Indoor Pathloss Radio Map Challenge
Dataset Documentation

-The data set includes PL radio maps generated with an intelligent ray tracing algorithm at:

(i) 25 different indoor geometries (referred to as B1, B2, ..., B25),
(ii) 3 different frequency bands (referred to as f1, f2, f3). Note that **f1** corresponds to **868 MHz**, **f2** to **1.8 GHz**, **f3** to **3.5 GHz**
(iii) 5 antenna radiation patterns (referred to as Ant1, Ant2, ..., Ant5).

- The spatial resolution for all the simulations is 0.25 m, i.e., the PL is evaluated every 0.25

- For all the simulations the transmitting antenna (Tx) is at the same height as the receiving plane for which the PL is simulated, specifically 1.5 m above the floor.

- For the 3D radiation pattern, $G(\varphi,\theta)$, of each antenna, we have isolated the values for $\theta = 0$ (no elevation, same Tx-RX height), and we have stored them in the files Radiation_Patterns/Ant#ID_Pattern, i.e., in the file each row corresponds to the gain at this angle

For each simulation, we have stored an input RGB image and a grayscale target output image:

(i) Input data: A $W \times H$ RGB image, where the first two channels indicate the absolute value of the (i) normal incidence reflectance (0 for air) and (ii) the normal incidence transmittance at each point of the grid in dB (0 for air)[1], as well as (iii) the physical distance between the Tx and each point of the grid
(ii) Output data: A $W \times H$ grayscale image where each point of the image denotes the PL at that point.

- Note that $W \times H$ is different for each building and depends on its physical dimensions (however, it remains the same for different cases in the same building, e.g., for B1 the images for Ant1 and Ant2 will have the same size)
- The positions of the Tx for each sample are found in the directory Positions/Positions_B#ID_Ant#ID_f#ID, and they indicate the pixel at which the Tx is located (note it's not physical distance, but the pixel in the image)

Naming Convention:

- To facilitate locating the images, each image is named according to the building, antenna, frequency, and sample ID: B#ID_Ant#ID_f#ID_S#ID, e.g., B5_Ant1_f2_S10 refers to the 11th sample generated at Building 5 considering Ant1 transmitting at 1.8 GHz

[1] Note that both reflectance and transmittance make physical sense only in the presence of an interface, and the 0 value for the reflectance and transmittance pseudo-indicates that there is reduction in the power of the propagation wave due to the presence of an interface, e.g., air-concrete. These values are extracted from the software.

- Input and Output images use the same naming convention but are located in different directories
- While building, antenna and frequency numbering ranges from 1 to max_ID, not that for the samples the numbering ranges from 0 to max_ID -1, so sample 0 corresponds to the first simulation we conducted

Task 1 (30%): For this task the participants will use only the data under the input/output folders Task_1_ICASSP. The folder includes the data for simulation with an isotropic antenna pattern (Ant1) conducted at 868 MHz (f1) for all the buildings in the dataset (B1 to B25).

For each building we have generated 50 radio maps by placing the Tx at different locations within the building (note valid sample names are B(1-25)_Ant1_f1_S(0-49)

The goal of the task is to probe how well a model can generalize to new geometries.

The participants can train their models with the data and their trained model will be tested with samples from 5 geometries not included in the current dataset

Task 2 (30%): For this task the participants will use only the data under the input/output folders Task_2_ICASSP. The folder includes the data for simulation with an isotropic antenna pattern (Ant1) conducted at 0.868, 1.8, and 3.5 GHz (f1, f2, f3) for all the buildings in the dataset (B1 to B25) – note that this also includes the data from Task 1

For each building and frequency we have generated 50 radio maps by placing the Tx at different locations within the building (note valid sample names are B(1-25)_Ant1_f(1-3)_S(0-49)

The goal of the task is to probe how well a model can generalize to new geometries and frequencies.

The participants can train their models with the data and their trained model will be tested with samples from 5 geometries and a frequency band not included in the current dataset

Task 3 (40%): For this task the participants will use the data under the input/output folders Task_3_ICASSP. The folder includes the data for simulation with *5 different antenna radiation patterns* (Ant1 to Ant5, Ant1 is the isotropic) conducted at 0.868, 1.8, and 3.5 GHz (f1, f2, f3) for all the buildings in the dataset (B1 to B25) – note that this also includes the data from Task 2

For Ant1, for each building and frequency we have generated 50 radio maps by placing the Tx at different locations within the building (note valid sample names are B(1-25)_Ant(1-5)_f(1-3)_S(0-49)

For Ant2 to Ant5, for each building and frequency, we have generated 80 radio maps by placing the Tx at different locations within the building and assuming randoms steering angles (note valid image names are B(1-25)_Ant(1-5)_f(1-3)_S(0-79)

The goal of the task is to probe how well a model can generalize to new geometries, frequencies, and radiation patterns.

The participants can train their models with the data and their trained model will be tested with samples from 5 geometries, a frequency band, and two antenna radiation patterns not included in the current dataset

Note 1: We expect to allocate 30%, 30%, and 40% for Task 1, 2, and 3, respectively. The exact scoring scheme will be finalized towards the end of September and will be announced in the competition website: https://indoorradiomapchallenge.github.io/results.html

Note 2: For all the tasks it is up to the participants to properly split the data into training and validation to select the best model and avoid overfitting.

Note 3: For all the tasks (and especially for task 1 and 2 that have lower volume of data), the participants are encouraged to use data augmentation techniques, e.g., rotation/mirroring (please see the provided code snippets for some simple examples)

Note 4: As per https://indoorradiomapchallenge.github.io/timeline.html, before the final submission we will release part of the test set inputs so the participants can verify the applicability of their methods, and we also plan to have a preliminary ranking evaluation (relevant announcements will follow)