

Course Analysis for DD2424 - 2024

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1 Course overview

The basic numbers and details for the course:

Administration details

Course Name: Deep Learning in Data Science
Course Code: DD2424
Course Credits: 7.5 hp
Distribution of credit: Homework assignments (4.5 hp),
Project (3hp)
Dates of Course: mid March 2024 - early June 2024

Personnel

Course Leader: Josephine Sullivan
Teaching Assistants: RPL PhD students & undergraduate TAs for homework corrections

Teaching hours within the course

of lectures: 11 × 2 hour lectures
of help sessions: 6 × 3 hour sessions

Student numbers and their performance

of registered students: 306 (in reality ~250 active students including PhDs)
of students completing project: ~231 (before re-exam)
of 2nd cycle students completing assignments: 202 (before re-exam)
of 2nd cycle students have completed course: ~187 (before re-exam)

2 Goals of the course

The course's objectives are to

- Explain and detail the most common recent architecture networks used in deep learning and how they are applied to different input data.
- Give a coherent and consistent exposition of the back-propagation algorithm so that the students can understand and reproduce how it can be mechanically applied to a wide array of network architectures.
- Introduce to students the common and successful ways to train (supervised + self-supervised approaches) and regularize networks.
- Give the students a sufficiently broad and deep knowledge (and practical experience with DL) to enable student to learn more about the area independently by reading the literature.

3 Changes made to this year's version of the course

Improved teaching material on Diffusion models To keep the course up-to-date with recent advances in the field I increased the lecture time devoted to diffusion models and improved the lecture content describing DDPM.

Updated *Default & Custom* group projects

Updated the bonus point exercises for some assignments Once again tinkered with the bonus point exercises in the assignments to keep them interesting and up to date. The keen students appear to enjoy these exercises.

4 Summary of my high level thoughts on the course

I was happy with how the course went. The course has reached a steady state with updates made each year to address major technological developments in the prior year. I think most students are pleased with the content of the course and the material presented in the lectures and appreciate the combination of

theory and the practical know-how covered in the course. Happy that I did not hear about as many problems w.r.t. GCP this year as in previous ones.

5 Teaching

The teaching in the course consisted of traditional lectures in tandem with help sessions manned by the TAs.

6 Assessment in the course

To pass the course the students had to

- complete the programming assignments and upload a report on each assignment **and**
- complete a group project, write a report on it and make an oral presentation of their project.

The students' programming assignments were reviewed by the TAs and myself and were graded as pass/fail. The projects reports were graded from A-F. As project groups typically have 2-3 members, There are a significant number of projects ~80 projects to review. To make this grading possible each group before the project set goals for the project and the grade they should achieve upon achieving a hierarchy of goals. After the project is finished, the report written and the project presentations, each group grades themselves through a self-assessment report. The project and the self-assessment report are reviewed by a TA and they either approve the suggested grade and/or change the grade with motivation and this is reviewed by me. Finally I review all the grading to check for consistency and fairness.

7 Reading list

The original textbook for the course [Deep Learning](#) by Ian Goodfellow, Yoshua Bengio and Aaron Courville has become a little dated. The textbook was used more as a complement to the course. The book is freely available online. The book still obviously contains useful material but the field is moving so we also point the students to these recently published books:

- *Dive into Deep Learning* by Aston Zhang, Zack C. Lipton, Mu Li, and Alex J. Smola,
- *Understanding Deep Learning* by Simon Prince and
- *Deep Learning - Foundations and Concepts* by Chris Bishop and Hugh Bishop.

The above are available for download as pdf.

8 Requirements

The formal pre-requisites for taking DD2424 are to have passed courses covering these topics:

- Programming
- Linear algebra
- Single and multi-variate calculus
- Probability and statistics
- Machine Learning OR Artificial Intelligence

9 Actual course content

The schedule is available at the [KTH Canvas webpage for DD2424 2024](#) and shows the exact topics covered by the course.

10 Planned changes for next year

10.1 Aspects of the course that should be improved

Replace/update assignment 3

Assignment 3 continues to be a little bit fiddly and not hugely satisfying for the students. This year I made initial developments to create an assignment based on a supervised contrastive learning to replace it. Unfortunately, I did not have time to finish these developments and create a new assignment. But progress was made and I envision that the developments can be continued to create a new assignment for next year's version of the course.

Improve once again the specification of the default projects and the grading steps

The introduction of the default projects has worked well. Once again though I would like to tweak the grading steps so there is better calibration of the grading criteria between the different default projects and it is a bit more challenging to get the different grades. Also I will tinker with the specification of the custom projects to keep them relevant. Also I would like to have a more even distribution of grades.

10.2 Summary of planned improvements

Here is a list of the planned improvements for the next year's course:

- For the *Default Projects* continue with improved calibration between these projects and add slightly more difficulty for each of the grade steps.
- Once again update the list of potential *Custom Projects*.
- Continue development of assignment 3 replacement.
- Update relevant lectures to keep up with the developments in AI that have occurred since the last version of the course.