* Nolan, D., and Temple Lang, D. (2015), *Data Science in R: A Case Studies Approach to Computational Reasoning and Problem Solving*. Boca Raton, FL: CRC Press (NTL)
* <http://rdatasciencecases.org/>

1. Appendix (?)