ARIADNE

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After completing its theoretical work on analysis of D-Band link characteristics and application of Reconfigurable Intelligent Surfaces, design of D-Band antennas and investigation of AI aided wireless networks, the ARIADNE project presents its demonstrators.

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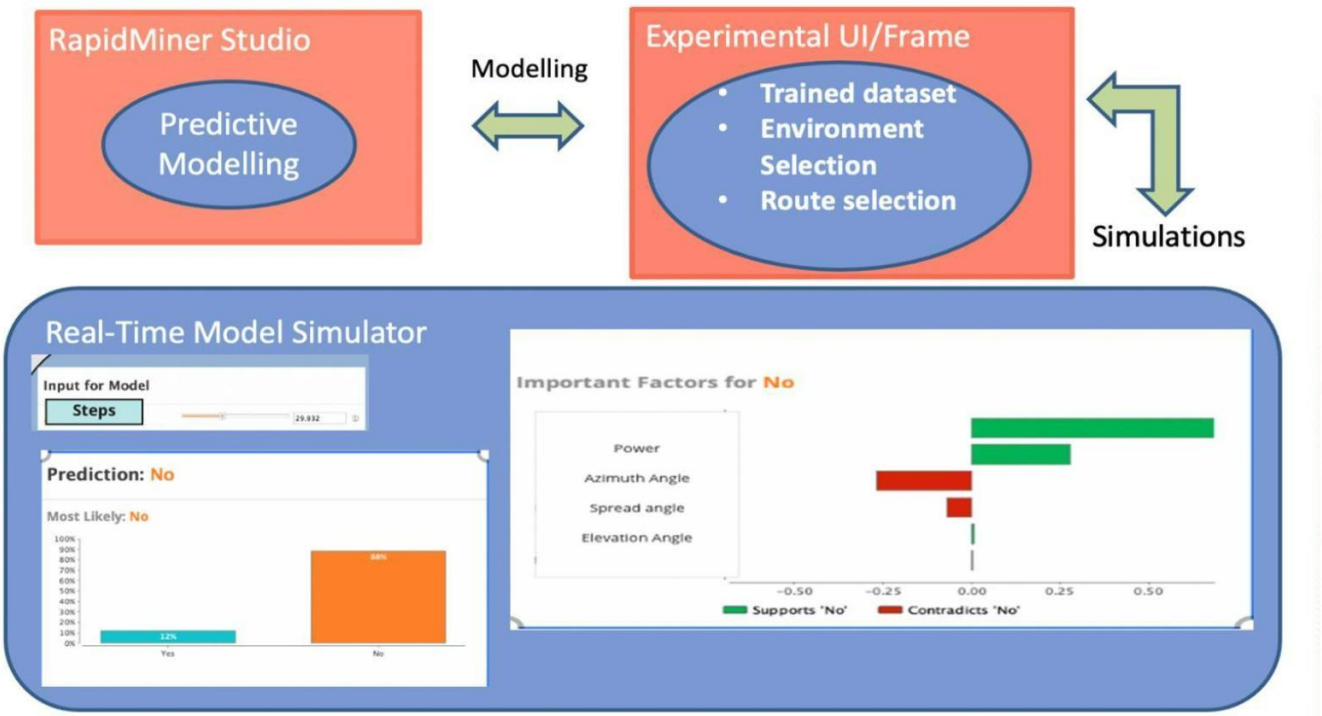
Management of high-frequency communications resources by applying Artificial Intelligence and Machine Learning

Our goal is to develop predictive Machine Learning (ML) model for environment-specific wireless channels.



- ML models for specific wireless environments considering user mobility and blockages
- Visual interactions to elaborate influence of attributes and understand the achieved solutions

Predicting Pathloss and LoS existence for environment aware channel modelling

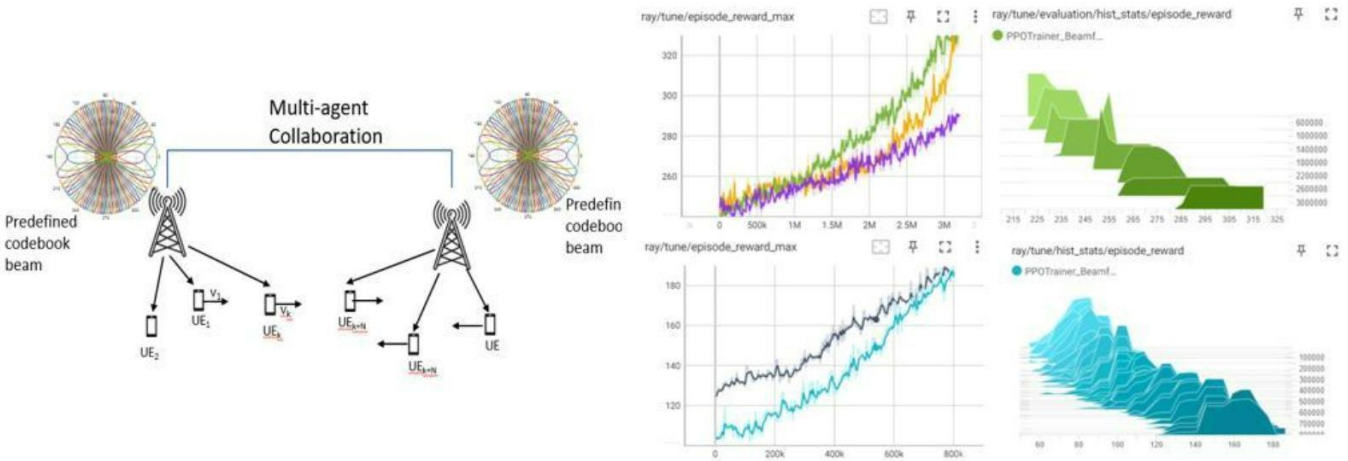
Accuracy: 75%	True LOS	True NLoS	**Precision**
Pred. LoS	3072	55	90.24%
Pred. NLoS	5673	14076	70.85 %
Recall	34.71%	99.61%	

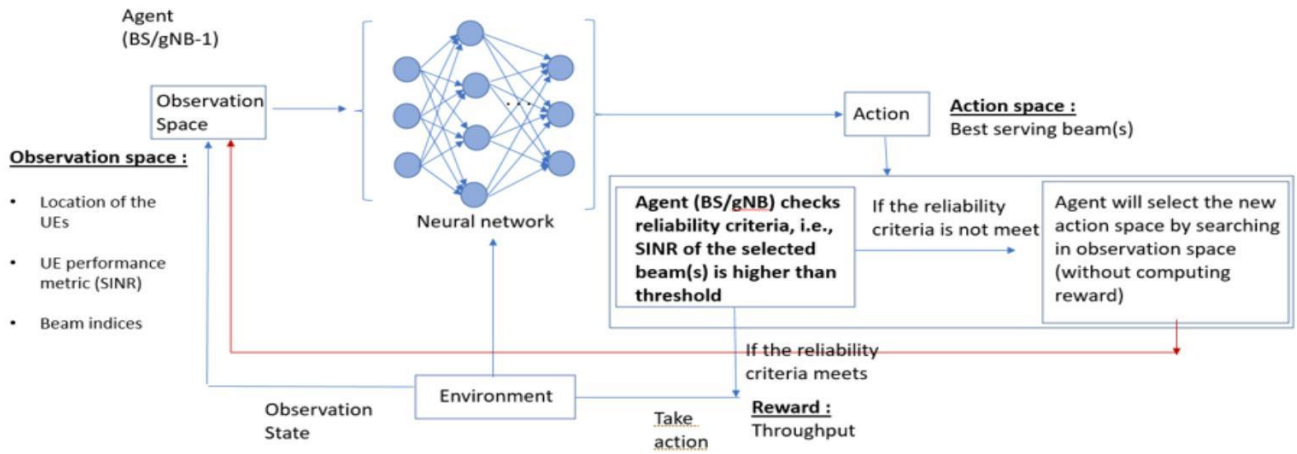
Achievements:

- Users get a better understanding of how the attributes influence model predictions in an interactive manner.
- Users can validate analytical models with machine learning predictions.
- Model predictions can be further optimized with minimization/maximization of attributes.

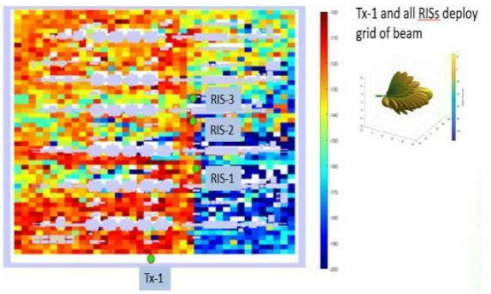
Beam Prediction applying Proximal Policy Optimization based Distributed Deep Reinforcement Learning

Our goal is to develop beam prediction method where the base station interacts with environment and perform training real-time





- Our algorithm can ensure the reliability constraint at each UE, where the signal-to-noise-ratio (SINR) is guaranteed to be higher than a specific threshold.
- The BS/gNB can select the optimal beam real-time by interact with the environment, the BS/gNB can select the optimal beam which maximize the throughput for all the steps.

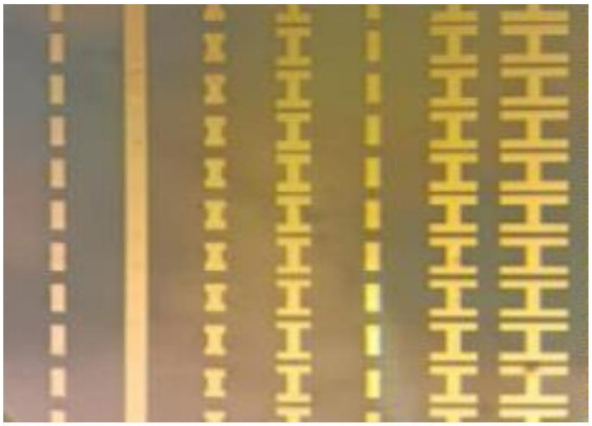


RIS with Ray-Tracing for indoor scenario is also demonstrated

Reconfigurable Intelligent Surface (RIS)

showcasing anomalously reflecting metasurfaces to direct millimeter-band waves towards receivers in the shadow of walls or other obstacles.

Close-up of metasurface working at 157 GHz



Related ARIADNE project results:

- Analysis of the metasurface characteristics for communications purposes
- Design of reconfigurable surfaces
- Manufacturing of multiple RIS samples working at different frequencies

The demonstration / measurement setup:

- an exemplary “anomalous” communications link is established
- thanks to RIS an otherwise failed link is established
- showcasing the fully integrated radio frequency up- and down-converting modules
- operated with novel quasi-optical lens designed in ARIADNE (medium antenna gains ~30dBi)