Q4: Neural Network Playground Demo

CS 695, Prof. Stein

Due: Wednesday November 8, 2023

In this question, you will be training some simple fully-connected neural networks using TensorFlow Playground: `https://playground.tensorflow.org`

We tinkered with this site a bit in class. There are a number of parameters you can tune, but upon opening the page, you will be met with an already-working example that looks like what I've included in Figure 1. Pressing the big play button at the top left will begin training, the losses will decrease, and you should see the output on the right correctly classify most (if not all) of the data.

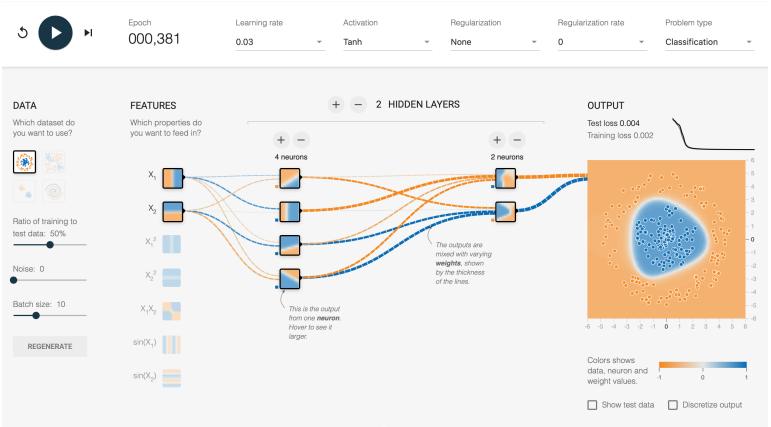

Figure 1: An example screenshot of TensorFlow Playground

1. To begin, we will try training on the same data (called **Circle** in the GUI element on the top left), but with **no hidden layers**, which means that this problem is a simple (linear) logistic regression objective. Use the '-' button at the top to remove all the hidden layers and

try retraining. How is the performance on the "circular" dataset?

2. To make this training work, we will need to do some *feature engineering*, a nonlinear preprocessing step that allows for nonlinear functions of the data to contribute to the learning performance. Try enabling the next two features (by clicking on them): x_1^2 and x_2^2. Retrain and comment on the performance: how does the system do? Include a screenshot of your Playground. (Your screenshot should contain the entire window, like Figure 1, and not just the output).

3. Now, let's change the data and see what we can do with a few hidden layers. Switch to using the **Exclusive Or** data (the one with + and - examples at alternating corners) and limit yourself to using only the two linear features: x_1 and x_2. Add a few hidden layers and play around with the settings, including the number of neurons. Can you get nearly perfect performance on the test data? Include a screenshot of your final configuration, showing the performance of your trained model.

4. Finally, switch to using the spiral data and try to recover good (perfect is not required) performance. Feel free to tune any of the parameters you'd like (including enabling the non-linear features). Include a screenshot of your trained system.