**COURSE SYLLABUS**

| **Course Code:** CS2212 | **Course Name:** Introduction to Machine Learning 2 | |
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| **Semester:** 4 | **Category:** Major Computer Science Core (Programming) | |
| **Credits:** 2 | **L T P J:** 1 0 1 0 | **Contact Hours:** 15:0:30:0 = 45 |
| **Prerequisite (Course/Skill/Knowledge):**   * Sem 4: CS2211 - Introduction to Machine Learning 1 | | |

# **Course Overview**

Introduction to Machine Learning 2 is a fourth-semester computer science core course designed for undergraduate students with a prerequisite in CS2211. This course introduces students to the complicated models of machine learning and deep learning. This course will cover supervised, unsupervised, and deep learning, along with hyperparameter tuning. Students are provided with real-time datasets and activities to inculcate the skills of problem solving, critical thinking and adaptability

# **Course Outcomes and Contents**

**CO1: Determine the relationship between dependent and independent variables encountered in specific domains using multiple linear regression and its error metrics (MSE, MAE, RMSE) 6 Hours**

Multiple-linear regression, mean squared error, mean absolute error, root mean squared error.

**CO2: Improve model performance of multiple linear regression using grid search hyperparameter tuning technique 3 Hours** Hyperparameters, common hyperparameters with examples, and hyperparameter tuning techniques: grid search, random search

**CO3: Perform model evaluation using cross-validation, confusion matrix, classification report and area under curve for Decision Tree in specific domains 6 Hours**

Decision tree, Random forest, model evaluation metrics: confusion matrix, accuracy, precision, recall, F1-Score, cross validation, Area under curve, Gradient Boosting.

**CO4: Apply Principal Component Analysis (PCA) to reduce dimensionality on real-world datasets belonging to health/finance 6 Hours**

Dimensionality reduction techniques - Principal Component Analysis (PCA)

**CO5: Apply convolutional neural networks for classification 9 Hours**

Introduction to CNN: Difference between CNN and MLP; Layers in CNN: Convolution, Pooling, BatchNorm, Dropout, Activation, Dense Layers, Loss Functions, Standard CNN models.

**CO6: Understand the building blocks of a classic CNN model (ResNet, VGG-18) 3 Hours**

ResNet : Residual connections, ResNet model: variants, VGG-18.

**CO7: Solve a real-world problem belonging to health/finance by applying machine learning skills**

**12 Hours**

Project selection, project status review-1. Final project submission: source code and report, presentation, and Viva.

# **Textbooks**

1. Müller, A. C., & Guido, S. (2016). *Introduction to machine learning with Python: a guide for data scientists*. " O'Reilly Media, Inc.".
2. Aurélien, Géron. "Hands-on machine learning with scikit-learn & tensorflow." *Geron Aurelien* 134 (2017): 145-150.

# **Reference Material**

1. Goodfellow, I., Bengio, Y., & Courville, A. (2016). *Deep learning*. MIT press.
2. VanderPlas, Jake. *Python data science handbook: Essential tools for working with data*. " O'Reilly Media, Inc.", 2016.

# **Activities Plan:**

**Note: Please provide the details of HW or SW tools or platforms planned to be used for the lab activities.**

| **No:** | **Activity** |  |
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