HW2_report

110652012 施品光

Method

$$f(x) = \frac{1}{1 + 25x^2}, \quad x \in [-1, 1].$$

Using Runge function

I trained a feedforward neural network with one input neuron, two hidden layers of 50 neurons each, and one output neuron. The activation function was chosen as tanh.

The dataset was sampled uniformly from [−1,1], and split into 80% training and 20% validation.

The model was trained with the Adam optimizer, learning rate 0.001, and MSE loss, for 1000 epochs.

Result

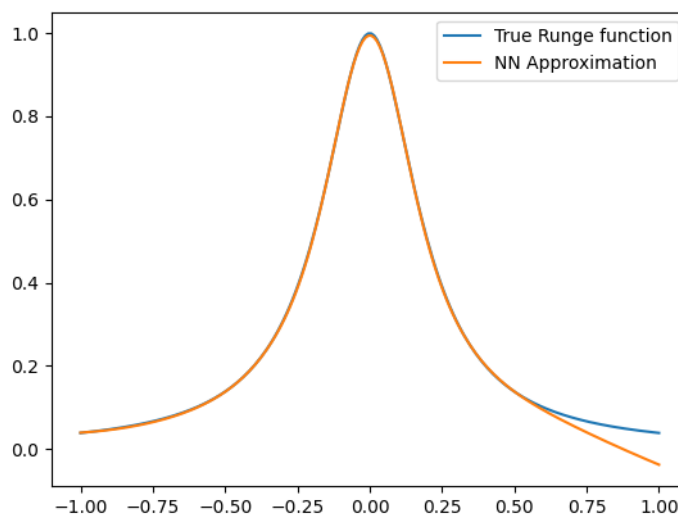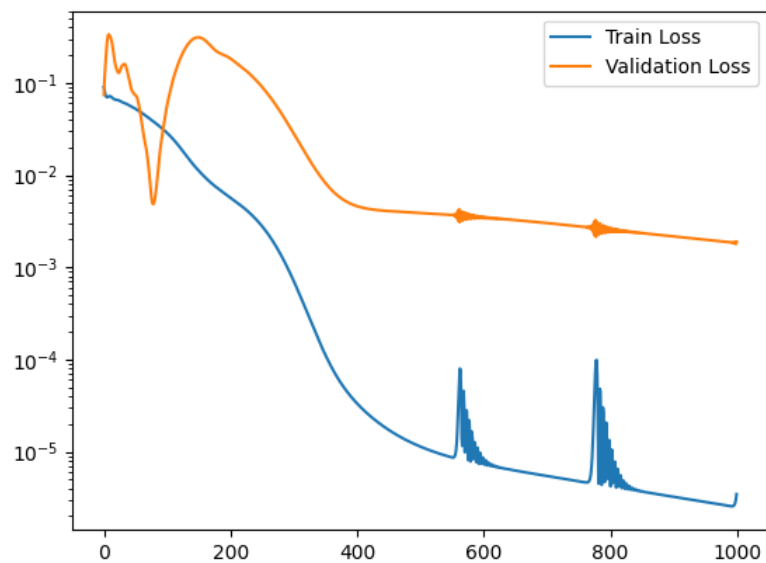Figure 1. True Runge function vs NN approximation

Figure 2. Training and validation loss curves

MSE

```
user@LAPTOP-THSPJJNM:/mnt/c/2025_ML/2025_machine_learning/Week2$ python3 HW2_110652012.py
Final MSE: 0.00038142397534102
```

Discussion

The neural network achieved a small error (MSE ≈ 2.3×10−42.3 \times 10^{-4}2.3×10−4) and captured the main shape of the Runge function.

The approximation is very accurate near the center, with small deviations at the boundaries.

Training and validation losses both decreased and stabilized, indicating effective learning without serious overfitting.