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Fundamentals of Deep Learning (III)

Learning Objectives

- Learn the gold standard: evaluate the performance of deep learning model using validation curve and learning curve.

Evaluate the performance of deep learning models

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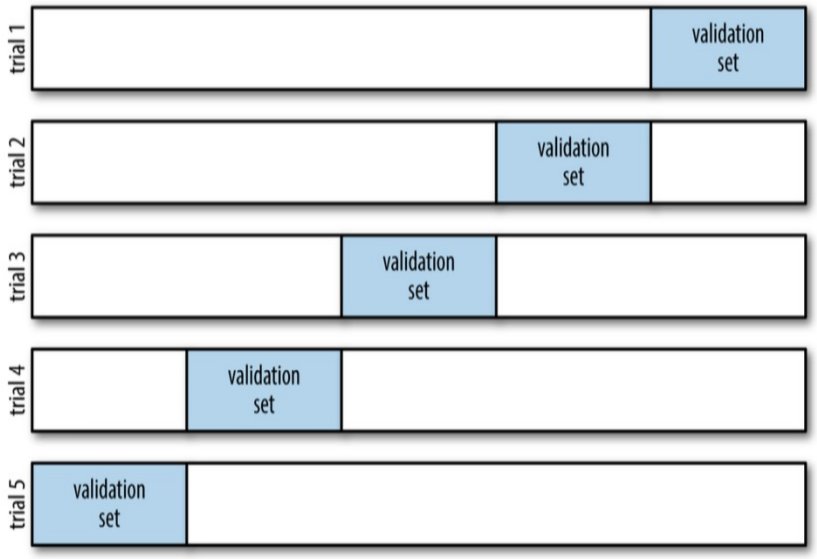
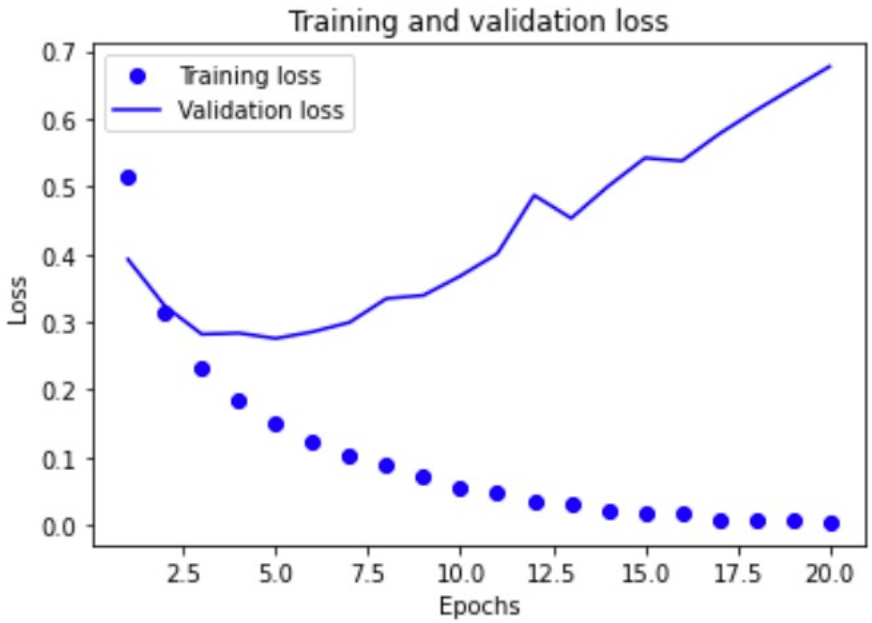
Machine Learning vs. Deep Learning: Performance Assessment

- K-fold cross validation is a gold standard in classical machine learning to evaluate performance but rarely used in deep learning (computational prohibited)
- Gold standard in deep learning is the validation curve.





Validation curve and learning curve: theoretical minimum and example

- The phrase “theoretical minimum” is taken from a very successful book series written by Leonard Susskind, a great physicist at Stanford University.
- “Theoretical minimum” means just the minimum theories and equations you need to know in order to proceed to the next level.
- See Learning_Curve.pdf

Fundamentals of Deep Learning: Summary

- Deep learning has made significant progress on many applications; it has reached super-human performance on **Go**, par-human performance on **image classification** and sub-human performance on **speech recognition** and **robotics**.
- **Neural Networks**, a collection of simple processing units (nodes) that are connected by directed links (edges), is the heat of deep learning.
- **Deep neural networks** result in **modularization** and give better performance on less training data.
- **Deep neural networks** result in **feature extraction** that allow us to do representational learning without hand-designed features.

Fundamentals of Deep Learning: Summary

- **Weight** of an edge in a neural network determines the strength of connection between the nodes and training a neural network means finding the right values for the weights.
- **Backpropagation** allow us to efficiently adjust the **weights** to make the output closer to the ground truth.
- We often use a **mini-batch gradient descent** to training our neural networks.
- **Keras** is now a part of TensorFlow and is our de-facto choice for deep learning (although PyTorch is getting popular)
- Deep learning model tends to **overfit** and the **validation curve** is often used to help us evaluate the **generalization** performance of the model.