# INT422:DEEP LEARNING

L:2 T:0 P:2 Credits:3

**Course Outcomes:** Through this course students should be able to

CO1 :: Understand TensorFlow to build and optimize deep learning models

CO2 :: Define the hardware and software architecture of the NVIDIA DGX Station A100

CO3 :: apply deep Convolutional Neural Networks (CNNs) for image classification

CO4 :: Apply autoencoders and pre-trained CNNs for data compression, and image processing tasks

CO5 :: Examine recurrent neural networks for modelling sequential data

CO6 :: Apply Generative Adversarial Networks (GANs) in developing interactive AI applications using the Streamlit framework.

**Unit I**

**Building Models with TensorFlow** : Introduction to TensorFlow, Installation of TensorFlow, TensorFlow ranks and tensors, TensorFlow's computation graphs, variables in TensorFlow, TensorFlow optimizers, transforming tensors as multidimensional data arrays, visualization with Tensorboard, Introduction of Deep Learning, Applications of Deep Learning

**Unit II**

**Building Models with Keras** : Introduction to keras, Keras installation, keras layers and models, building a regression model, multi-layer Perceptron learning for classification, image classification with keras, building text classification model, overfit and underfit, save and load model, hyperparameter tuning

**NVIDIA DGX Station A100** : Introduction, Hardware Architecture, DGX Station A100 Software Stack, CUDA Toolkit, Future of AI with DGX Station A100

**Unit III**

**Classifying images with deep convolutional neural networks** : building blocks of convolutional neural networks, determining the size of the convolution output, performing a discrete convolution in 2D, subsampling, putting everything together to build a CNN, implementing a deep convolutional neural network using TensorFlow, Transfer learning with pre-trained CNN, data augmentation, image segmentation, NVIDIA Command Line Tools and Utilities

**Unit IV**

**Autoencoders and Pre-trained CNN** : introduction to autoencoders, need for autoencoders, architecture of autoencoder, types of autoencoders, data compression using autoencoders, variational autoencoders

**Unit V**

**Modeling sequential data using recurrent neural networks** : modeling sequential data, understanding the structure and flow of an RNN, computing activation in an RNN, challenges of learning long-range interactions, implementing a multilayer RNN for sequence modeling in TensorFlow, text classification with an RNN, text generation with an RNN, time series forecasting, LSTM units, sequence classification with LSTM, stacked LSTM for sequence classification

**Unit VI**

**Generative Adversarial Networks** : introduction to generative models, overview of GAN structure, discriminator, generator, building GAN, problems with GANs, CycleGAN, Adversarial FGSM, use of docker, Model deployment on NVIDIA Server Using Streamlit framework

**List of Practicals / Experiments:**

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- Identify a real world deep learning problem and select a suitable dataset for the project.
- Loading and Visualizing Dataset for Deep Learning Projects
- Basic Data Preprocessing: Normalization, Standardization, and Handling Missing Data
- Splitting Data into Training and Test Sets for Model Training
- Implementing a Simple Neural Network for Binary Classification

- Training a Feedforward Neural Network on a Simple Dataset
- Use Pretrained Models for Basic Image Classification
- Implement a Basic Convolutional Neural Network (CNN) for Image Classification
- Training an RNN Model for Text Classification Using Simple Sentences
- Building and Training an Autoencoder for Image Compression
- Evaluating a Model's Performance Using Accuracy
- Saving and Loading a Trained Deep Learning Model for Future Use
- Visualizing Activation Maps of a CNN Model to Understand Feature Learning
- Prepare and present comprehensive project report including problem statement, methods, results and challenges

**Text Books:**

1. DEEP LEARNING by AMIT KUMAR DAS, Pearson Education India

**References:**

1. DEEP LEARNING by JOHN D. KELLEHER, MIT Press

2. ADVANCED DEEP LEARNING WITH TENSORFLOW 2 AND KERAS by ROWEL ATIENZA, PACKT PUBLISHING