

ELEC 301 Extra Credit

Darrell Good

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1 Visualizing decision boundaries for 2-input Neural Network

Running a grid of test points after every few epochs allows us to calculate the decision boundaries. The left half shows the test (red) and train (blue) loss, while the right side shows the data-points superimposed on the decision boundary. The more certain the model (the higher the absolute value of the prediction) the darker the color, and as the model trains, we see the decision boundaries get sharper and the predictions more certain.

This updates live and allows us to "see" the model training and fitting the data.

Overfitting can occasionally be identified visually when the decision boundary creates "spikes" through gaps in the data, connecting two adjacent arms of the spiral. This is highly variable though and depends a lot on both the random assignment of points along the spiral and initialization of the model.

More apparently, overfitting occurs at 1800 epochs when the testing loss begins to diverge from the training loss (figure 3).

The video of the model running live and Jupyter notebook can be found at

https://github.com/darzgood/ELEC_301_Extra_cred

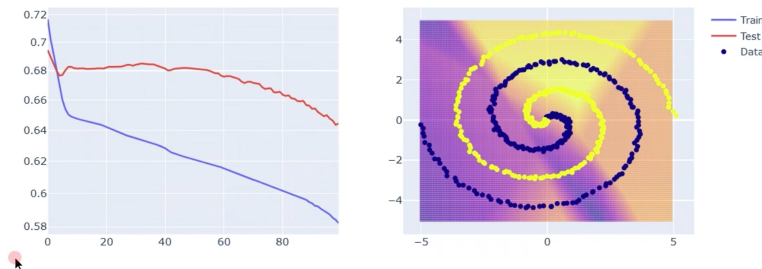


Figure 1: Initial Setup

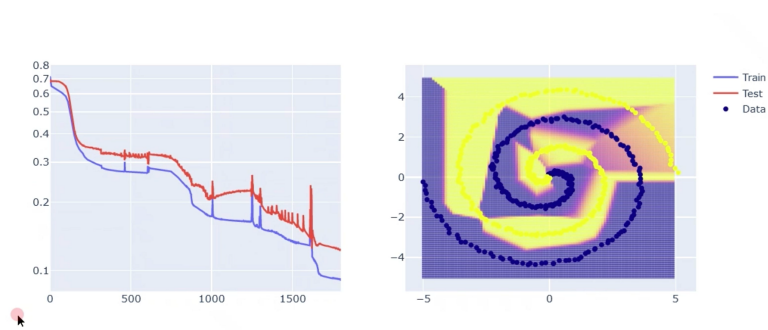


Figure 2: 1600 epochs

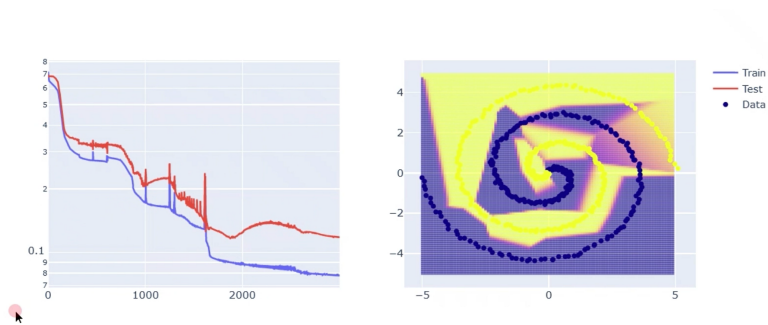


Figure 3: 3000 epochs

```
In [18]: # Evaluate on test data
with torch.no_grad():
    test_pred = model(test_ten).flatten()

# Time to print classification report
print(classification_report(test_y_ten, test_pred > 0.5))
```

| | precision | recall | f1-score | support |
|--------------|-----------|--------|----------|---------|
| 0.0 | 0.98 | 0.96 | 0.97 | 135 |
| 1.0 | 0.96 | 0.98 | 0.97 | 115 |
| accuracy | | | 0.97 | 250 |
| macro avg | 0.97 | 0.97 | 0.97 | 250 |
| weighted avg | 0.97 | 0.97 | 0.97 | 250 |

Figure 4: accuracy output report