Piecewise Regression via Classification and Regression Combination

Chia-Yu Ou

October 2025

1 Method

We reused the two neural network models developed in previous assignments:

- **Classification model** $C(\vec{x})$: A multi-layer perceptron (MLP) classifier from Assignment 4, trained to predict whether a given coordinate is land (label 1) or sea (label 0), using the dataset `classification_data.csv`.
- **Regression model** $R(\vec{x})$: Another MLP regressor from Assignment 4, trained to predict temperature based on the same input features, using the dataset `regression_data.csv`.

To combine these models into a piecewise function, we implemented an object-oriented design by defining a `CombinedModel` class in Python. This class accepts both a classifier and a regressor object as input during initialization, and implements a `predict()` method that behaves as follows:

- If the classifier $C(\vec{x})$ predicts 1 (land), return the regressor output $R(\vec{x})$.
- If the classifier predicts 0 (sea), return a sentinel value of -999.

This modular approach allows us to easily integrate the two learned models while preserving clean separation of functionality.

2 Result Visualization

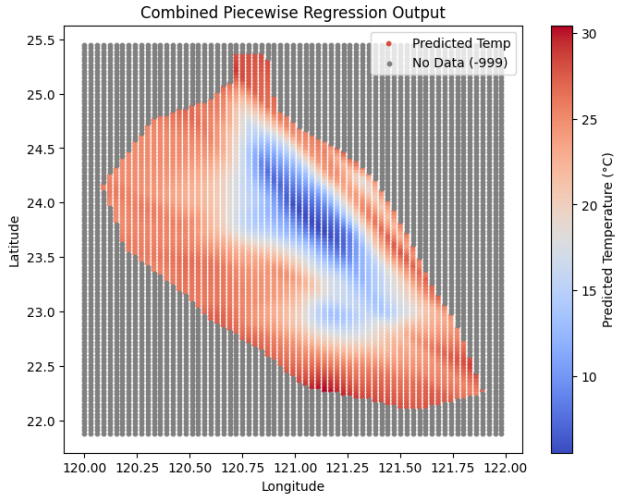

Figure 1: Combined Piecewise Regression Output. Red/blue regions denote predicted temperatures. Grey areas represent ocean regions where predictions are not available.

3 Conclusion

The combined model successfully demonstrates piecewise behavior. The classifier accurately segments land from ocean, while the regressor models temperature over land regions. The output visualization clearly separates predicted and invalid regions, reflecting the effectiveness of the pipeline.