

Fall 2020

CS 677-1J1: Deep Learning

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CS6771J1-Deep Learning

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Syllabus

Books

1. [Deep Learning \(GBC\)](#)

https://www.amazon.com/dp/0262035618/ref=cm_sw_r_cp_api_i_k3lcFb7BNCN61 This classic book is the main book that we will use to learn the concepts behind this architectural pattern. This book is required and is freely available in html and pdf forms.

2. [Deep Learning with Python \(CHOLLET\)](#)

https://www.amazon.com/dp/1617294438/ref=cm_sw_r_cp_api_i_v4lcFbYV5N5VS This #1 best selling book will be used for both concepts and applications / projects throughout the course. This book is not freely available and must be purchased. Note that the 2nd edition will be out in 2021 so you may want to buy a used 1st edition.

3. [Foundations of Deep Reinforcement Learning \(GK\)](#) <https://www.amazon.com/Deep-Reinforcement-Learning-Python-Hands/dp/0135172381>

This book will be used only for the corresponding lecture and therefore may not be purchased. However, it may be a good book to have in your bookshelf.

To be successful you will need to **pay particular attention to the notes that Prof Monogioudis provides just before each lecture** and read from the books above only the overlapping with the notes sections as provided in the reading list below.

Schedule

The schedule below is based on [Academic Calendar Fall 2020](https://www5.njit.edu/registrar/fall-2020-academic-calendar/) <https://www5.njit.edu/registrar/fall-2020-academic-calendar/>:

Details:

Lecture	Date	Description	Reading List
1	9/3	What is deep learning We start with an <i>introduction to ML and AI</i> and through an end to end deep learning application we understand and experience in our Colab notebooks (our default computing environment) an end to end deep learning application.	GBC Chapter 1, 5.1, CHOLLET Chapter 1, notes

Lecture	Date	Description	Reading List
2	9/10	The Learning Problem and Review of Key Machine Learning Tasks I Using a regression problem statement we review essential probability and information theory concepts that we will use throughout this course.	GBC Chapter 3, portion of GBC Chapter 5, portion of CHOLLET Chapter 4, notes
3	9/17	The Learning Problem and Review of Key Machine Learning Tasks II We finish the review with the principles of Maximum Likelihood and Bayesian learning as well as optimization theory and algorithms.	Portion of GBC Chapter 5, portion of CHOLLET Chapter 4, notes
4	9/24	Deep Feedforward networks We develop bottom up from the baseline deep network architecture and learn how to calculate the gradient efficiently using backpropagation in a stochastic gradient descent setting.	GBC Chapter 6, CHOLLET Chapter 10, 11, notes
5	10/1	Regularization and Optimization for Deep Learning	GBC Chapter 7, 8, notes
6	10/8	Spatial Data and Convolutional Networks CNNs are instrumental to tasks involving learning from imaging data and in general any data that locally highly correlated.	GBC Chapter 9, CHOLLET Chapter 5, notes
7	10/15	Deep Scene Understanding is the #1 sought after skill in robotics and industrial automation that are expected to be in very high demand across the US due to our latest re-industrialization policy.	notes
8	10/22	Good luck in your midterm	
9	10/29	Sequenced Data and Recurrent Neural Networks For learning of dynamical systems whose state is evolving, RNNs can produce state of the art models applicable to many sequenced / streaming data problems	GBC Chapter 10, CHOLLET Chapter 6, notes
10	11/5	Transformers and Natural Language Understanding (NLU) is the #1 sought after skill in the financial industry in NYC and is in widespread use in many other industries. We will focus on “attention” (sic) and on understanding the most advanced and useful architecture for building language models.	CHOLLET 6, notes
11	11/12	Sparse and Variational Autoencoders We will see how dimensionality reduction, embeddings / data representation learning can help us design systems.	GBC Chapter 19 ,CHOLLET Chapter 8, notes

Lecture	Date	Description	Reading List
		Generative Models and Generative Adversarial Networks (GANs)	
12	11/19	Applications using this approach have exploded in the last few years. We look at first principles and a key application - hyper-resolution of satellite imaging that is increasingly used in many industries.	GBC Chapter 20
13	12/3	Deep Reinforcement Learning (DRL) We will understand how to use deep learning and optimal decision making.	Notes only, (optional) GK Chapters 1-3
14	12/10	Deep Learning and AI Can we go beyond feedback based schemes ? How neurosymbolic computation can model intelligence (logical inference)?	
15	12/17	Good Luck in your final	

Projects

For details on 3 projects that you need to submit see [Projects \(https://pantelis.github.io/cs677/docs/projects_index.md\)](https://pantelis.github.io/cs677/docs/projects_index.md) page.

Course Summary:

Date	Details
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