Deep Learning - Theory and Practice

IE 643
Lecture 0

July 28, 2025.

Credit Requirements

- **Course Project:** 40%
  - Topics will be floated soon - selection to be done **only** from the list of topics floated.
  - Team size: Limited to maximum of 2 members. (strict limit)

Credit Requirements

Course Project: 40%

- Team details and interests will be collected immediately after the course drop deadline:.
- Course project topic statements will be floated based on the interests provided and bids, topic preferences will be collected from teams on the floated topics.
- Based on the bids and topic preferences, course project topics will be allotted.
- Course project will have three evaluation phases:
  - Preparatory assessment - 20% of total project score
  - Continuous assessment - 10% of total project score
  - Primary intensive assessment - 50% of total project score
  - Novelty assessment - 20% of total project score
- More details to be provided soon.
- Please talk to classmates and form teams based on mutual interests.

Credit Requirements

Course Project:

- Preparatory assessment - **20%** of total project score. Main components involve:
  - Teams understanding the tasks/goals outlined in the Course Project Topic Statement.
  - Teams exploring ideas for the project statement, finding datasets, data collection procedures, codebases, relevant research papers to read and carving out the main milestone timelines for the project.
  - Discussing and finalizing these by meeting with the TAs/Instructor.
  - Teams preparing a presentation containing details about the team's exploration and details of the initial reading (e.g. blogs/papers/other resources) toward the project and outlining the roadmap for the project with timelines, milestones, etc.
  - In-person meet with the Instructor and TAs to discuss the preparatory activities.
- **Note:** Clear instructions on these activities will be provided later.

Credit Requirements

Course Project:

- Continuous assessment - **10%** of total project score. Main components involve the following:
  - Teams will regularly meet TAs/Instructor and update their progress of the project during office hours and after the lectures (if required).
  - Teams will discuss on the datasets, models, experimental settings, training/validation/testing methodologies they would be choosing for their projects and get them verified by TAs and Instructor.
  - Teams will clear doubts related to their projects.
  - All team members should be present for the meetings.
- **Note:** Clear instructions on these activities will be provided later.

Credit Requirements

Course Project:

- Primary intensive assessment - **50%** of total project score. Main components involve the following:
  - Based on regular meetings of teams with TAs/Instructor teams are expected to successfully execute their projects to completion.
  - Teams will present their work done towards the successful execution of the course project with necessary demonstrations.
  - Teams will also submit an extensive report along with code files and code walkthrough videos.
- **Note:** Clear instructions on these activities will be provided later.

Credit Requirements

Course Project:

- Novelty assessment - **20%** of total project score. Main components involve the following:
  - Teams will work on a novel task beyond the task outlined in the course project topic statement.
  - Poster presentation of course project to general audience.
  - Live demos for general audience.
- **Note:** Clear instructions on these activities will be provided later.

Credit Requirements

IMPORTANT:

- Each student must mandatorily participate in executing the course project.
- Each student must appear for preparatory assessment meetings, continuous assessment meetings, primary intensive assessment meetings, and novelty assessment meetings and poster presentations.
- Students who do not execute their course projects and those who do not appear for regular meetings will be awarded **Fail** grade. (No exceptions!)
- NOTE: No verification emails about your course projects during placements!

Credit Requirements

- **Mid-Term Exam:** 20%
  - Mid-term exam will be open notes and open scribes.
- **Quizzes:** 20%
  - 3 quizzes would be held. Weightage for each quiz will be made clear during the quiz.
  - Announcements of quiz date and timings will be made in class. Moodle postings on quiz timing and instructions will be made a day before the quiz.
  - Quizzes will be open notes and open scribes.
- **Class participation, general enthusiasm and other activities:** 5%
- **Homework problems, practice questions (both theory and coding related) will be provided regularly.** (Will not be graded!) (Discussions on homework and practice problems in Moodle are encouraged.)

Credit Requirements

- **Challenge Programming contests:** 15%
  - Problem description and solution requirements along with training and validation data sets will be posted (typically in kaggle).
  - Individual participation. (No teams!)
  - Students can propose solutions based on the problem description and solution requirements.
  - Submissions will be ranked based on their performance on private test data sets or based on the outcome criteria.
  - Students who provide top 5 best performing solutions for each programming contest would be given extra marks, and their ideas will deserve special mention during the course.
  - **Two challenges to be conducted**: one at intermediate level and another at advanced level. Individual weights will be made clearer during the challenge.
- **Note:** Clear instructions on these challenges will be provided later.

Essential Programming Skills

- Medium level expertise in Python programming language is **essential** for the course.
- No special training for Python programming language will be provided.
- Some practice codes might be given for those who wish to refresh their Python skills (only based on individual/group requests).

Essential Programming Skills

- Knowlege of Pytorch deep learning framework will need to be acquired during the course.
- Materials will be provided and practice sessions will be conducted.

Request to participants

- If you are completely new to Python
- If you have not done any course on basic Linear Algebra, basic Probability and Statistics
- If you are a B.Tech (or) B.S. sophomore
- If you have already credited a different Deep Learning course in IITB
- If you have registered the course for audit or ALC
- If you have registered for another course in slot 12

Please de-register !!!

Request to participants

- Please bring a laptop and/or mobile phone to every class. We shall have several practice sessions through the course.
- Please keep your laptop speakers and mobile phones in mute mode.
- Please plan to be in class latest by 5:35 pm.
- No strict attendance policy for the course, however your presence and participation will definitely enhance the discussions during the class hours.

Course Outline

Tentative agenda:

- Perceptron
- Multi-layer Perceptron, Feed Forward Neural Networks
- Convolutional Neural Networks
- Recurrent Neural Networks (LSTMs, GRUs)
- Generative models - GANs, VAEs, Diffusion models
- Popular and recent deep network models for vision, NLP, multi-media analytics applications.
- Large language and vision models and implications
- Distilling and adapting from large models
- Discussions based on theory, examples and case studies throughout the course.
- Applications of deep learning in auto ML, transfer learning and other areas.
- Course Project will cover more topics which might not be discussed in class. Please make full use of course projects as they will be helpful for exploring other topics.

Alert about tagging

- Please do not perform arbitrary re-tagging of the course in asc.
- It leads to immediate cancellation of registration.
- Getting the course back in asc takes quite some effort (multiple visits to acad office, etc.)

Materials for self-study and Reference Texts

Materials for self-study

Lecture slides and related research papers will be posted in Moodle.

Ref. Book-1

Deep Learning. *Ian Goodfellow, Yoshua Bengio and Aaron Courville*. An MIT Press book. `https://www.deeplearningbook.org/`

Ref. Book-2

Deep Learning with Python. *François Chollet*. Manning Publications. `https://www.manning.com/books/deep-learning-with-python/`

Reference Texts

Ref. Book-3

Deep Learning with PyTorch. *Eli Stevens, Luca Antiga, and Thomas Viehmann*. Manning Publications.
`https://www.manning.com/books/deep-learning-with-pytorch/`

Ref. Book-4

Linear Algebra and Learning from Data. *Gilbert Strang*.
Wellesley-Cambridge Press.
`http://math.mit.edu/~gs/learningfromdata/`

Web Resources

- `https://towardsdatascience.com/`
- `https://medium.com/`
- Code repositories: `https://github.com`
- Model repositories: `https://huggingface.co`

Online tools

Please familiarize yourselves with the following web resources.

- Code management: `https://github.com`
- Model imports and exports: `https://huggingface.co`
- Model development, training and experimentation:
  - `https://www.kaggle.com/`
  - `https://colab.research.google.com/`

More resources on this will be provided.

Teaching Assistants for the course

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- Bheeshm Sharma (bheeshmsharma@iitb.ac.in)

Office Hours

- Tuesdays, 12 PM to 1 PM.
- A regular venue will be confirmed by next week.

Note on academic integrity, copying and plagiarism

- As a responsible individual, each course participant will strictly adhere to the academic integrity principles laid out by the Institute.
- Any aberration will not be tolerated and will be dealt with appropriately.