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networks, Michael Nielsen's [Neural Networks and Deep Learning](http://neuralnetworksanddeeplearning.com/index.html) (<http://neuralnetworksanddeeplearning.com/index.html>) is a good place to start. For a more technical overview, try [Deep Learning](http://www.deeplearningbook.org/) (<http://www.deeplearningbook.org/>) by Ian Goodfellow, Yoshua Bengio, and Aaron Courville.

This Is Cool, Can I Repurpose It?

Please do! We've open sourced it on [GitHub](https://github.com/tensorflow/playground) (<https://github.com/tensorflow/playground>) with the hope that it can make neural networks a little more accessible and easier to learn. You're free to use it in any way that follows our [Apache License](https://github.com/tensorflow/playground/blob/master/LICENSE) (<https://github.com/tensorflow/playground/blob/master/LICENSE>). And if you have any suggestions for additions or changes, please [let us know](https://github.com/tensorflow/playground/issues) (<https://github.com/tensorflow/playground/issues>).

We've also provided some controls below to enable you tailor the playground to a specific topic or lesson. Just choose which features you'd like to be visible below then save [this link](http://playground.tensorflow.org/#activation=tanh&batchSize=10&dataset=circle®Dataset=reg-plane&learningRate=0.03®ularizationRate=0&noise=0&networkShape=4,2&seed=0.62789&showTestData=false&discretize=false&percTrainData=50&x=true&y=true&xTimesY=false&xSquared=false&ySquared=false&cosX=false&sinX=false&cosY=false&sinY=false&collectStats=false&problem=classification&initZero=false&hideText=false) (<http://playground.tensorflow.org/#activation=tanh&batchSize=10&dataset=circle®Dataset=reg-plane&learningRate=0.03®ularizationRate=0&noise=0&networkShape=4,2&seed=0.62789&showTestData=false&discretize=false&percTrainData=50&x=true&y=true&xTimesY=false&xSquared=false&ySquared=false&cosX=false&sinX=false&cosY=false&sinY=false&collectStats=false&problem=classification&initZero=false&hideText=false>), or [refresh](#) the page.

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|---|--|--|
| <input type="checkbox"/> Show test data | <input type="checkbox"/> Discretize output | <input type="checkbox"/> Play button |
| <input type="checkbox"/> Step button | <input type="checkbox"/> Reset button | <input type="checkbox"/> Learning rate |
| <input type="checkbox"/> Activation | <input type="checkbox"/> Regularization | <input type="checkbox"/> Regularization rate |
| <input type="checkbox"/> Problem type | <input type="checkbox"/> Which dataset | <input type="checkbox"/> Ratio train data |
| <input type="checkbox"/> Noise level | <input type="checkbox"/> Batch size | <input type="checkbox"/> # of hidden layers |

What Do All the Colors Mean?

Orange and blue are used throughout the visualization in slightly different ways, but in general orange shows negative values while blue shows positive values.

The data points (represented by small circles) are initially colored orange or blue, which correspond to positive one and negative one.

In the hidden layers, the lines are colored by the weights of the connections between neurons. Blue shows a positive weight, which means the network is using that output of the neuron as given. An

orange line shows that the network is assigning a negative weight.

In the output layer, the dots are colored orange or blue depending on their original values. The background color shows what the network is predicting for a particular area. The intensity of the color shows how confident that prediction is.

What Library Are You Using?

We wrote a tiny neural network [library](https://github.com/tensorflow/playground/blob/master/src/nn.ts) (<https://github.com/tensorflow/playground/blob/master/src/nn.ts>) that meets the demands of this educational visualization. For real-world applications, consider the [TensorFlow](https://www.tensorflow.org/) (<https://www.tensorflow.org/>) library.

Credits

This was created by Daniel Smilkov and Shan Carter. This is a continuation of many people's previous work — most notably Andrej Karpathy's [convnet.js demo](http://cs.stanford.edu/people/karpathy/convnetjs/demo/classify2d.html) (<http://cs.stanford.edu/people/karpathy/convnetjs/demo/classify2d.html>) and Chris Olah's [articles](http://colah.github.io/posts/2014-03-NN-Manifolds-Topology/) (<http://colah.github.io/posts/2014-03-NN-Manifolds-Topology/>) about neural networks. Many thanks also to D. Sculley for help with the original idea and to Fernanda Viégas and Martin Wattenberg and the rest of the [Big Picture](https://research.google.com/bigpicture/) (<https://research.google.com/bigpicture/>) and [Google Brain](https://research.google.com/teams/brain/) (<https://research.google.com/teams/brain/>) teams for feedback and guidance.

TensorFlow (<https://www.tensorflow.org/>)

Source on GitHub (<https://github.com/tensorflow/playground>)