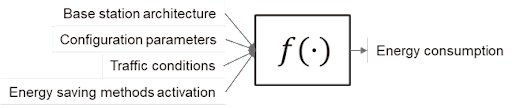
5G, the fifth generation of radio technology, has brought about new services, technologies, and networking paradigms, with the corresponding social benefits. However, there is growing concern over the energy consumption of these new network deployments. While 5G networks are estimated to be about 4x more energy-efficient than 4G networks, their energy consumption is approximately 3x larger due to the need for a larger number of cells to provide the same coverage at higher frequencies and the increased processing required for wider bandwidths and more antennas. It is worth noting that, on average, network operational expenditure (OPEX) already accounts for around 25 percent of the total operator’s cost, and 90 percent of it is spent on large energy bills. More than 70 percent of this energy is estimated to be consumed by the radio access network (RAN), particularly by the base stations (BSs), while data centres and fibre transport account for a smaller share.

Base station energy consumption depends on multiple factors, such as specific architecture (e.g. RRU or AAU), configuration parameters (e.g., number of operated carriers, bandwidth, transmit power), traffic conditions (e.g., number of allocated physical resource blocks), and the activation of energy-saving methods (e.g., symbol shutdown, RF shutdown). To reduce network energy consumption, it is crucial to optimize base station parameters and energy-saving methods. This requires a deep understanding of how these parameters and methods impact the energy consumption of different base stations. Therefore, accurate modelling of energy consumption is essential for achieving more energy-efficient network deployments.



This ML challenge targets addressing the important questions mentioned above. In the challenge, the participants are asked to design a machine learning-based solution that can be trained on a dataset of few scenarios and then generalize successfully to data from scenarios not seen before. In particular, the designed machine learning model must be able to achieve the following objectives.

Objective A: Develop a model able to estimate the energy consumed by different base station products. The participants are required to develop a model that estimates the energy consumed by different base station products, taking into consideration the impact of various engineering configurations, traffic conditions, and energy-saving methods.

Objective B: Achieve generalization capabilities across different base station products. The model must estimate the energy consumption of a new base station product based on measurements collected from existing ones, such as Products A, B, and C. For example, if training data is available for these three products, the model must be able to provide an estimate of the energy consumed by Product D.

Objective C: Achieve generalization capabilities across different base station configurations. The model must predict the energy consumption of newly configured parameters based on a small number of real network configuration parameters. For instance, if the training data contains samples collected from many base station products, when the transmit power is set to 30, 35, and 43 dBm, the model must estimate the energy consumed when the transmit power is set to 40 dBm.

**About AI for Good - International Telecommunication Union (ITU)**

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AI for Good is organized by ITU in partnership with 40 UN Sister Agencies. The goal of AI for Good is to identify practical applications of AI to advance the United Nations Sustainable Development Goals and scale those solutions for global impact. It’s the leading action-oriented, global & inclusive United Nations platform on AI.

Evaluation

While the challenge is running your submissions will be scored on Mean Absolute Error.

For every row in the dataset, submission files should contain 2 columns: Time and Energy.

Your submission file should look like this (numbers to show format only):

Time Energy

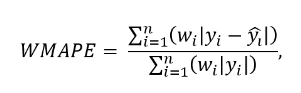
2023-01-01\_B\_0 84.154

2023-01-01\_B\_0 17.178

Once the challenge has closed the private leaderboard will be delayed by 48 hours as we take your submission file and score it against WMAPE and this will constitute your final leaderboard score.

The private leaderboard scores of your two chosen submissions, will be overwritten with your WMAPE scores, so remember to select your two best submissions before the deadline.

To focus on the cross-equipment and cross-configuration generalization capability of the model, the test set estimation accuracy is evaluated by using a weighted relative error evaluation method. Specifically, the error weight, w\_i, of the sample corresponding to the new device and/or new configuration in the test set is larger and is provided in the test set. The error metric is defined as:



where y\_i is the true energy consumption and (y\_i)^ is the estimated energy consumption.

The final model performance is ranked according to the minimum WMAPE error.

Participants are required to submit:

* A CSV file named power\_consumption\_prediction.csv, containing the power consumption prediction performed over the test set;
* The developed model code;
* A report explaining their solution, including the outcomes of their models.

In evaluating the final submission, both the quality of the report (weighted 50%) and the achieved model score (weighted 50%) will be considered.

As there are 8 prizes to be won, once the private leaderboard has been revealed, ALL users will be required to submit the 3 items detailed above to a Google Form that will be shared with the client. The form will be shared and opened once the private leaderboard has been revealed and closed 48 hours afterward.

Prizes

* 1st place: 5 000 CHF cash prize + 5 000 CHF travel grant to Dubai to present your solution.
* 2nd place: 3 000 CHF
* 3rd place: 2 000 CHF
* 4th place: 1 000 CHF
* 5th place: 1 000 CHF
* Best solution from students: 1 000 CHF
* The most creative solution: 1 000 CHF
* Best presentation: 1 000 CHF

Internship will be offered the winning team at Huawei.

Participants are required to submit:

* A CSV file named power\_consumption\_prediction.csv, containing the power consumption prediction performed over the test set;
* The developed model code;
* A report explaining their solution, including the outcomes of their models.

As there are 8 prizes to be won, once the private leaderboard has been revealed, ALL users will be required to submit the 3 items detailed above to a Google Form that will be shared with the client. The form will be shared and opened once the private leaderboard has been revealed and closed 48 hours afterward.

There are 20 000 Zindi points available. You can read more about [Zindi points here](https://zindi.africa/discussions/13959?utm_source=zindi&utm_medium=blog&utm_campaign=challenge_resources&utm_id=CR).

Timeline

Competition closes on 13 October 2023.

Final submissions must be received by 11:59 PM GMT.

We reserve the right to update the contest timeline if necessary.

How to get started with Zindi