**Deep Learning**

Fall-2023

# Course Statistics

**Title:** Deep Learning

**Offered To:** MS in Computer Science

## Credit Hours 3

**Proposed Semester:** 2rd

**Pre-requisite:** Probability & Statistics, Linear Algebra and basic Calculus  
Programming skills and desire to read & implement.

# Course Learning Objectives

In the past 10 years, Artificial Neural Networks (ANN) have gone from being a theoretical concept to a practical reality. Today is the era of IOTs producing massive amount of data at every moment for ANN to extract the reality from abstraction of the world problems like autonomous vehicles, image recognition, Natural Language Processing and its translations to other languages, self-adaptive real-time systems which compete the human intelligence through massive computations, A lot of these success stories have come from the exciting field of Deep Learning; a learning methodology based on the concept that human mind captures details at multiple levels or at multiple abstract levels. One property of deep learning is removing the responsibility of humans to design features, instead Deep Learning is given a task to find the appropriate representation.

# Course Contents

Introduction of Course, why Deep learning Taking off?,

Logistic Regression (Binary and Multi-classification), Shallow NN, Deep NN

DNN Optimization Forward Propagation, Backward propagation, Building blocks of Deep Neural Network(DNN),

Improving the Optimization with GD Momentum, Adagrad, RMSProps and other techniques.

Parameter and Hyper Parameter of DNN, improving the learning throgh

Distribution of Train and Test data, Bias vs Variance, Regularization and over fitting, Dropout Regularization,

Minibatch GD, Exponential Weighted Average, GD Momentum, Learning Rate Decay, Hyper parameter Tuning, Normalization Activation Network, Deep Learning Framework.

Convolutional Neural Network(CNN)

Computer Vision, Edge Detection, padding, Stride, convolutional Network Layer, Pooling Layer, Class Network, ResNet, Network in Network, Inception, Transfer Learning, Object Localization, Landmark detection, sliding, Bounding box prediction, Non max suppression, anchor box, yolo Algorithm, oneshot learning, siames learning, 1D and 3D Gernalization, Variation of CNN

Sequence Model, Notation, RNN Model Different Type of NN, Back propgation thought time, Different type RNN, Language and Model Sequence, Novel Sequence, Vanishing Gradient with RNN

LSTM, Bidirectional RNN, Deep RNN, Gated Recurrent Units (GRU)

Generative Adversial Network (GAN) Model, Variation Auto encoders (VAEs), and their applications in generating realistic images or other data

# Reference Books

* 1. **Deep Learning** by *Ian Goodfellow*, [*Yoshua Bengio*](https://www.amazon.com/Yoshua-Bengio/e/B00IWC47MU/ref=dp_byline_cont_book_2)*,* [*Aaron Courville*](https://www.amazon.com/Aaron-Courville/e/B01N8XGWRL/ref=dp_byline_cont_book_3) , First edition, The MIT Press, 2016; ISBN-13: 978-0262035613
  2. [**Neural Networks and Deep Learning: A Textbook**](https://www.amazon.com/Neural-Networks-Deep-Learning-Textbook/dp/3319944622?ref_=fsclp_pl_dp_1)by *[Charu C. Aggarwal](https://www.amazon.com/Charu-C.-Aggarwal/e/B00E6PGCPM&ref_=fsclp_pl_s_1)* , First edition 2018, ISBN-13: 978-3319944623
  3. [**Hands-On Machine Learning by Scikit-Learn and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems**](https://www.amazon.com/Hands-Machine-Learning-Scikit-Learn-TensorFlow/dp/1491962291?ref_=fsclp_pl_dp_3) *by Aurélien Géron,* First edition , 2018, ISBN-13: 978-1491962299