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4 Model Fitting

Model fitting is the process by which a machine learning model adjusts its internal parameters to minimize the discrepancy between its predictions and the observed data. In supervised learning, we define a loss function $L(\theta)$ that measures this error—where θ denotes all trainable parameters—and then optimize:

$$\theta \leftarrow \theta - \eta \, \nabla_\theta L(\theta),$$

using gradient-based methods such as (stochastic) gradient descent.

Within neural networks, backpropagation efficiently computes $\nabla_\theta L$ by applying the chain rule through each layer. Iterating this update over many epochs (and possibly minibatches) lets the model "fit" patterns in the training set. Although modern libraries automate these steps, understanding loss optimization and backpropagation is essential for diagnosing convergence issues, tuning hyperparameters (learning rate, batch size, etc.), and avoiding overfitting.

Model Fitting

- Definition: tuning model parameters to reduce prediction error
- Loss function $L(\theta)$ optimized via gradient descent
- Backpropagation computes gradients layer by layer
- Key hyperparameters: learning rate, batch size, epochs
- Understanding fitting helps with convergence diagnostics and generalization

5 Diagnostics

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6 Plotting & Discussion

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7 Conclusion

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