OmniTech
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ITAI 1378
L05

TensorFlow Playground

Introduction to Neural Networks

Neural networks (NN) are computational models inspired by the structure and function of the human brain. They are made up of interconnected nodes organized in layers, including input, hidden, and output layers. Activation functions will determine the output of each node, and learning algorithms adjust the connections between the nodes to minimize errors during training.

Activation Functions

Experimenting with different activation functions revealed notable differences in the network's performance. The ReLU activation function resulted in faster convergence compared to the sigmoid function.

Hidden Layer Neurons

Increasing the number of neurons in the hidden layer initially improved the network's performance, but performance decreased beyond a certain point. Adding more hidden layers also enhanced performance, but the benefits plateaued after a certain amount, indicating the importance of finding the right balance between model complexity and generalization.

Learning Rate

Adjusting the learning rate demonstrated its impact on convergence speed and accuracy. Higher learning rates accelerated convergence but risked overshooting optimal solutions, leading to instability. Conversely, lower learning rates resulted in slower convergence but offered better stability and improved accuracy over time.

Data Noise

Introducing noise in the data negatively affected the network's ability to generalize. As the level of noise increased, the network's performance on unseen data deteriorated. This underscores the importance of robustness in NN models and the need to account for noisy input data during training.

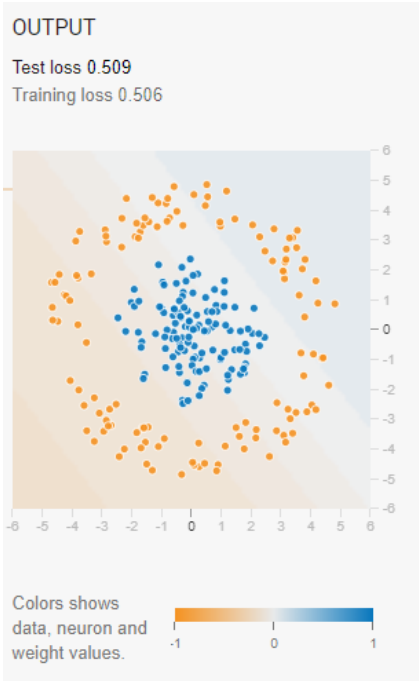
Dataset Explorations

Exploring different datasets highlighted how the characteristics of the dataset will influence network performance. Datasets with clear patterns and less variability yielded higher accuracy, while datasets with complex or noisy patterns posed greater challenges for the network. This emphasizes the importance of dataset selection and preprocessing in neural network applications.

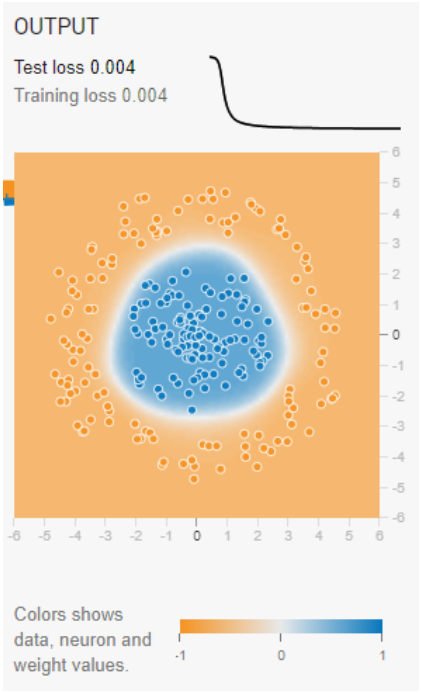
Conclusion:

In summary, this assignment provided valuable insights into the behavior of neural networks through hands-on experimentation. Understanding the impact of activation functions, hidden layer configurations, learning rates, data noise, and dataset characteristics is crucial for designing an effective NN model. There is an immense amount of balancing required to create an effective model. Practical implications include the need for careful parameter tuning and robust testing to ensure optimal performance in the real world.

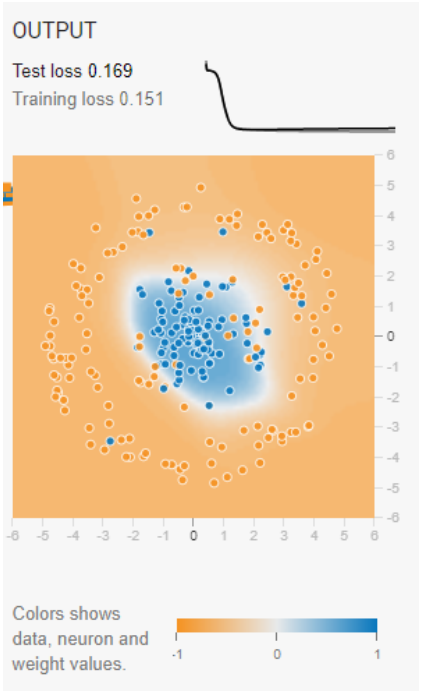
Images:



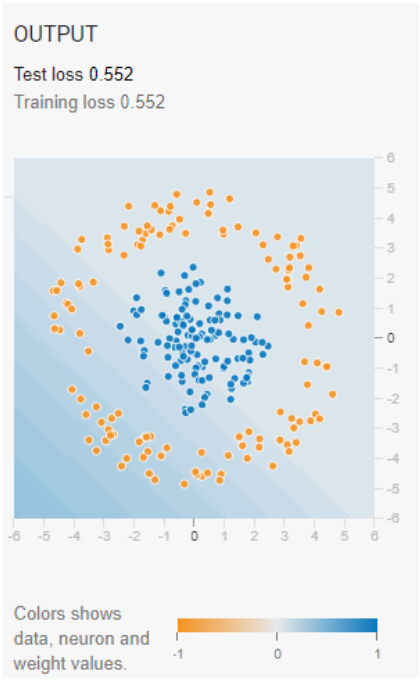
Sigmoid



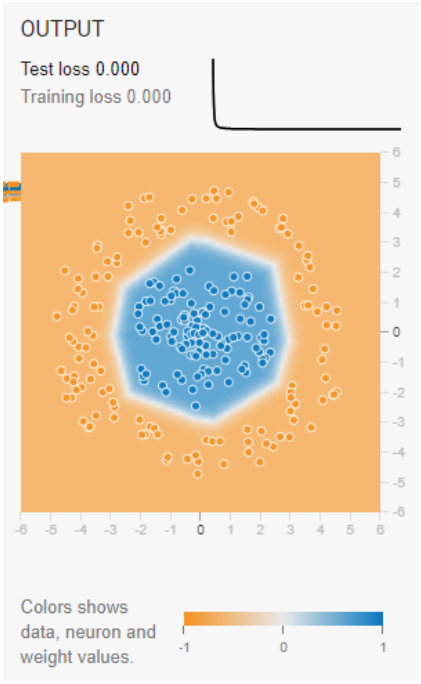
Sigmoid Learning Rate 0.1



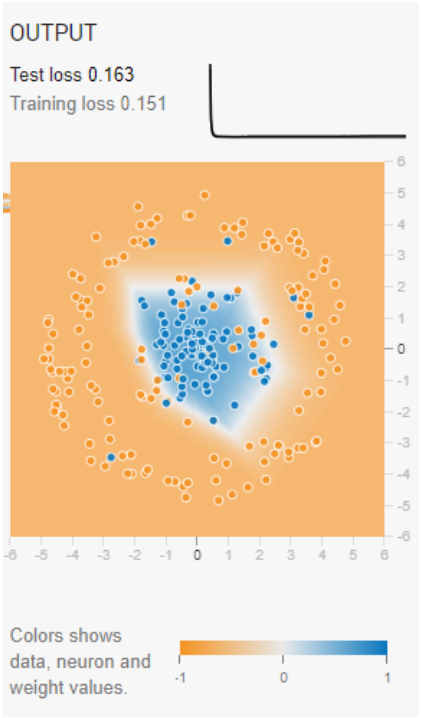
Sigmoid Noise @ Level 35



ReLU



ReLU Learning Rate 0.1



ReLU Noise @ Level 35