# DS 265: Deep Learning for Computer Vision

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# DS 265 Course focus

We aim to help students:

- Understand the theory of deep learning and learn how to build and structure models best suited for a given task.

- Through the course, students will learn to build models of different complexity, from simple linear/logistic regression to convolutional neural network and recurrent neural networks with LSTM to solve tasks such as object detection, segmentation, recognition. Advanced concepts like VAE, GAN, Diffusion Models, Transformers, NeRF, 3DGS etc

- Students will also learn best practices to structure a model and manage research experiments.

# Requirements

- Machine Learning (strong prerequisite)
- Programming ability (we will use python)
- Mathematical confidence
- Enthusiasm for Research


Basic knowledge of the ML is assumed. Do not do DLCV if you don't meet the requirements. This course is not an introduction to machine learning

# Topic coverage

Introduction to DL and CV

Image Classification, Loss functions, Optimization

Introduction to Neural Networks and Backpropagation

Convolutional Neural Networks, Recurrent Neural Networks

Training Neural Networks

Object Detection/ Localization

Attentions and Transformers

Self Supervised Learning

Generative Models: VAE, GAN, Diffusion Models

3D Vision: SfM, NeRF, 3DGS

**Note: The remaining sessions are all guest lectures which are also mandatory to attend.**

# Topic coverage

Visualization

Segmentation

RNN/ LSTMs

GANs/ VAEs

Applications of GANs

**Note: The remaining sessions are all guest lectures which are also mandatory to attend.**

# Administrative information

| | |
|---|---|
| T.A.s | : Aakash, Badrinath, Priyam |
| Class Time | : Monday & Wednesday (11:30 am) |
| Text | : Deep Learning* & Research papers |
| Online forum | : Microsoft Teams, Course Webpage( https://val.cds.iisc.ac.in/DLCV/ ) |

*__Deep Learning__ by Ian Goodfellow, Yoshua Bengio and Aaron Courville

# Grading policy*

- Assignments - 40% (4 Assignments, tentatively)
- Exams - 35% (Mid Term, End Term)
- Mini Project - 25%
  - Project Proposal
  - Midterm Review
  - Final Presentation
  - Project report

***This is a tentative grading scheme and is subject to changes.**

# Reading list

1. Yoshua Bengio, Ian Goodfellow and Aaron Courville, *Deep Learning*, 2016, MIT Press. *Comprehensive.*
2. Michael Nielsen, *Neural Networks and Deep Learning* 2015. *Introductory.*
3. Christopher M Bishop, *Neural Networks for Pattern Recognition,* 1995, Clarendon Press.