I. Problem Statement

Wireless systems are characterized by many variables, each of which influence multiple performance metrics such as reliability, throughput, latency, ...

To find optimal settings, a large design space is explored, typically in the order of 1000+ combinations of parameter settings. As a result, finding optimal settings is very time-consuming.

II. Solution

Surrogate models are created based on a small number of experiments and these models are used to quickly identify optimal settings.

During optimization, the Multi-Objective Surrogate Based Optimizer (MOSBO) predicts the performance from the surrogate model constructed (green cells in the table) and compare it to the real performance (blue cells in the table) retrieved through experimentation.

III. Experimental Validation

An experimental validation of the MOSBO optimizer using the iMinds w-Abt.t wireless testbed.

The speaker node configures codec parameters and selects codec based on the Optimized Pareto Front and injects audio to listeners.

The MOSBO optimizer locates the Approximate Pareto Front (APF) after 82 runs (Speed Up Factor = 7680/82 = 93.65) and covers 98.36% of the dominated elements bounded within the Optimum Pareto Front (OPF).

The knee point of the optimization problem corresponds to a MOS score of 4.48065 and exposure value of 1.153 mW/kg.

IV. Result

The MOSBO optimizer locates the Approximate Pareto Front (APF) after 82 runs (Speed Up Factor = 7680/82 = 93.65) and covers 98.36% of the dominated elements bounded within the Optimum Pareto Front (OPF).

The MOSBO optimizer predicts the performance from the surrogate model constructed (green cells in the table) and compare it to the real performance (blue cells in the table) retrieved through experimentation.

V. Conclusions

Optimizing Multi-Objective Wireless Systems in search of the optimum settings is computational expensive.

Most of the time, it is impractical to retrieve the Optimum Pareto Front (OPF) of Wireless Systems. To tackle such problems, a Multi-Objective Surrogate Based Optimization (MOSBO) is presented.

MOSBO works by building kriging models of design objectives and predicts the next parameters. To validate the approach, a Wi-Fi conferencing system is selected having 2 conflicting objectives (Transmission Exposure and Audio Quality) and 4 design parameters (codec BitRate, codec FrameLength, Wi-Fi TxRate and Wi-Fi TxPower).

The MOSBO optimizer locates the Approximate Pareto Front (APF) after 82 runs (Speed Up Factor = 93.65) and dominates 98.36% of the elements bounded within the Optimum Pareto Front (OPF)