

ML Exercise 2: Neural Network

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Outline

- 1 Implementation
- 2 Hyperparameter optimization
- 3 Comparison with other methods

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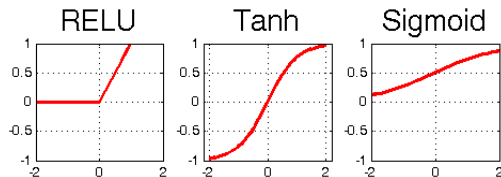
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- Made use of object-oriented programming principles by encapsulating the layer and network behavior in Python classes
- Code structure inspired by Omar Aflak

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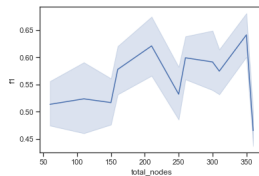
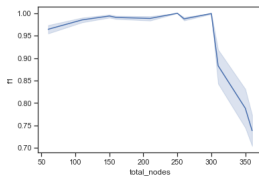
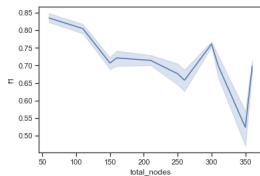
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- Split into train, validation and test set
- Different hyperparameter settings
 - nodes per layer – 10, 50, 100 or 200
 - hidden layers – 2, 3 or 4
 - threshold – 0.3, 0.5 or 0.9
 - activation functions for hidden layers – Tanh or ReLU



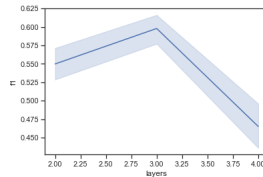
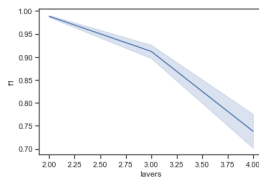
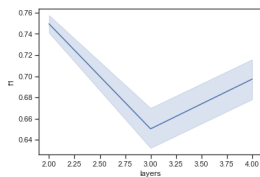
Impact of Hyperparameters

Total number of nodes; hepatitis, breast cancer, dry beans



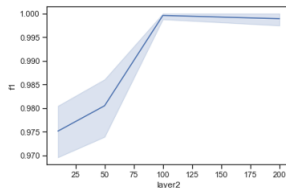
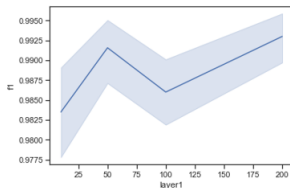
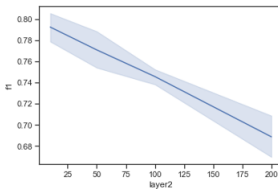
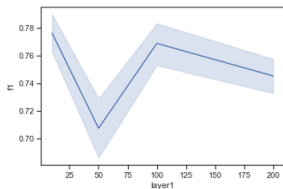
Impact of Hyperparameters

Number of layers; hepatitis, breast cancer, dry beans



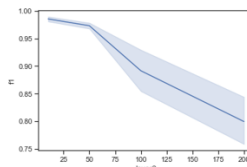
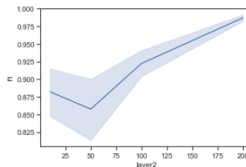
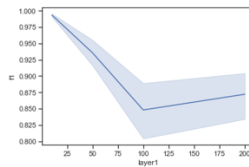
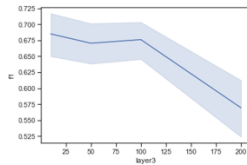
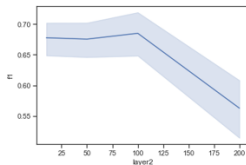
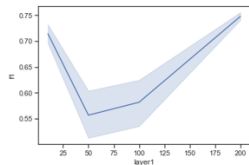
Impact of Hyperparameters

Number of nodes per layer – 2 layer NNs; hepatitis & breast cancer



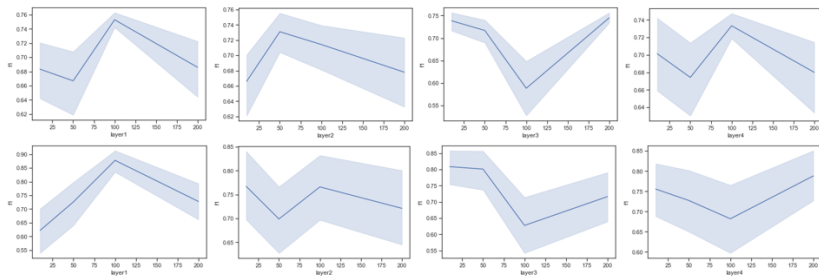
Impact of Hyperparameters

Number of nodes per layer – 3 layer NNs; hepatitis & breast cancer



Impact of Hyperparameters

Number of nodes per layer – 4 layer NNs; hepatitis & breast cancer



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Table: Comparison with other classification methods (5-fold cross-validation with regards to the mean of the F1-score)

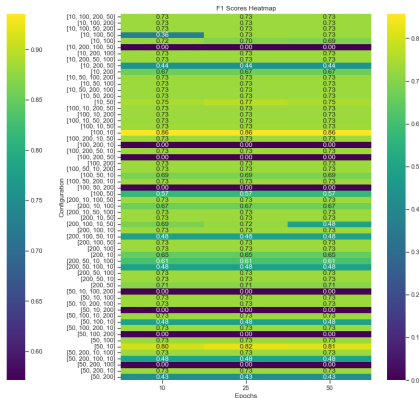
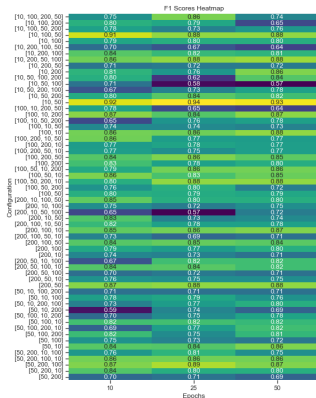
| Dataset | Our NN | Keras |
|---------------|----------|----------|
| Hepatitis | 0.832043 | 0.704000 |
| Breast Cancer | 0.965974 | 0.943478 |
| Dry Beans | 0.885843 | 0.915548 |

Table: Comparison with other classification methods from exercise 1
(5-fold cross-validation with regards to the mean of the F1-score)

| Dataset | Our NN | LogReg | SVM | DecTree |
|---------------|----------|----------|----------|----------|
| Hepatitis | 0.832043 | 0.898341 | 0.917261 | 0.876667 |
| Breast Cancer | 0.965974 | 0.962698 | 0.967143 | 0.828402 |
| Dry Beans | 0.885843 | 0.923538 | 0.929239 | 0.893124 |

Appendix: Impact of Hyperparameters

Hepatitis



Appendix: Impact of Hyperparameters

Breast Cancer

