FED4AI – Stage 1

Experimental validation of of AI models for the prediction of wireless links performance

GOALS

- Accurate prediction of wireless performance links can be very useful to optimize radio planning which is an important business activity for ALLBESMART.
- The main goal of Phase 1 of this experiment is the validation of Machine Learning algorithms for predicting the performance of Wi-Fi radio links in multi node scenarios.

CHALLENGES

- The Wi-Fi links performance depends in a highly complex way on the actual topology, channel qualities, spectral configurations, etc. It is especially hard to predict in quantitative terms how a given configuration will perform.
- We use machine learning techniques to learn implicit performance models, from a limited number of real-world measurements.

DEMO SETUP

- The CityLab testbed was used to validate Machine Learning algorithms to forecast the throughput of Wi-Fi links in outdoor and high interference environment.

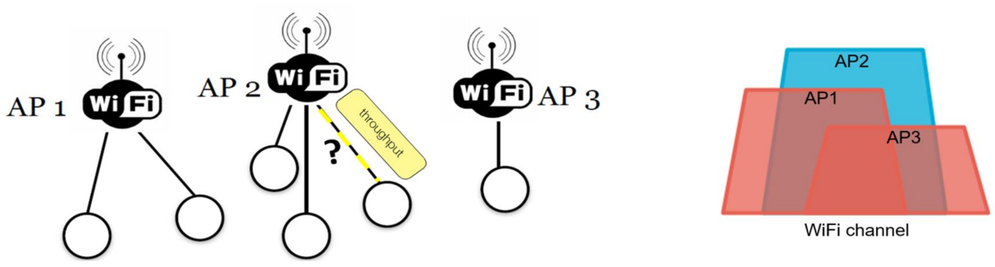


Figure 1 Multi node scenario where prediction of link performance can be challenging.

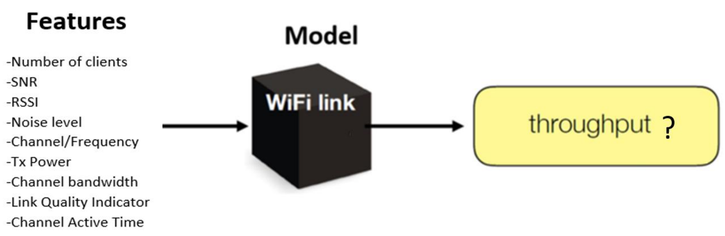


Figure 2 Prediction of a link throughput based on a “black-box” Machine Learning model.

DEMO SETUP

City of Things – CityLab – Antwerp – imec

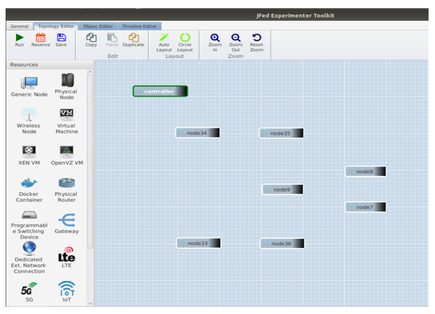


Figure 3: jFed toolkit used to remotely setup the experiment.

Figure 4: Gateway deployment in the city of Antwerp for wireless experimentation.

Figure 5: Layout of the CityLab wireless testbed used in this experiment.

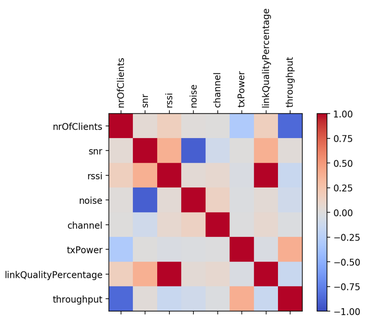
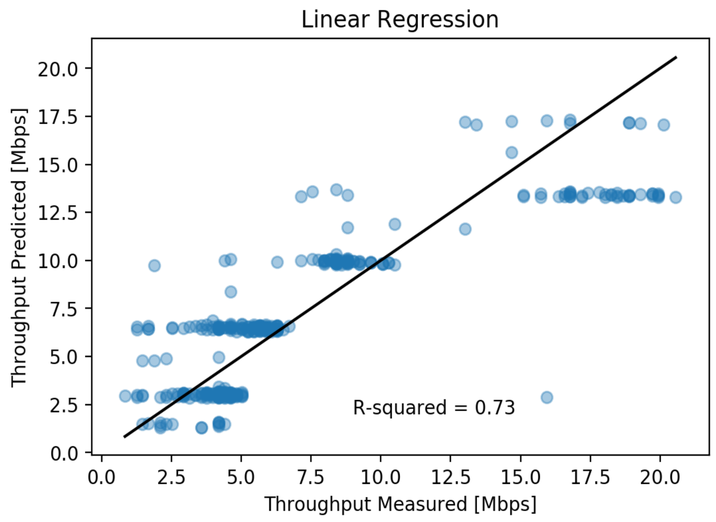


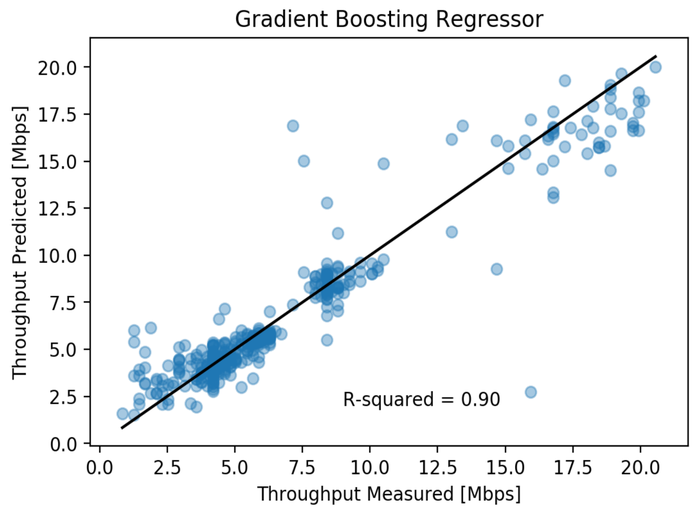
Figure 6: Correlation matrix between all the measured features of the Wi-Fi links.

RESULTS

- We have measured the performance of the Machine Learning models: Gradient Boosting Regressor, Linear Regression, kNN and Decision Tree.



- The closer the points are to the diagonal, the better the prediction accuracy. The Gradient Boosting Regressor outperforms the other methods and produce fewer outlying predictions.



CONCLUSIONS

- We observed that abstract “black box” models built using Supervised Machine Learning techniques, without any deep knowledge of the complex interference dynamics of IEEE 802.11 networks, can estimate the link throughput with very good accuracy, reaching a value of R2-score of 90% with the Gradient Boosting Regressor.

allbesmart

POST MORTEM

- The acquired new competences will allow ALLBESMART to include new link quality forecast features in its network analytics framework **UXPERT.**
- Stage 2 experiment: extension of this “black box” approach to forecast the capacity of LTE-A radio links without using active transmission over the mobile network.
- Contact: pmarques@allbesmart.pt
- www.allbesmart.pt