

MODULE 1: INTRODUCTION TO PROGRAMME

MOTIVATION FOR PROGRAMME
OVERVIEW OF PROGRAMME
EXPECTED OUTCOMES OF PROGRAMME

MODULE 2: MACHINE LEARNING TASKS AND APPLICATIONS

FUNCTION APPROXIMATION (REGRESSION), CLASSIFICATION, CLUSTERING,
RANKING, INFORMATION RETRIEVAL
TEXT PROCESSING APPLICATIONS
IMAGE AND VIDEO PROCESSING APPLICATIONS
SPEECH PROCESSING APPLICATIONS
DATA REPRESENTATION

MODULE 3: PARADIGMS OF MACHINE LEARNING

SUPERVISED LEARNING & UNSUPERVISED LEARNING
SEMI-SUPERVISED LEARNING & ACTIVE LEARNING
SELF-SUPERVISED LEARNING & TRANSFER LEARNING
DOMAIN ADAPTATION
FEDERATED LEARNING

MODULE 4: REVIEW OF BASICS OF MATHEMATICAL TOPICS

LINEAR ALGEBRA
CALCULUS
PROBABILITY AND STATISTICS

MODULE 5: REGRESSION METHODS

SUPERVISED LEARNING
PARAMETER ESTIMATION - MAXIMUM LIKELIHOOD METHOD
OVERFITTING & REGULARISATION
RIDGE REGRESSION
LASSO

MODULE 6: PROBABILISTIC MODELS FOR CLASSIFICATION

- K-NEAREST NEIGHBOUR CLASSIFIER
- BAYES CLASSIFIER
- NORMAL DENSITY FUNCTION
- MAXIMUM LIKELIHOOD ESTIMATION
- GAUSSIAN MIXTURE MODEL
- NAÏVE BAYES CLASSIFIER
- DECISION SURFACES
- DIMENSION REDUCTION METHODS

MODULE 7: ARTIFICIAL NEURAL NETWORKS FOR CLASSIFICATION AND REGRESSION

- MCCULLOCH-PITTS NEURON
- PERCEPTRON CONVERGENCE THEOREM
- SIGMOIDAL NEURON
- SOFTMAX FUNCTION
- MULTILAYER FEEDFORWARD NEURAL NETWORK
- ERROR BACKPROPAGATION METHOD
- GRADIENT DESCENT METHOD
- STOPPING CRITERIA
- LOGISTIC REGRESSION BASED CLASSIFIER

MODULE 8: OPTIMIZATION AND REGULARIZATION METHODS FOR DFNNS

- DEEP FEEDFORWARD NEURAL NETWORKS (DFNNS)
- OPTIMIZATION METHODS
- ADAGRAD, RMSPROP, ADADELTA & ADAM
- SECOND ORDER METHODS
- REGULARIZATION METHODS
- BATCH NORMALIZATION

MODULE 9: AUTOENCODERS

- ANN & STACKED AUTOENCODER

GREEDY LAYER-WISE TRAINING
PRE-TRAINING & FINE TUNING A DFNN
REGULARIZATION IN AUTOENCODERS
DENOISING AUTOENCODER
VARIATIONAL AUTOENCODER

MODULE 10: CONVOLUTIONAL NEURAL NETWORKS (CNNs)

BASIC CNN ARCHITECTURE
RECTILINEAR UNIT (RELU)
2-D DEEP CNNs
IMAGE CLASSIFICATION USING 2-D CNNs
3-D CNN FOR VIDEO CLASSIFICATION
1-D CNN FOR TEXT AND AUDIO PROCESSING
VLAD METHOD FOR AGGREGATION

MODULE 11: RECURRENT NEURAL NETWORKS (RNNs)

ARCHITECTURE OF AN RNN & ITS UNFOLDING
BACKPROPAGATION THROUGH TIME
VANISHING AND EXPLODING GRADIENT PROBLEMS IN RNNs
LONG SHORT TERM MEMORY (LSTM) UNITS
GATED RECURRENT UNITS
BIDIRECTIONAL & DEEP RNNs

MODULE 12: ENCODER-DECODER PARADIGM BASED DEEP LEARNING MODELS

ENCODER-DECODER PARADIGM
IMAGE AND VIDEO CAPTIONING MODELS
MACHINE TRANSLATION
TEXT PROCESSING MODELS
REPRESENTATION OF WORDS: WORD2VEC AND GLOVE

MODULE 13: TRANSFORMER MODELS

- ATTENTION-BASED MODELS
- POSITION ENCODING
- ENCODER AND DECODER MODULES IN A TRANSFORMER
- SEQUENCE TO SEQUENCE MAPPING USING TRANSFORMER
- MACHINE TRANSLATION USING TRANSFORMER MODEL
- VISION TRANSFORMER
- BERT MODEL

MODULE 14: GENERATIVE ADVERSARIAL NETWORKS (GANS)

- IMAGE GENERATION MODELS
- ARCHITECTURE AND TRAINING OF A GAN
- DEEP CONVOLUTIONAL GAN
- CYCLIC GAN
- CONDITIONAL GAN
- SUPER-RESOLUTION GAN
- APPLICATIONS OF GANS FOR IMAGE PROCESSING

MODULE 15: REINFORCEMENT LEARNING

- INTRODUCTION TO REINFORCEMENT LEARNING
- MARKOV DECISION PROCESSES
- POLICY GRADIENTS
- TEMPORAL DIFFERENCE LEARNING
- Q-LEARNING
- DEEP REINFORCEMENT LEARNING
- TEXT PROCESSING USING DEEP REINFORCEMENT LEARNING