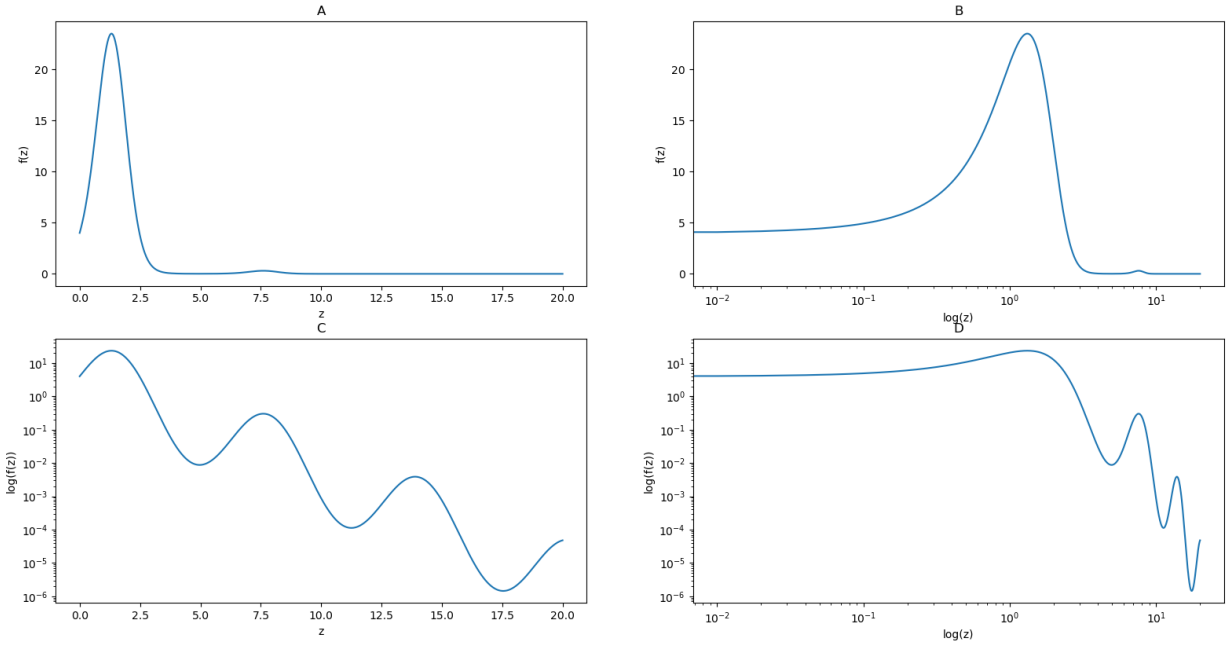
Technical Neural Networks
Assignments Sheet 4
Group: Svetlana Seliunina, Aleksei Zhuravlev

Assignment 21



Logarithmic scale allows us to see changes in exponential functions more clearly.

Assignment 23

Weight change in R-Prop does not depend on gradient magnitude, but only on its sign. The weight change for each weight and each step is determined individually and is equal to update-value * sign of a partial derivative.
After weight change is applied update-value for next generation is determined. If the sign of the partial derivative has not changed comparing to last iteration, update-value will increase. Otherwise, it will decrease.

Literature:
Riedmiller, Martin. "Advanced supervised learning in multi-layer perceptrons—from backpropagation to adaptive learning algorithms." Computer Standards & Interfaces 16.3 (1994): 265-278.

Assignment 24

Overfitting occurs when there is too many parameters in the network, and instead of generalizing neural network just learns the right answers for all training data.
This can be avoided by reducing the number of parameters - wights. Weight decay punishes large weights to keep the weights small. That way really small weights will not contribute to the outcome.

Assignment 26

If transfer functions in MLP are identity that the output of each layer is $out = \sum_i w_i in_i$ or using matrix notation $out_{b\times 1} = W_{b\times a} \cdot in_{a\times 1}$
For input layer:

$$out_{h_1\times 1} = W_{h_1\times n} X_{n\times 1} = in_{h_1}$$

For hidden layer:

$$out_{h_2\times 1} = W_{h_2\times h_1} in_{h_1\times 1} = in_{h_2}$$

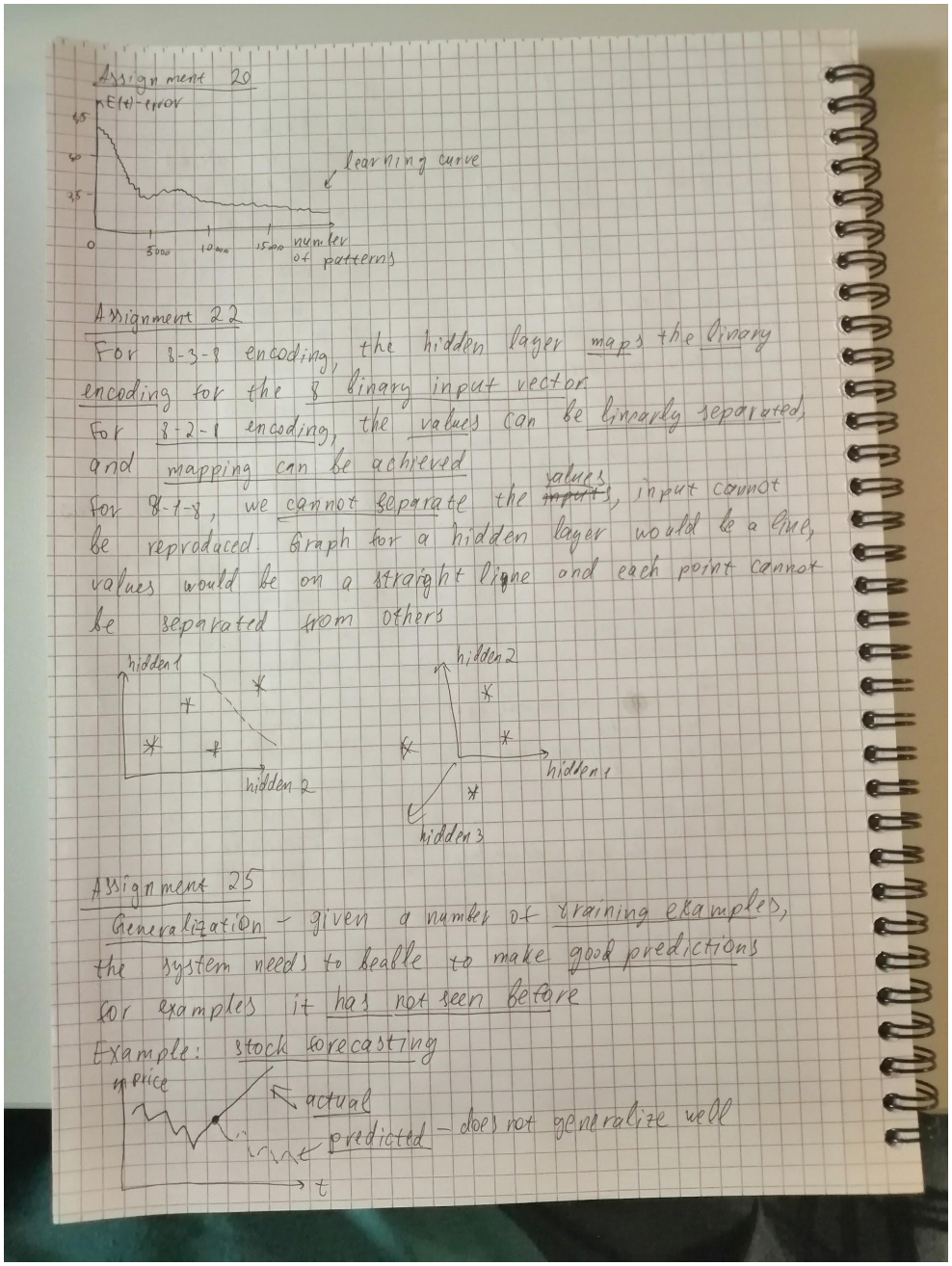
For output layer:

$$Y_{m\times 1} = W_{m\times h_n} in_{h_n\times 1}$$

Combining all together:

$$Y_{m\times 1} = W_{m\times h_n} W_{h_n\times h_{n-1}} \ldots W_{h_2\times h_1} W_{h_1\times n} X_{n\times 1} = W^*_{m\times n} X_{n\times 1}$$

Therefore, MLP with the identity as transfer function in all layers, can be completely replaced by a perceptron with identity as transfer function.



Programming assignment:
https://colab.research.google.com/drive/1HDzo7yNZsaYOBQ8STEolmRfzcylpdo2J?usp=sharing