Value added courses
to be offered by
Department of Statistics, Shivaji University, Kolhapur

Title of the course: Artificial Intelligence and Machine Learning-I

Credits of the course: 02

Eligibility: PG second year students of the subjects Statistics, Applied Statistics and Informatics, Mathematics, Physics, Electronics, Computer Science, Nano-Science (Students should have studied Mathematics up to second year of UG). Basic understanding of programming language.

Examination: Students will be evaluated through the Department level exam of 30 marks and case study/project work for 20 marks. Passing criteria is 40% (combined).

Certificate: Certificate will be issued by the Department to the successful students.

Syllabus

Unit 1: Introduction to machine learning and artificial intelligence, software platforms and hypes, Supervised Learning and Examples, Semi Supervised Learning and Examples, Un-Supervised Learning, Data Science Implementation Methodology, Concept of Cost/Loss Function and its Optimization, Gradient Decent: Algorithm, Stopping Rules, Linear Problem, Gradient Descent in High Dimensions, Partial Differentiation and Matrices. Linear Regression: Model, Cost Function, Estimation of Parameters and Prediction, examples. Discrete Regression: Model, Cost Function, Estimation of Parameters and Prediction, examples. Model Fitments, Cost Regularization

(15 L)

Unit 2: Neural Networks: Neural Networks arrive, model formulation: Neural Network architectures, layers in Neural Network, concept of activation function and some popular activation functions, cost functions, Training of Neural Network, Propagation (forward and backward), Chain Rule, Back-Propagation Algorithm, Examples

(15 L)

Implementation of the algorithm will be in R/Python

References:
1. Anthony, M., Bartlett, P. L., & Bartlett, P. L. (1999). *Neural network learning: Theoretical foundations* (Vol. 9). Cambridge: cambridge university press.
2. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT press.
3. Han, J., Pei, J., & Tong, H. (2022). *Data mining: concepts and techniques*. Morgan kaufmann.
4. Hastie, T., Tibshirani, R., Friedman, J. H., & Friedman, J. H. (2009). *The elements of statistical learning: data mining, inference, and prediction* (Vol. 2, pp. 1-758). New York: springer.

Title of the course: Artificial Intelligence and Machine Learning-II

Credits of the course: 02

Eligibility: PG second year students of M.Sc.(Statistics/Applied Statistics and Informatics) OR Second year students of other PG programmes who have completed the value added course *"Artificial Intelligence-I"* offered by Department of Statistics.

Examination: Students will be evaluated through the Department level exam of 30 marks and case study/project work for 20 marks. Passing criteria is 40% (combined).

Certificate: Certificate will be issued by the Department to the successful students.

Syllabus

Unit 1: Introduction to deep learning, designing architecture of deep neural network, optimization of deep neural networks. Convolutional operation, vision and convolutions, kernels and their effects, relation between input size, output size and filter size, Convolutional Neural Networks (CNN), Convolution and Pooling Layers, training of CNN, prediction using CNN, Convolutional Neural Network Architectures: LeNet, AlexNet, ZFNet, VGGNet.

(15 L)

Unit 2: Introduction to sequential data and examples, Sequence Learning Problems, Recurrent Neural Networks (RNN), RNN architectures, training of CNN, back propagation through time (BPTT), problem of vanishing and exploding gradients, Long Short Term Memory Cells (LSTMs) and Gated Recurrent Units (GRUs). Neural networks for word embedding's: wordtovec.

(15 L)

Implementation of the algorithm will be in R/Python

References:

1. Anthony, M., Bartlett, P. L., & Bartlett, P. L. (1999). *Neural network learning: Theoretical foundations* (Vol. 9). Cambridge: cambridge university press.
2. Goodfellow, I., Bengio, Y., & Courville, A. (2016). Deep learning. MIT press.
3. Kelleher, J. D. (2019). Deep learning. MIT press.
4. LeCun, Y., Bengio, Y., & Hinton, G. (2015). Deep learning. nature, 521(7553), 436-444.