For this assignment, you will use the **“cat\_dog”** dataset used in midterm1. You can use either the augmented or the non-augmented training set depending on the computing capacity of your personal computer. The test set remains the same. Your task is to perform hyper-parameter optimization on a CNN model. The CNN model should contain the following layers:

* Input layer
* Hidden 2D CNN layers (ReLU activation) and a kernel size of (3,3) with dropout.
* Max Pooling layer after all the CNN layers. Pooling size of (2,2) and stride of 1.
* Hidden Dense layers (ReLU activation) with dropout.
* Output layer with one node (sigmoid activation).

You will need to tune the following hyperparameters given the provided range/options.

* Number of CNN layers: should be between 2 and 4.
* Number of kernels in each CNN layer: should be between 20 and 150. Tune so that different CNN layers can have different numbers of kernels.
* The number of hidden dense layers after all the CNN layers should be between 1 and 3.
* The nodes in each dense layer should be between 10 and 50. Tune so that different dense layers can have different numbers of nodes.
* Dropout rate:
  + For CNN layers 1 and 2, the dropout rate should be between 20% and 40%.
  + For CNN layers 3 and 4, the dropout rate should be between 30% and 50%.
  + For hidden dense layers 1 and 2, the dropout rate should be between 20% and 40%.
  + For hidden dense layers 3, the dropout rate should be between 30% and 50%.

Ideally, you should also tune the hyperparameters such as batch size, and optimizer (along with the learning rate) etc. But for the sake of time, please use an option of your choice. You don’t need to tune the learning rate of the optimizer. Just use the default values.

Use HyperOpt to perform hyperparameter optimization and run it for at least 20 iterations (you can increase the depending on how much time it takes). Find the best-tuned model and report predicted accuracy on the test set.