# Training Course Outline

## MLDL-I: Machine Learning and Deep Learning - I

| Class | Discussion Topic | Practical Implementation |
|---|---|---|
| 1 | **Introduction to Supervised Learning:**<br>Supervised classification: feature vector, training, testing, validation,<br>K nearest neighbor (KNN)<br>Linear regression, cost function, gradient descent. | Learning the use of Colab platform<br>Learning the use of Kaggle platform<br>Learning Python Programming<br>Basic submission using Pandas on Kaggle<br>Assignment: Complete code for Titanic submission using Linear Reg. & KNN. |
| 2 | **Supervised Learning Methods:**<br>Logistic regression<br>Support vector machine (SVM)<br>Maximum likelihood (ML)<br>Decision Trees and XGBoost | Implementation of Linear Regression with Gradient Descent<br>How to use SVM, XGB, RF etc<br>Ensembling (Bagging, Boosting)<br>Assignment: None |
| 3 | **Neural Network & Unsupervised learning:**<br>Intro to Deep Learning<br>Multi-layer perceptron<br>Batching, SGD, Adam<br>K-means clustering<br>Hierarchical clustering. | Introducing Tensorflow and Keras<br>Model building with MLP<br>Digit Recognition with MLP<br>Clustering<br>Assignment: Competition (CIfar10) |
| 4 | **Convolutional Neural Network**:<br>Types of convolutions, Padding, stride, dilation, augmentation, pooling, activation function. | 1D CNN application, 2D CNN with application, Shape and Cost calculation, CNN model building, Overfitting, Augmentation (data + model), Model Checkpointing (callbacks), Intermediate layer's output,<br>Edge detection using CNN<br>Assignment: CIFAR10 with CNN |
| 5 | **CNN Classification Architecture:**<br>Transfer Learning, Bias/variance theory, hyperparameter tuning, learning curve, regularization, cross-validation, data-split, error analysis, attention mechanism, | CNN based classification architecture (AlexNet, VGG, ResNet, InceptionNet, DenseNet, EfficientNet),<br>Transfer Learning,<br>Cat Vs Dog with Transfer Learning.<br>Assignment: None |
| 6 | **Traditional CNN Architectures:**<br>Performance improvement of CNN architecture, Base Model, ResNet, Inception Net, Mobilenet, Efficientnet<br>Transfer learning | Deep neural network based classification architecture using traditional models, implementation a transfer learning.<br>Cross-Validation<br>Bias/Variance in practice<br>Learning Rate analysis |

| Class | Discussion Topic | Practical Implementation |
|---|---|---|
| 7 | **CNN Segmentation Architecture:** Segmentation, encoder-decoder, Unet | Implementing image segmentation using Unet |
| 8 | **Application of ML-DL:** An application details using image/video data. | Individual presentation from the trainee presenting a complete work with results. |