

Appendix III: MagNet Challenge Final Evaluation Rules – 11/10/2023

This document presents the key principles of the final evaluation rules for the 2023 MagNet Challenge. These rules should be interpreted as general guidelines with potential updates. Please check <https://github.com/minjiechen/magnetchallenge> for the most updated explanation of the rules.

The final evaluation of the 2023 MagNet Challenge is a two-step process. With the first step completed-- student teams self-report the pre-evaluation results of their pre-trained models for the 10 already known materials with abundant data, we now enter the second step.

The second step is the final submission (due 12/31/2023), student teams will (1) submit their prediction results based on the new given data, and (2) submit the codes and supporting documents. The top-ranked teams will be invited for a final presentation followed by a code review.

Here are some necessary facts about the newly released data:

- 1) 5 new materials are provided, which are kept anonymous and labeled as A, B, C, D, and E.
- 2) Training data contains 5 CSV files, including: B_Field ($N \times 1024$, in T), H_Field ($N \times 1024$, in A/m), Frequency ($N \times 1$, in Hz), Temperature ($N \times 1$, in $^{\circ}\text{C}$), and Volumetric_Loss ($N \times 1$, in W/m^3). N refers to the number of data points.
- 3) Testing data contains 3 CSV files, including: B_Field ($N \times 1024$, in T), Frequency ($N \times 1$, in Hz), and Temperature ($N \times 1$, in $^{\circ}\text{C}$). Similarly, N refers to the number of data points.
- 4) The number of data points for each material is provided in the following table:

Number of Data Points	Material A	Material B	Material C	Material D	Material E
Training Data	2432 (101/694/1637)	7400 (364/2253/4783)	5357 (215/1679/3463)	580 (145/400/35)	2013 (57/667/1289)
Testing Data	7651 (334/2174/5143)	3172 (147/980/2045)	5357 (212/1751/3394)	7299 (61/2247/4991)	3738 (107/1205/2426)

(The numbers in brackets denote the number of data points for sinusoidal waves, triangular waves, and trapezoidal waves, respectively.)

***Please note that the training data and testing data are intentionally split and selected in specific ways, different from material to material, for the purpose of the MagNet challenge. Unbalanced data distribution is normal and should be considered when developing / refining your models.**

***The complete dataset will be released after the MagNet challenge is completed.**

Timeline for the final evaluation:

November 10th, 2023 – Data released for final evaluation.

- 1) Download the new training data and testing data from the following link for the 5 additional materials:
https://www.dropbox.com/sh/q5w2ddol8y6bk0k/AABXKxv_aiLj8yXspeusJq4na?dl=0
- 2) Train, tune, and refine your model or algorithm using the training data.
- 3) Predict the core losses for all the data points contained in the testing data for the 5 materials. For each material, the prediction results should be formatted into a CSV file with a single column of core loss values. Please make sure the index of these values is consistent with the testing data, so that the evaluation can be conducted correctly.

December 31st, 2023 – Final submission.

- 1) Prediction results for the testing data are due as 5 separate CSV files for the 5 materials.
- 2) A 5-page IEEE TPEL format document due as a PDF file. Please briefly explain the key concepts.
- 3) Full executable model due as a ZIP file for a potential code review with winning teams.
- 4) Submit all the above required files to pelsmagnet@gmail.com.

January to March 2024 – Model Performance Evaluation, Code Review, Final Winner Selection