

III B.Tech II Semester (E.C.E)

23A04607	<u>MACHINE LEARNING AND DSP (SEC-IV)</u>	L	T	P	C
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Course Objectives:

1. To understand the modules and dependencies for machine learning corresponding to different applications.
2. To understand a range of machine learning regression techniques & clustering along with their datasets.
3. To write the programs and implement k-Nearest Neighbor algorithm to classify the iris data sets, images & CNN.
4. To simulate the basic signal processing operations like convolution and correlation.
5. To simulate the DSP operations like DFT, FFT & implement IIR and FIR filters using simulation software and verify their frequency responses.

Course Outcomes:**At the end of the course, the students will be able to**

1. Understand the modules and dependencies for machine learning corresponding to different applications.
2. Learn a range of machine learning regression techniques & clustering along with their datasets.
3. Write the programs and implement k-Nearest Neighbor algorithm to classify the iris data sets, images & CNN.
4. Simulate the basic signal processing operations like convolution and correlation.
5. Simulate the DSP operations like DFT, FFT & implement IIR and FIR filters using simulation software and verify their frequency responses.

MACHINE LEARNING (Implement any six concepts)

Implement the following concepts using python with supporting applications.

1. Familiarizing with Anaconda and Jupyter for importing modules and dependencies for ML Familiarization with NumPy, Panda and Matplotlib by Loading Dataset in Python
2. **Linear regression:** Predict the profit of a company/House price from a dataset using the concept of linear regression. Implement the speech recognition model (NLP) from a speech/audio dataset using the concept of linear regression
3. **Logistic regression:**
 - a) Identify whether the patient has diabetes or not from diabetes dataset using Logistic regression
 - b) Implement the speech to text model (NLP- Speech recognitions system) from a speech dataset using the concept of linear regression
4. **Polynomial regression :**
 - a. Determine the quality of wine using wine dataset with the help of polynomial regression
 - b. Implement the speech recognition model (NLP) from a speech / audio data set using the concept of polynomial regression.

5. **K-means clustering:** Apply the concept of K-means clustering for image segmentation problem (Brain tumor and Lung images)/Color quantization
6. Write a program to implement k-Nearest Neighbor algorithm to classify the iris data set to demonstrate the working of the decision tree based ID3 algorithm.
7. Write a program to implement the k-Nearest Neighbor algorithm for image classification and distance metric learning for large margin with image classification applications using k-nearest neighbor.
8. **PCA/LDA:** Reduce the dimensionality of a dataset for Face recognition system
9. Design an Artificial neural network for Digit classification using Back Propagation Algorithm for MNIST Data set. Train MLP using Gradient descent algorithm by applying Linear, Sigmoid, tanh, and ReLu activation functions
10. **Digit recognition using CNN:** Identify the digits 0-9 from MNIST data and CIFR 10 set using CNN
11. ImageClassificationusingCNN:ClassifycatsanddogsusingCNNfromthegivendataset
12. LSTM (Long Short-Term Memory Networks)/ARIMA--- Implementation biomedical signals (like EEG, ECG, EMG) classifications and disease prediction.

DIGITAL SIGNAL PROCESSING (Implement any six concepts)

1. Generate the following standard discrete time signals.
 - i) Unit Impulse ii) Unit step iii) Ramp iv) Exponential v) Sawtooth
2. Generate sum of two sinusoidal signals and find the frequency response (magnitude and phase).
3. Implement and verify linear and circular convolution between two given signals.
4. Implement and verify autocorrelation for the given sequence and cross correlation between two given signals.
5. Compute and implement the N-point DFT of a given sequence and compute the power density spectrum of the sequence.
6. Implement and verify N-point DIT-FFT of a given sequence and find the frequency response (magnitude and phase).
7. Implement and verify N-point IFFT of a given sequence.
8. Design IIR Butterworth filter and compare their performances with different orders (Low Pass Filter /High Pass Filter)
9. Design IIR Chebyshev filter and compare their performances with different orders (Low Pass Filter /High Pass Filter).
10. Design FIR filter (Low Pass Filter /High Pass Filter) using windowing technique.
 - i. Using rectangular window, ii. Using hamming window , iii. Using Kaiser window
11. Design and verify Filter (IIR and FIR) frequency response by using Filter design and Analysis Tool.
12. Compute the Decimation and Interpolation for the given signal.
13. Real time implementation of an audio signal using a digital signal processor.

Reference books:

1. S.N.SivanandamandS.N.Deepa,IntroductiontoneuralnetworksusingMatlab,2006.
2. SimonHaykin,NeuralNetworksandLearningMachines,PHI,2008, 3rd Edition
3. Digital Signal Processing: Alon V. Oppenheim, PHI
4. Digital Signal processing(II-Edition): S.K. Mitra, TMH