AI Saturdays Lesson Plan

Here are learning roadmaps organised in weeks. Each week consists of lecture videos, reading materials and programming assignments. Feel free to head to the AI6 forums to discuss or ask questions you might have.

Machine Learning from Scratch

This is for anyone who wants to learn Machine Learning or TensorFlow. The only prerequisite is high school math and a ton of passion. We will follow Machine Learning Crash Course by Google - it breaks down concepts of Machine Learning in fun, bite-sized portions and provides thoughtful exercises to deepen your understanding.

Timeline	Learning material	Assignments
Week 1/ Week of 4 August 2018	Prerequisites: Linear Algebra - Khan academy Linear Algebra (Finish Complete Vectors and Spaces and Matrix Transformations modules) - Still hungry for more? Try Essence of linear algebra	Assignments and readings
Week 2/ Week of 11 August 2018	Prerequisites: Python basics For those **without** any programming experience: - Automate the boring stuff with python: Chapter 0 - Python for Data Science (7 hours) For those **with** programming experience: - Automate the boring stuff with python: Chapters 1 - 5	Finish 5 python exercises here (solutions provided)
Week 3/ Week of 18 August 2018	Prerequisites: Python advanced - A Byte of Python ebook: Object oriented programming - Udemy Numpy stack in Python: Numpy, Matplotlib, Scipy, Pandas - MIT Course Object Oriented Programming	Replicate the codes in "A Byte of Python" Create a Cheat Sheet summarising all that you have learnt about Python.
Week 4/ Week of 25	Recommended reading: - Machine Learning is Fun!	Complete "Check Your Understanding"

August 2018	Machine Learning Crash Course by Google: - Introduction to ML - Framing - Descending into ML	Discuss: Artificial Intelligence, Machine Learning, Deep Learning, Data Science
Week 5/ Week of 1 September 2018	Machine Learning Crash Course by Google: - Reducing Loss	Complete "Check Your Understanding" Code up a simple gradient descent algorithm on a linear regression problem (example). Linear regression from scratch Another Linear regression from scratch in Python
Week 6/ Week of 8 September 2018	This week, explore different frameworks for Machine Learning. Recommended readings: - What are Machine Learning Frameworks - Best Python libraries for Machine Learning and Data Science - TensorFlow or Keras? - Introduction to scikit-learn - Machine Learning Crash Course by Google: First Steps with TensorFlow Note: Don't spend too much time on picking a framework. If you cannot decide, try out TensorFlow first, since assignments offered in the Crash Course are in TensorFlow.	Programming exercise with tensor flow Official scikit-learn tutorial

Week 7/ Week of 15 September 2018	Machine Learning Crash Course by Google: - Generalization - Training and Test Sets Validation - Representation	Complete "Check Your Understanding" and "Programming Exercises", if any
Week 8/ Week of 22 September 2018	Machine Learning Crash Course by Google - Feature Crosses	Complete "Check Your Understanding" and "Programming Exercises", if any
Week 9/ Week of 29 September 2018	Machine Learning Crash Course by Google - Regularization: Simplicity - Logistic Regression	Complete "Check Your Understanding" and "Programming Exercises", if any Logistic Regression with Tensor Flow Logistic Regression from scratch in Python Titanic challenge using sklearn Alternatively, find your own dataset to perform logistic regression
Week 10/ Week of 6 October 2018	You are at the halfway mark! Use this week to take a good break and re-energize.	
Week 11/ Week of 13 October 2018	Machine Learning Crash Course by Google - Classification - Regularization: Sparsity	Complete "Check Your Understanding" and "Programming Exercises", if any AUC curve: discussion and analogy

		Evaluating a classification model (using scikit learn) K-means clustering algorithm (hands-on assignment)
Week 12/ Week of 20 October 2018	Video Lecture: What is a Neural Network? Machine Learning Crash Course by Google - Introduction to Neural Nets	Complete "Check Your Understanding" and "Programming Exercises", if any Create a Neural Network using Keras Implementing a Neural Network from Scratch in Python
Week 13/ Week of 27 October 2018	Video Lectures: - Gradient descent - What is backpropagation really doing? Machine Learning Crash Course by Google - Training Neural Nets - Multi-Class Neural Nets	Complete "Check Your Understanding" and "Programming Exercises", if any Tutorial on Backpropagation (highly recommended)
Week 14/ Week of 3 November 2018	Machine Learning Crash Course by Google - Embeddings - All sections under "ML Engineering" and "ML Real World Examples"	Complete "Check Your Understanding" and "Programming Exercises", if any

Deep Learning Specialization Lesson Plan

This lesson plan is for those who have understood the basics of Machine Learning and would like to gain a deeper understanding in Deep Learning. It follows deeplearning.ai's

Deep Learning Specialization on Coursera. This course is one of the **highest rated** courses on Deep Learning.

Neural Networks and Deep Learning (Weeks 1-6)

Period	**Youtube lecture videos (each video is labelled with an alphanumeric string, e.g C1W1L01)**	**Assignment**
Week 1/ 4 August 2018	Revision on Python	
Week 2/ 11 August 2018	C1W1L01 - C1W1L06	Assignment 1
Week 3/ 18 August 2018	C1W2L01 - C1W2L06	Assignment 2
Week 4/ 25 August 2018	C1W2L07 - C1W2L18	Assignment 3
Week 5/ 1 September 2018	C1W3L1 - C1W3L11	Assignment 4
Week 6/ 8 September 2018	C1W4L01 - C1W4L18	Assignment 5
Week 7/ 15 September 2018	Break	

Improving deep neural networks: hyperparameter (Weeks 8-13)

Period	**Youtube lecture videos (each video is labelled with an alphanumeric string, e.g C2W1L01)**	**Assignment**

Week 8/ 22 September 2018	C2W1L01 - C2W1L06	Assignment 1
Week 9/ 29 September 2018	C2W1L07 - C2W1L14	Assignment 2
Week 10/ 6 October 2018	C2W2L01 - C2W2L05	Assignment 3
Week 11/ 13 October 2018	C2W2L06 - C2W2L09	Assignment 4
Week 12/ 20 October 2018	C2W3L01 - C2W3L05	Assignment 5
Week 13/ 27 October 2018	C2W3L06 - C2W3L11 NOTE: C2W3L10 and C2W3L11 are mislabeled as C2W2L10 and C2W2L11 respectively.	Assignment 6

Research-focused Lesson Plan

Learners of this track are those who have acquired the prerequisites to understand and implement state of the art AI models. They can choose from one or more of the following courses : UCL course on Reinforcement Learning (UCL RL), Berkeley CS294, Stanford Natural Language Processing (CS224n) and Stanford Computer Vision (CS231n).

These courses are offered by their respective universities and (fortunately for us) are freely accessible by the public. Learning materials for the courses can be quite 'scattered', i.e lecture videos for these courses are not found on the official website but on youtube; they are also not aligned with the course outline on the official website. We will follow one lecture video from youtube every week and refer to the official pages for lecture notes or assignments.

Important links

UCL RL	**CS231n (Computer vision)**	**CS224n (NLP)**

• Lecture Videos from youtube • Official Page • Code and exercises • Berkeley CS294 (advanced RL)	• Lecture Videos from youtube • Official Page • Assignments	• Lecture Videos from youtube • Official Page • Lecture Notes (click on 'notes1.pdf' or similar) • Independent Review of this course

Lesson schedule

Week of	UCL RL	CS231n (Computer vision)	CS224n (NLP)
4 August 2018	Revision of prerequisites: Python, Linear Algebra etc	See "Module 0" Assignments	See "Suggested readings on Jan 9"
11 August 2018	UCL/Deep Mind Reinforcement Learning Lecture 1 – Intro to Reinforcement Learning Assignments/ Links to materials	Youtube lecture video: Image Classification Course Notes Assignments	Youtube lecture video: Word Vector Representations:word2vec Assignments and readings
18 August 2018	UCL/Deep Mind Reinforcement Learning Lecture 2 – Markov Decision Processes Assignments/ Links to materials	Youtube lecture video: Loss Functions and Optimization Assignments and readings	Youtube lecture video: Global Vectors for Word Representation Lecture Notes Assignments and readings
25 August 2018	UCL/Deep Mind Reinforcement Learning Lecture 3 – Planning by Dynamic Programming Assignments/ Links to materials	Youtube lecture video: Introduction to Neural Networks Assignment and readings	Youtube lecture video: Word Window Classification and Neural Networks Lecture Notes
1 September 2018	UCL/Deep Mind Reinforcement Learning Lecture 4 – Model-free Prediction	Youtube lecture video: Convolutional Neural Networks Assignments and readings	Youtube lecture video: Backpropogation Assignments and readings

	Assignments/ Links to materials		
8 September 2018	UCL/Deep Mind Reinforcement Learning Lecture 5 – Model-free Control	Youtube lecture video: Training Neural Networks Part 1	Youtube lecture video: Dependency parsing Lecture Notes Assignments and readings
15 September 2018	Break		
22 September 2018	UCL/Deep Mind Reinforcement Learning Lecture 6 – Value Function Approximation	Youtube lecture video: Training Neural Networks Part 2	Youtube lecture video: Introduction to TensorFlow (optional) Youtube lecture video: Recurrent Neural Networks and Language Models Lecture Notes Assignments and readings
29 September 2018	UCL/Deep Mind Reinforcement Learning Lecture 7 – Policy Gradient Methods	Youtube lecture video: Deep Learning Software	Youtube lecture video: Machine Translation and Advanced Recurrent LSTMs and GRUs
6 October 2018	UCL/Deep Mind Reinforcement Learning Lecture 8 – Integrating Learning & Planning	Youtube lecture video: CNN Architectures	Youtube lecture video: Neural Machine Translation and Models with Attention
13 October 2018	UCL/Deep Mind Reinforcement Learning Lecture 9 – Exploration & Exploitation	Youtube lecture video: Recurrent Neural Networks	Youtube lecture video: Gated Recurrent Units and Further Topics in NMT
20 October 2018	UCL/Deep Mind Reinforcement Learning Lecture 10 – Classic Games	Youtube lecture video: Detection and Segmentation	Youtube lecture video: End-to-End Models for Speech Processing

27 October 2018	Break		
3 November 2018	Berkeley CS294 Deep Reinforcement Learning	Youtube lecture video: Visualizing and Understanding	Youtube lecture video: Tree Recursive Neural Networks and Constituency Parsing
10 November 2018	Berkeley CS294 Deep Reinforcement Learning	Youtube lecture video: Generative Models	Youtube lecture video: Coreference Resolution
17 November 2018	Berkeley CS294 Deep Reinforcement Learning	Youtube lecture video: Deep Reinforcement Learning	Youtube lecture video: Dynamic Neural Networks for Question Answering
24 November 2018	Berkeley CS294 Deep Reinforcement Learning	Youtube lecture video: Efficient Methods and Hardware for Deep Learning	Youtube lecture video: Issues in NLP and Possible Architectures in NLP
1 December 2018	Berkeley CS294 Deep Reinforcement Learning	Youtube lecture video: Adversarial Examples and Adversarial Training	Youtube lecture video: Tackling the Limits of Deep Learning for NLP
Until January 2019	Work on projects		

Bonus tips

- The lecture videos go up to 2 hours; watch the lecture video at 2x speed, slowing down only at parts that cover important concepts
- Revise and make sure that you have **mastered** the fundamentals of deep learning
- Don't aim to understand everything and anything.