CHAPTER 1

Neural Networks for Classification

Neural Networks can also be used for classification tasks, which involve predicting a discrete class label output for an instance. The process of using a Neural Network for classification is similar to using it for regression, but there are key differences in the output layer and loss function.

1.1 Neural Networks for Classification

For a binary classification problem, where the output can be either of two classes, the output layer of the neural network typically consists of a single neuron with a sigmoid activation function, which squashes the output between 0 and 1. This output can be interpreted as the probability that the instance belongs to a particular class.

For a multi-class classification problem, where the output can be one of more than two classes, the output layer typically has as many neurons as there are classes, and a softmax activation function is used, which gives the probability distribution over the classes.

Here is the basic process:

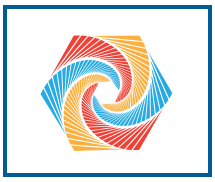
- **Feedforward:** Compute the output of the network given the input features, just as in regression.
- **Loss Calculation:** Calculate the loss (difference between the network's prediction and the actual class). For classification tasks, common loss functions include Cross-Entropy Loss.
- **Backpropagation:** Update the network's weights to minimize the loss, the same way as in regression.
- **Iteration:** Repeat the feedforward, loss calculation, and backpropagation steps for a number of epochs (complete passes through the dataset) or until the loss converges to a minimum.

Once trained, the neural network can classify a new instance by performing a feedforward pass and predicting the class with the highest probability in the output layer.

This is a draft chapter from the Kontinua Project. Please see our website (https://kontinua.org/) for more details.

Appendix A

Answers to Exercises



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