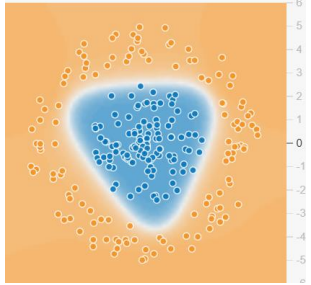
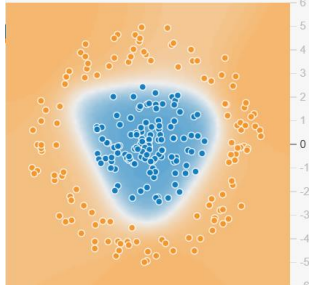
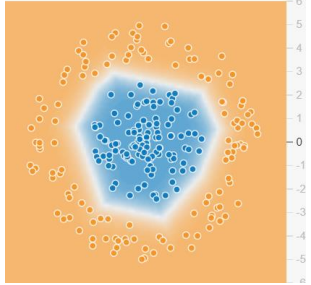


ARI3129 – Neural Networks Simulator

Note: There was no use of Generative AI whilst carrying out all the mentioned tasks.

Task 1: Understanding Activation Functions

Activation Function	Num. Of Epochs to Converge	Problem Type	Has Function Failed?	Figure
Tanh	350	Classification	No	<p>OUTPUT</p> <p>Test loss 0.018 Training loss 0.010</p> 
Sigmoid	400	Classification	No	<p>OUTPUT</p> <p>Test loss 0.028 Training loss 0.026</p> 
ReLU	150	Classification	No	<p>OUTPUT</p> <p>Test loss 0.009 Training loss 0.009</p> 

Task 2: Exploring Learning Rates

Learning Rate	Num. Of Epochs to Converge	Oscillations or Overshooting?
0.00001	∞	Yes (test loss is way over training loss)
0.0001	16,000	No
0.001	2,750	No
0.003	660	No
0.01	335	No
0.03	175	No
0.1	100	No
0.3	100	Yes
1	1,000	Yes
3	500	Yes
10	∞	Yes

Task 3: Playing with Layers and Neurons

Num. Of Hidden Layers	Num. Of Neurons	Num. Of Epochs to Converge	Decision Boundary Complexity
1	1	∞	Overfitting
1	2	∞	Overfitting
1	3	500	Simple
1	4	350	Simple
2	1, 1	∞	Overfitting
2	2, 1	∞	Overfitting
2	3, 1	150	Simple
2	4, 1	200	Simple
2	3, 2	250	Simple
2	3, 3	200	Simple
2	3, 4	250	Simple
2	4, 2	350	Simple
2	4, 3	200	Simple
2	4, 4	150	Simple
3	1, 1, 1	∞	Hard
3	2, 1, 1	∞	Overfitting
3	2, 2, 1	∞	Overfitting
3	3, 2, 1	500	Simple
3	3, 2, 2	350	Simple
3	3, 2, 3	∞	Overfitting
3	3, 3, 2	200	Simple
3	3, 3, 3	150	Simple

3	4, 1, 1	300	Simple
3	4, 1, 2	200	Simple
3	4, 1, 3	150	Simple
3	4, 1, 4	150	Simple
3	4, 2, 1	350	Simple
3	4, 2, 2	250	Simple
3	4, 2, 3	200	Simple
3	4, 2, 4	150	Simple
3	4, 3, 1	200	Simple
3	4, 3, 2	300	Simple
3	4, 3, 3	200	Simple
3	4, 3, 4	200	Simple
3	4, 4, 1	350	Simple
3	4, 4, 2	200	Simple
3	4, 4, 3	150	Simple
3	4, 4, 4	150	Simple

Task 4

Note: For this exercise, number of examples was used as epochs was difficult to calculate using ConvnetJS.

Optimisation Function	Min Num. Of Examples to Converge (x10³)	Sensitivity to Initial Conditions	Early Plateau?
SGD	44.8	Low	No
SGD+Momentum	44.8	Low	No
AdaGrad	44.8	Low	No
WindowGrad	25.6	Low	Yes
AdaDelta	66.13	Low	No
Nesterov	51.2	Low	No