**Computational MR imaging**

**Laboratory 9: Machine learning in MRI and neural network architecture design**

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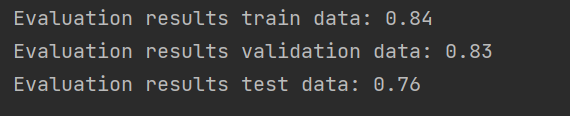
1. **Diffusion Data Classification:**
2. In the data, different regions of brain are labeled. Classes are

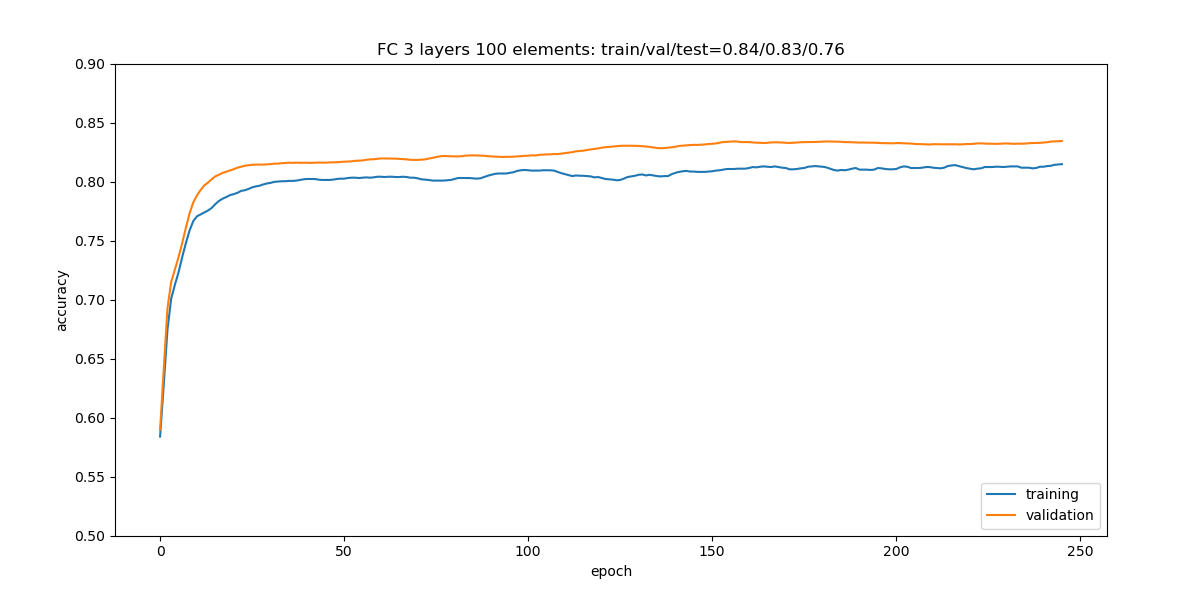
#1: left thalamus 左丘脑

#2: left genu of the corpus callosum 胼胝体左膝

#3: left subcortical white matter of inferior frontal gyrus 额下回左侧皮质下白质

1. The evaluation and accuracy of the model within 250 epoch are as followed:



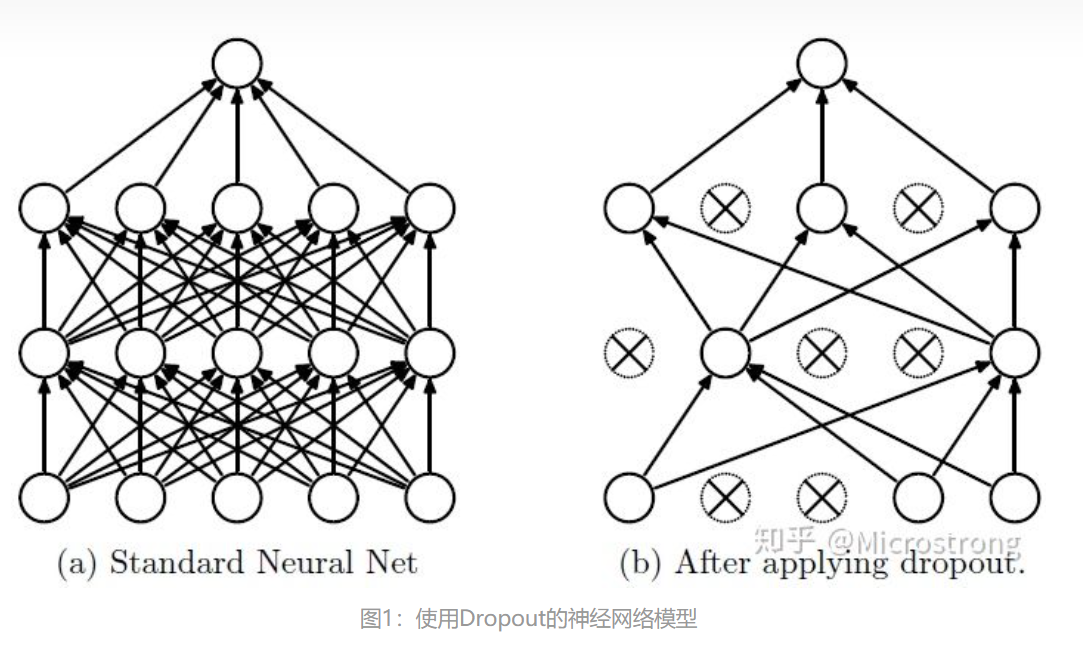


1. Dropping different parameter

Overfitting means that the model complexity is higher than the actual problem. The model performs well on the training set but poorly on the test set.

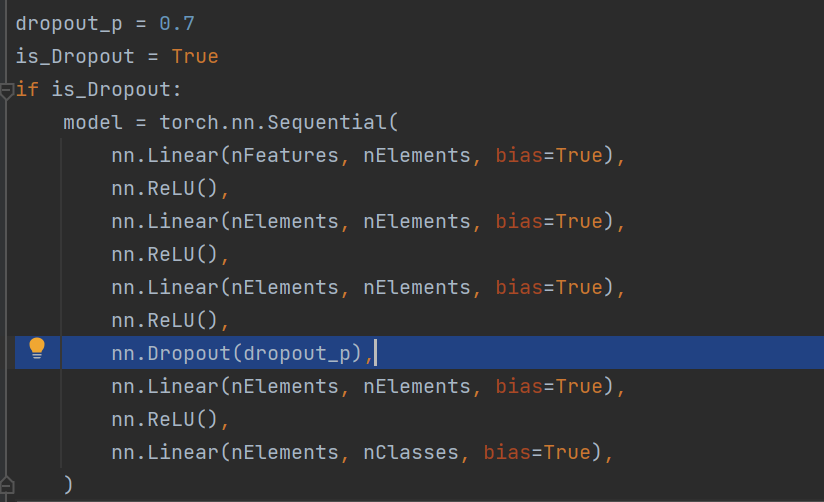
To avoid overfitting, we need to add regularization in the network, for example ‘’Drop Out’’. Concretely, we set activations to 0 randomly, with probability 1 − p.

The figure below shows the neural network model after applying dropout.

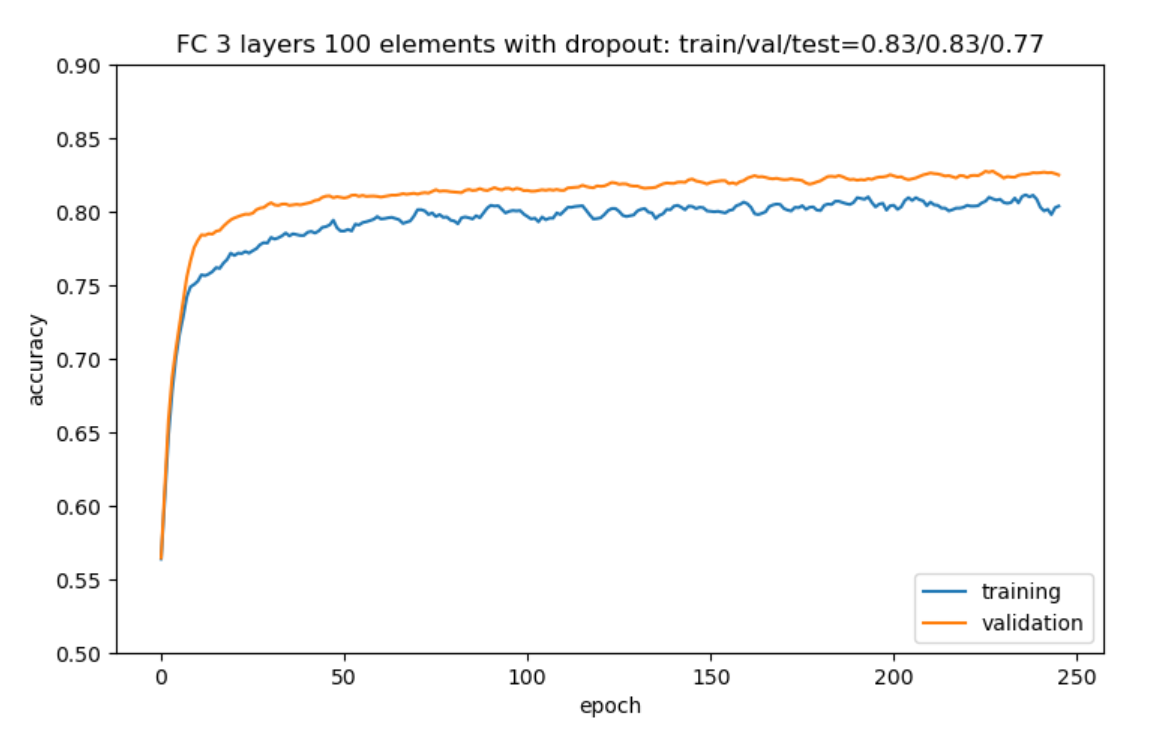


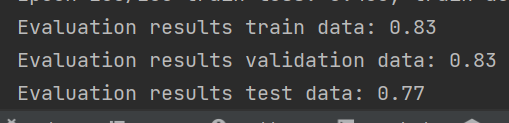
The entire dropout process is equivalent to averaging many different neural networks. Different networks produce different overfitting, and some "reverse" fittings cancel each other to reduce overfitting as a whole and improve the robustness.

Here is the structure of model with dropout.



The image below is the evaluation and accuracy of the model with dropout.





While the accuracy in test data of model without dropout is 0.76, the accuracy in test data of model with dropout is 0.77. The model’s generalization ability improves a bit after applying the dropout layer.

1. **Image Quality Classification**
   1. **Plot the kdata and at the sampling trajectory**

Each column corresponds to the readout dimension for each radial line.