# High-precision indoor visible light positioning using deep neural network based on the Bayesion Regularization with sparse training point

## Introduction

Reasons to use LED’s for VLC:

* LED’s are cost-effective, energy-efficient and widely utilized for indoor illumination.
* VLC systemes do not create or suffer from radio frequency radiation (RF)

## Analysis of Principle and Method

4 Leds + photodetector, unique modulation frequency for each led

DNN consists of 4 parts: input layer, 2 hidden layers and the output layer. Signal strength is extracted by Fourier transformation of the RSS information detected by the PD and used as inputs.

BR-DNN functions through 2 stages:

1. In the training stage the network is trained by using the RSS values of a chosen set of points in the positioning area  
   periodically arbitrary points rechecking

## Experimental result and discussion

For the training set the floorarea is divided in 100 test points. 20 points are chosen from this set. This is done in 3 different ways: arbitrary, even and diagonal set

|  |  |  |  |
| --- | --- | --- | --- |
|  | Diagonal | Arbitrary | Even |
| x | 2.18 | 2.51 | 1.94 |
| y | 1.91 | 2.77 | 3.57 |
| total | 3.4 | 4.35 | 4.58 |

Waarom zo groot verschil tussen x en y?

Veel beter dan de traditionele methodes

## Conclusion

Results indicate that the positioning error with the algorithm is 3.4cm with only 20 training points in thee area

Realized a high positioning accuracy with sparse training points

Positioning error under the diagonal set is 3.4 cm which is lower than the other common methods

The training time is 11.25ms and positioning time is 8.66ms