**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 decade machine learning has developed from the science fiction to reality. Today is the era of IOTs producing massive amount of data at every moment for machine learning 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?, what is NN, supervising Learning with NN, Binary Classification, Logistic Regression, Cost Function, Gradient Descent, Derivative, Computation Graph, Vectorizing NN, , Forward Propagation, Backward propagation, Deep Layer of NN, Building block of Deep Neural Network(DNN), Parameter and Hyper Parameter,

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.

Division starategies of Training, Dev and Test Disribution, Evaluation Meterics, optimization Strategies, Error Analysis, cleaning data, Deep Learning Case Study

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 Gernlization, Variation of CNN

Sequence Model, Notation, RNN Model Different Type of NN, Backpropgation throught time, Different type RNN, Language and Model Sequence, Novel Sequence, Vanishing Gradient with RNN

LSTM, Bidirectional RNN, Deep RNN,

# 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