Resources

442.022 Nonlinear Signal Processing, Practical
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Overview

This document shall provide you with some references and resources that are relevant to this course and will help you to complete the assignments and deepen your understanding of certain topics. Of course you are not expected to read through all these materials - consider it rather as a buffet of knowledge where you can taste many different things from. I will update this document as the course progresses.

It should be understood that this by far is not an exhaustive list of (good) resources. In case you discover additional material that you think might be relevant to other participants, please let me know so that I can maybe include them in this list.

General Resources

Oppenheim and Schafer 2009 is a standard book on discrete time signal processing. The full text is provided online from the TU Graz Library and there are also many print versions available.

Zhang et al. 2020 is a fairly recent open-source book that provides a nice introduction to deep learning with many examples in PyTorch (which we also use in this course). It is definitely worth checking out!

Goodfellow, Bengio, and Courville 2016 is a very popular book on deep learning. Print versions available at TU Graz Library or online at www.deeplearningbook.org.

A comprehensive introduction to machine learning from a probabilistic perspective is provided by Murphy 2012. Again, some exemplars are available in the TU Graz library. The author currently prepares a new version Murphy 2021 with online draft freely available.

Normalizing Flows

Brubaker 2020 gives a nice introduction to normalizing flows based on their survey (Kobyzev, Prince, and Brubaker 2020). Papamakarios et al. 2019 provide another, more elaborate review of recent work on normalizing flows.

Convolutional Neural Networks

Personally, I think the NYU Deep Learning course LeCun, Canziani, and Goldstein 2020 is very comprehensible and well presented. For an introduction to CNNs I would recommend the following video lectures thereof.

- Canziani 2020a or a motivation of CNNs from the perspective of natural signal characteristics
- Canziani 2020b for an introduction to the linear algebra involved in CNNs
- Canziani 2020c for a very nice explanation of 1d and 2d convolutions and channels

References

Brubaker, Marcus (2020). *Introduction to Normalizing Flows (ECCV2020 Tutorial)*. URL: https://www.youtube.com/watch?v=u3vVyFVU_lI.

Canziani, Alfredo (2020a). *1D multi-channel convolution and autograd*. URL: https://www.youtube.com/watch?v=eEzCZnOFU1w.

— (2020b). *Listening to convolutions*. URL: https://www.youtube.com/watch?v=OrBEon3VlQg.

Canziani, Alfredo (2020c). *Natural signals properties and CNNs*. URL: https://www.youtube.com/watch?v=kwPWpVverkw.

Goodfellow, Ian, Yoshua Bengio, and Aaron Courville (2016). *Deep Learning*. The MIT Press. URL: https://www.deeplearningbook.org/.

Kobyzev, Ivan, Simon Prince, and Marcus Brubaker (2020). "Normalizing Flows: An Introduction and Review of Current Methods". In: *IEEE Transactions on Pattern Analysis and Machine Intelligence*, pp. 1–1. DOI: 10.1109/TPAMI.2020.2992934.

LeCun, Yann, Alfredo Canziani, and Mark Goldstein (2020). *Deep Learning (Course from the NYU Center for Data Science)*. URL: https://atcold.github.io/pytorch-Deep-Learning/.

Murphy, Kevin P. (2012). *Machine Learning: A Probabilistic Perspective*. The MIT Press.

— (2021). *Probabilistic Machine Learning: An introduction*. MIT Press. URL: probml.ai.

Oppenheim, Alan V. and Ronald W. Schafer (2009). *Discrete-Time Signal Processing*. 3rd. Prentice Hall Press.

Papamakarios, George et al. (Dec. 2019). *Normalizing Flows for Probabilistic Modeling and Inference*. arXiv: 1912.02762.

Zhang, Aston et al. (2020). *Dive into Deep Learning*. https://d2l.ai.