Birla Institute of Technology and Science, K.K. Birla Goa Campus
Center for Technical Education
Second Semester – 2021-2022

Course Title: Intro To ML and DL

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Course Description:

Machine Learning is a field that is developing at a tremendous pace today. It becomes all the more important that today's engineers are aware of the nitty-gritty of Machine Learning. This course aims to provide the students with an in-depth knowledge of Machine Learning, including theoretical and practical aspects. The course will also focus on making sure students are accustomed to learning new concepts independently through research papers, MOOCs, and others' understanding of people's code. As the field has become much more diverse than before, this course will also discuss basic concepts of recent Deep Learning and Reinforcement Learning methods, which will help the students pursue their journey into these fields further.

Course Prerequisites:

Basic Python

Course Plan:

Week	Topic	Subtopic
1	What is ML, DL, AI, RL? The foundation of ML in Probability, Statistics (Bayesian) and Information theory. Intro to python, K-nearest neighbors.	• **Python**: Lists, Tuples, Dictionaries, Conditionals, Loops, Iterators, Functions, Comprehensions • Using **Jupyter** notebooks and Google Colab.
2	-Linear and Logistic Regression -Exploratory Data Analysis (how to clean data, find correlations in data) -Feature engineering (Handling missing values, bad data).	• Pandas • Matplotlib • Box plots, correlation plots • Introduction to scikit-learn

3	- SVM, Naive Bayes Classifier. - Decision tree, GBM, and Random forests. Math and statistics behind it.	• Bias-Variance Trade-off, • Validation techniques Metric selection • Loss selection and Info theory • Bagging and Boosting
4	-Intro to OOP for ML -Neural nets -PyTorch Computation graphs	• Activation functions • Backpropagation • PyTorch Hooks
5	-CNNs -Optimizers and Regularisation. -basic theory behind RNNs.	• Working of CNN • Augmentation techniques • SOTA architecture • Transfer Learning for CNN • Tricks while training a CNN model.
6	-Intro to NLP - How to feed text data to machines? -Transfer Learning. -State of the art models	• Frequency vectors • Word-embeddings • contextual Embeddings • EDA over word-vectors
7	-Intro to Reinforcement learning -State-Action concept -Value and Policy-based methods -Dynamic Programming -Q Tables -Intro to Model-free vs Model-based	• Open-AI gym • Frozen lake
8	-Reading Research papers -building DL models from scratch.	• Reading and understanding complex terms from research papers • Implementing some landmark papers like GANs • How to implement something from scratch
9	-How to use/understand libraries on GitHub -How to keep up with the field	• Using GitHub for navigation • Class discussions

End Project Description: Final projects will require students to learn some new concepts independently and thus align with this course's goal.

Evaluation Components:

1. Kaggle Competitions/tutorial assignments.
2. Final Project

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