Python

&

Deep Learning

Group 3

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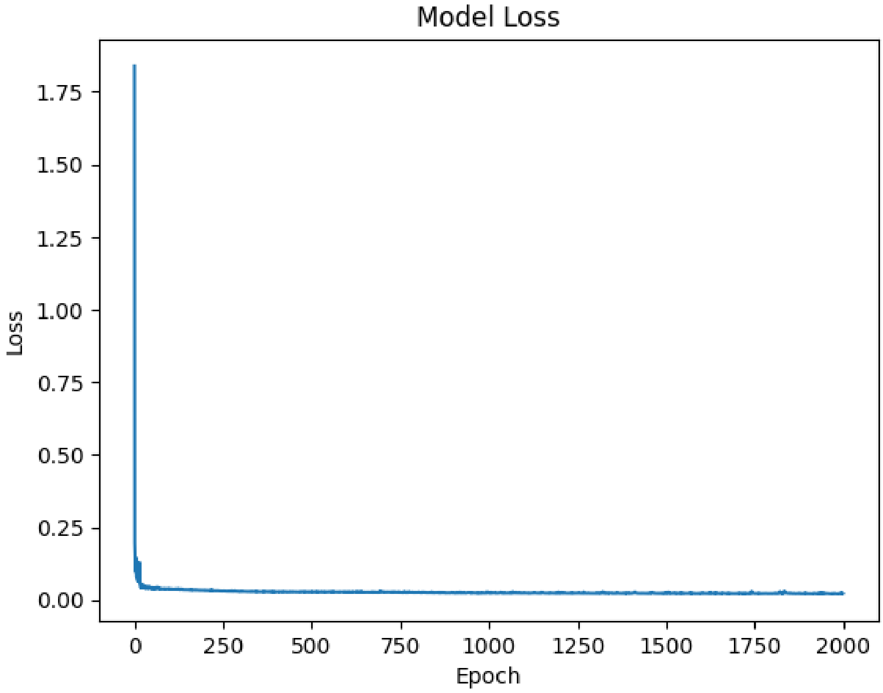
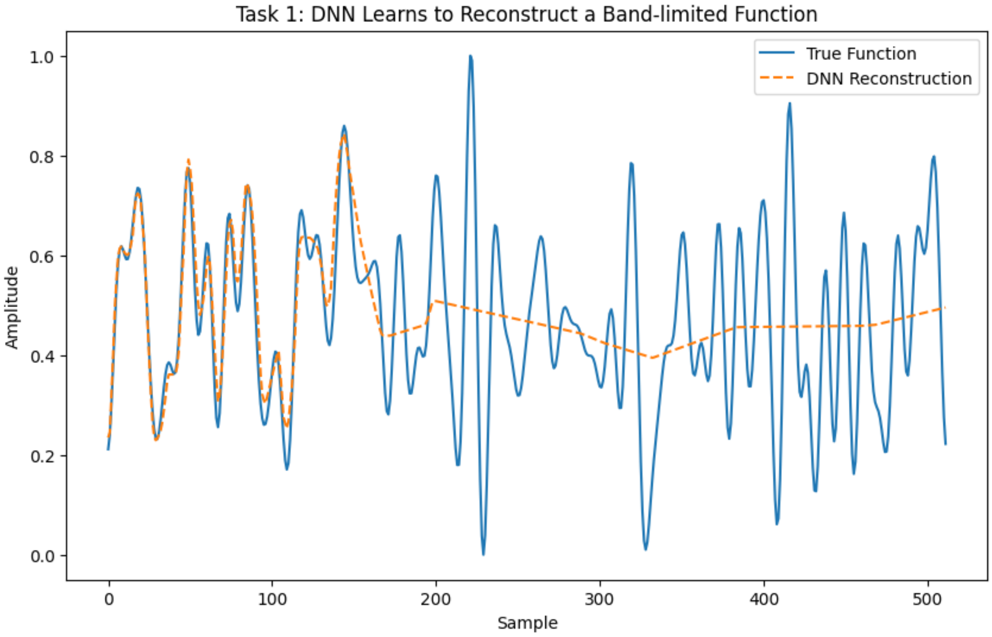
Task 1: A DNN Learns to Reconstruct one Band-limited Function.

1. Generate Fourier coefficients of band-limit function, random Fourier coefficients, symmetric Fourier coefficients, and finally generate band-limit function.
2. We define a DNN (Deep Neural Network) model and add L2 regularization to prevent overfitting. The activation function of the final layer is a linear function, allowing the output value to be unrestricted.
3. In terms of compiling the model, we use the Adam optimizer and mean squared error as the loss function, while also normalizing function values to better train the model.
4. To train the model, we first generate flattened training data and training labels. Then, we merge, shuffle, and restore the dataset to prevent model overfitting. Next, we convert the dataset into a numpy-type two-

dimensional data. Finally, we train the model.

5. We use the trained model for predictions, draw the loss curve during the training process, and the results to evaluate the model's accuracy.

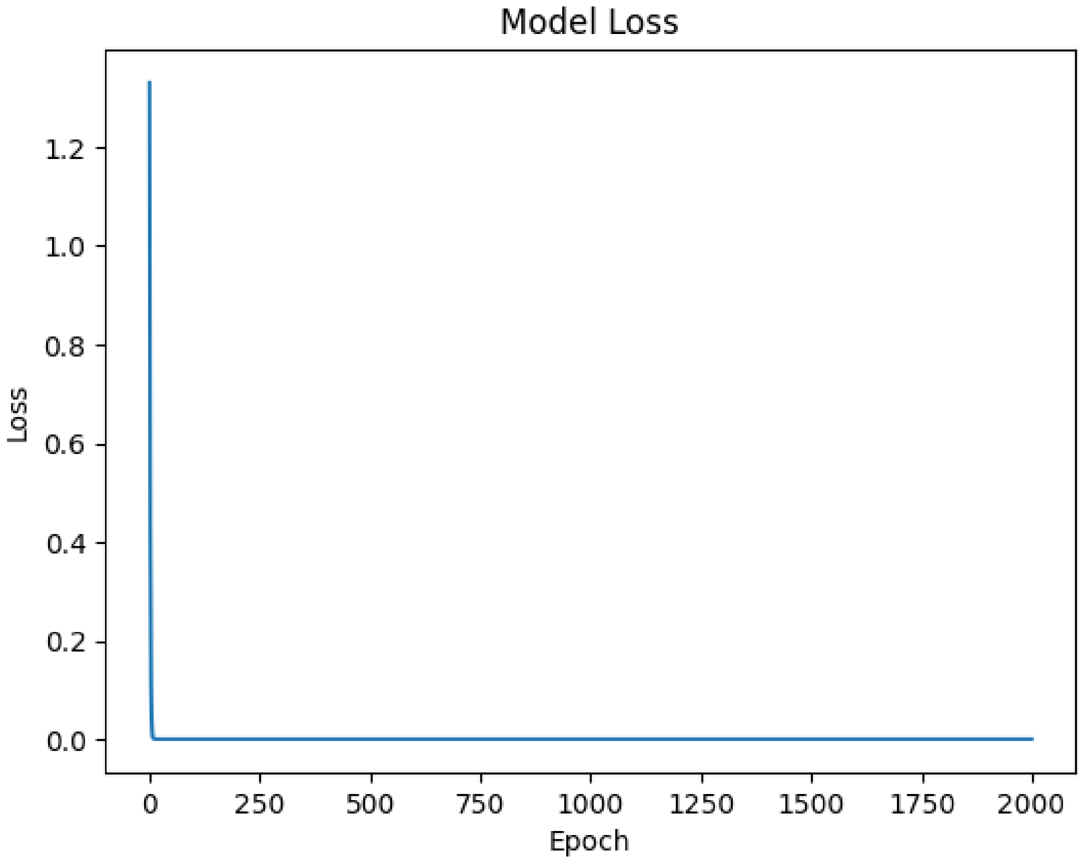


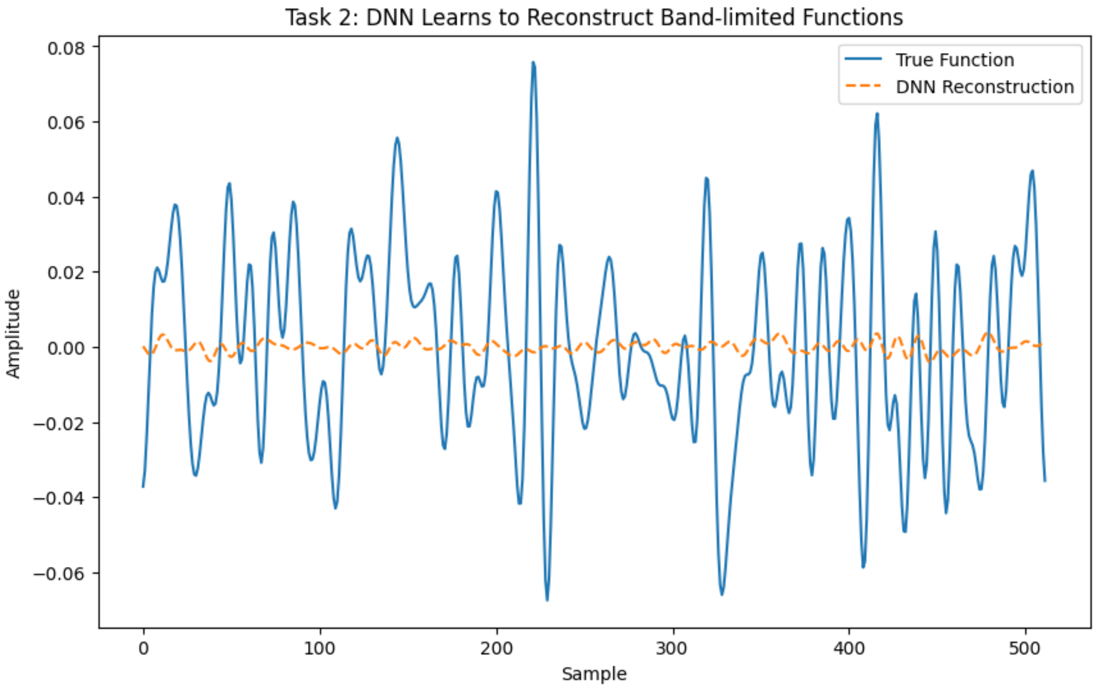


Task 2: Reconstruction of Band-limited Functions

1. Most steps used here are identical to those in Task 1; however, we

randomly choose 100 sampling points.

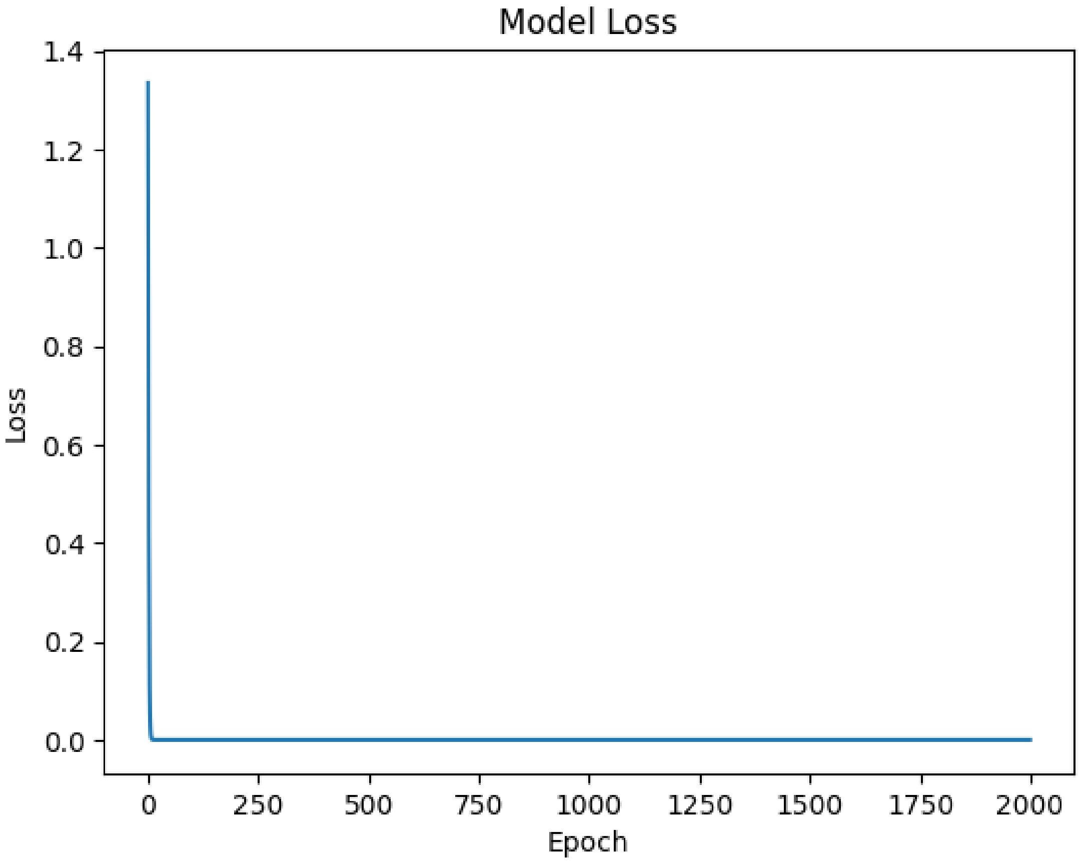


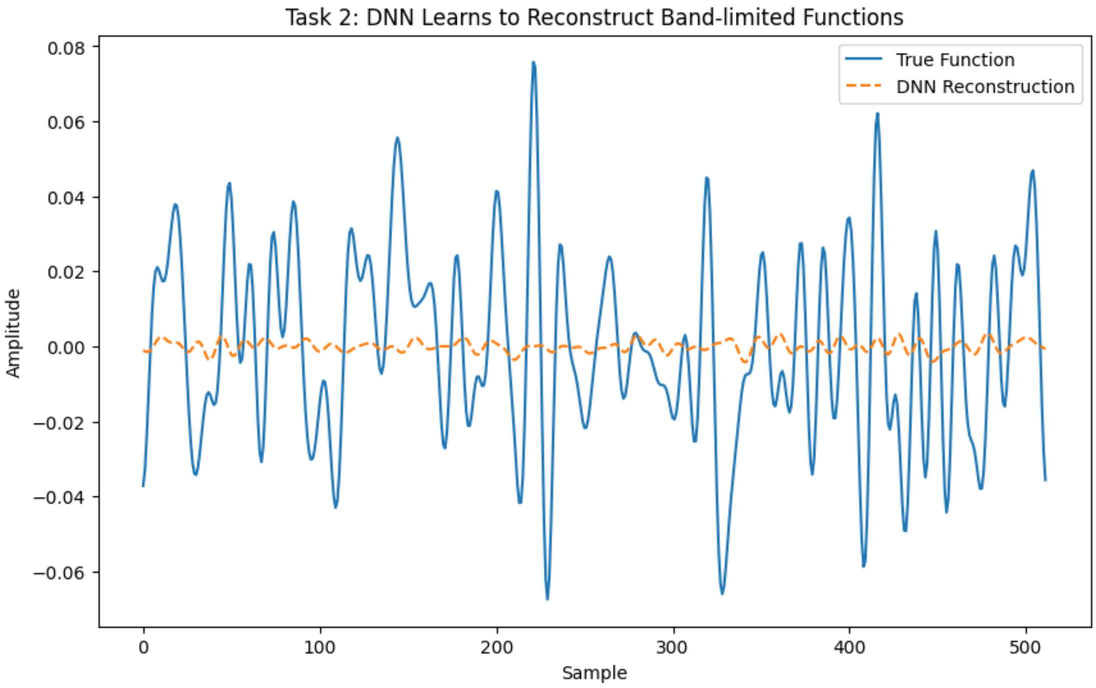


Task 2-2 Select 100 sampling points with

exponential intervals

1. Generate 512 functions, a total of 512 points, Band-limit = 50 。
2. The subsequent steps are the same as in Task 1; however, we use exponential spacing to select 100 points.




Task 2: DNN Learns to Reconstruct Band-limited Functions
True Function
DNN Reconstruction
Amplitude
0.08
0.06
0.04
0.02
0.00
−0.02
−0.04
−0.06
Sample
0
100
200
300
400
500