IAML DL - Study Guide - Week 01

Sambit Paul, Pavlos Andreadis

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1 Overview

Week 1 introduces the course and focuses on refreshing prerequisite knowledge. Learn provides a number of prerecorded lectures on Maths and Probability, while we also point to some useful readings below. Lab 0 is a good refresher on Python. We advise that you attempt Lab 1, though some points in it will become clearer in week 2 when the lab is run. Demonstrators will be available to answer your Lab 0 and 1 questions on Piazza. Their live availability for Week 1 will be announced later in the day (13/01/2020).

Introductory Week 1 class meetings are to be held on (all UK time and on Blackboard Learn) Thursday 3pm, Friday 4pm, Saturday 11am, and Saturday 5pm. No preparation is needed for this session. All live session hours are expected to change for later weeks after the poll results. These will be announced at the end of Week 1.

We aim to provide a list of weekly study guides, such as this, which you can refer to while studying. It will provide references to portions of the reading list which elucidate specific topics and areas very well.

2 Introduction to Machine Learning

The Introductions subsection in Learn's "Course Materials" section includes an overview of the course, relevant applications, and an aside on bias. There is a reference here to a **"W&F" book which you can ignore** (there are some references to this in the slides, but it is not part of the reading list).

For an introduction to the concept of Machine Learning, we would recommend Chapter 1 of Géron [2017]. This might also be a good chance to get a quick look at the content of different books in the reading list, and contrast their approach to the subject.

3 Mathematical Preliminaries

The course assumes that you have prerequisite knowledge in Linear Algebra, Calculus, and Probability. These are not examinable on their own, but an understanding of the relevant concepts is required.

3.1 Linear Algebra

Methods like Linear/Logistic Regression and SVMs use a lot of linear algebra (logarithms, vectors, matrices, etc) while processes like PCA and ICA (for dimensionality reduction) also use eigen values, ranks etc. which again falls under linear algebra.

For a thorough explanation of major linear algebra topics that we will be using, please skim through Chapters 1 through 7 from Strang [2016]. Students who just need a quick refresher can read Chapter 2 from Goodfellow et al. [2016].

3.2 Probability

Other than that, machine learning also relies heavily on probability. These includes theories and applications of conditional probability, Bayes' rule. Other than that, different kinds of distributions are key in building generative models and also different methods of model fitting. Few of the distributions that you need to be aware of are *Uniform Distribution*, *Gaussian Distribution*, *Bernoulli Distribution* and *Binomial Distribution*.

For students who need a deeper explanation of concepts, you can read through Chapter 3 of Goodfellow et al. [2016]. Students who just need a quick refresher may read Chapter 1 from Barber [2012].

3.3 Calculus

Calculus comes into play when we start moving into the realms of gradient-based optimisation. Unlike the problems which have a closed form solution, most real world problems are not such. For them, gradient based optimisation is usually the means to a solution.

To get a refresher on the calculus required for this course, you can refer to Appendix 2 (Multivariate Calculus) of Barber [2012].

References

David Barber. *Bayesian reasoning and machine learning*. Cambridge University Press, 2012.

Aurélien Géron. *Hands-on machine learning with Scikit-Learn and TensorFlow: concepts, tools, and techniques to build intelligent systems*. " O'Reilly Media, Inc.", 2017.

Ian Goodfellow, Yoshua Bengio, and Aaron Courville. *Deep learning*. MIT press, 2016.

Gilbert Strang. *Introduction to linear algebra*. Cambridge Press, Wellesley, MA, 2016. ISBN 978-09802327-7-6.