PROGRAMME DE RECHERCHE
RÉSEAUX DU FUTUR

Deep Learning Based Received Signal Strength Estimation

Project

NF-JEN

Network of the Future Just Enough Networks

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Resource Harvesting and Optimized wireless Devices for Enhanced Sustainability

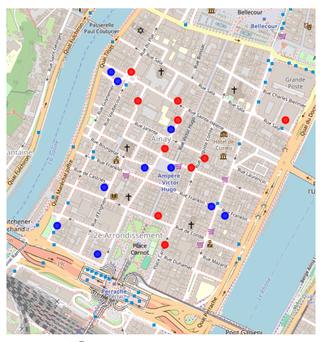
- Auto-RSS is a machine learning tool to facilitate received signal strength or coverage prediction in urban environment. Based on the realistic 4G and 5G network the proposed model is able to infer a realistic coverage map of wireless signal propagation characteristics based on a base station locations. The designed model learns wireless signal propagation characteristics in a realistic urban environment with varying locations of BS.

Approach

- An RSS / coverage map estimation algorithm is proposed using autoencoder (AE) based on **convolutional neural networks**. The coverage prediction is transformed into an image-to-image translation task by creating binary images of BS and coverage of the selected regions, where every pixel value of the image represents received power intensity.

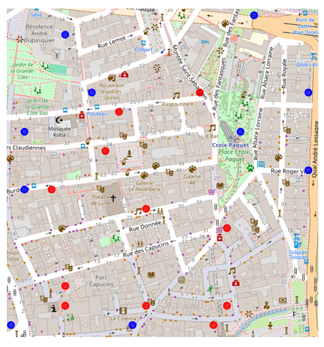
Region of Interest & Dataset:

3 realistic urban region in Lyon is considered to create the data set. The base station locations are converted into binary images.



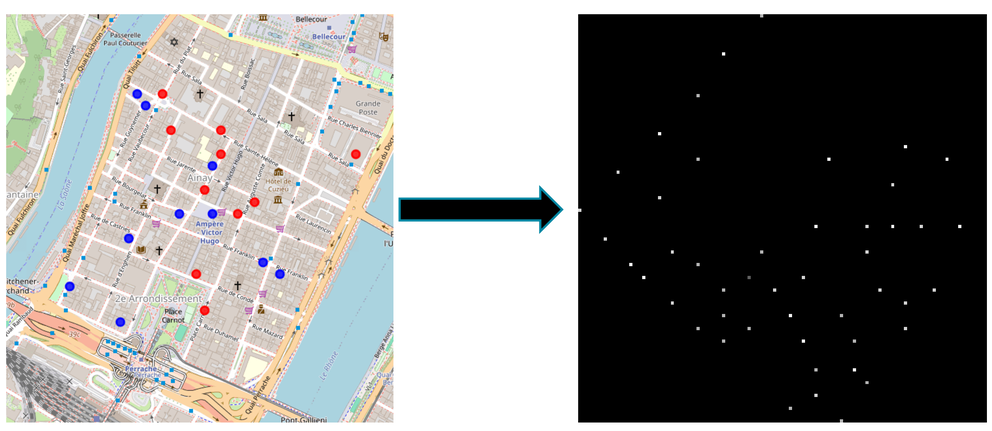
Place Carnot

Mairie du 1 Arr. de Lyon



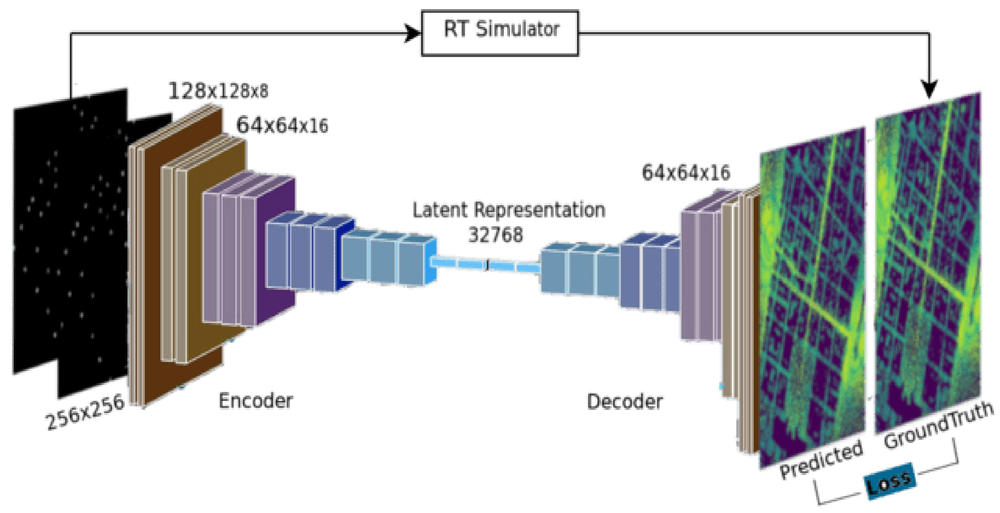
Fontaine Jacobins

From these areas, the dataset to train the CNN model was created using a simulator an open source simulator by NVIDIA.



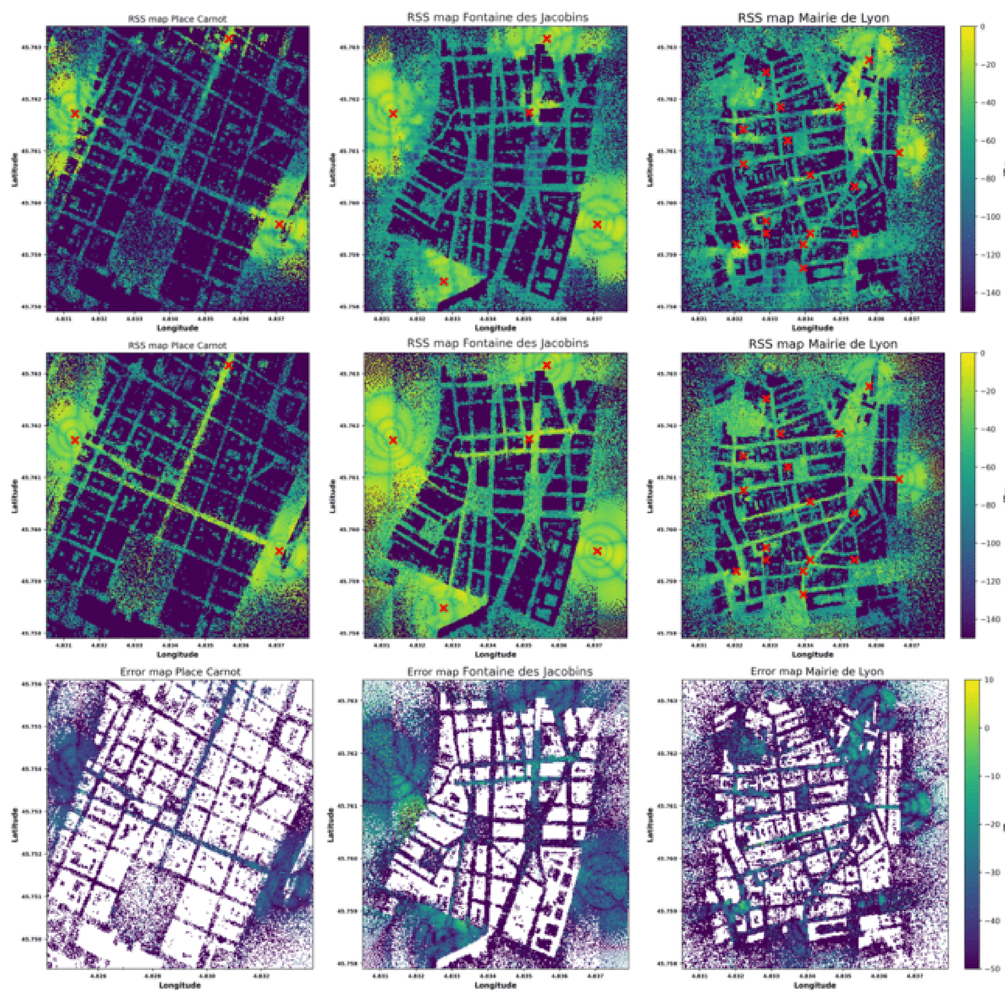
Methodology:

A U shaped CNN model is used to tain and predict RSS values in the RoIs from BS binary images.



Results

Experimental results for Auto-RSS: 1st row: Predicted maps, 2nd row (Left to right): reference maps generated from RT simulator, red cross reveals the transmitter locations, (Left to right): corresponding error maps.



Result:

For error calculation, the RMSE, MAE in *W* of the predicted and actual values of RSS is calculated and execution time for the model to predict 430 test images is presented in below table.

RMSE	MAE	Test time
$9{,}482\times10^{-6}$	4.246×10^{-7}	1s

References :

[1] Hoydis, Jakob, et al. "Sionna: An open-source library for next-generation physical layer research." arXiv preprint arXiv:2203.11854 (2022).

[2] Schmidhuber, Jürgen. "Deep learning in neural networks: An overview." Neural networks 61 (2015): 85-117.