**Module1- Edge AI and Robotics: Accelerated Data Science**

**Course Objective**: This course will provide students with fundamental knowledge of Traditional Robotics, Edge GPU Computing and Machine Learning and Deep Learning Primer.

**Introduction**: Overview of Robotics and Kinematics, Edge Computing with Jetson Devices, GPU Computing, Dockers & Containers, Parallel Programming, Machine Learning with RAPIDS.

**Basics of Robotics:** Introduction to Robotics, Traditional Image Processing: Camera Geometry, Color Sensing, Fourier Transforms, Image Convolution, Edge Detection, Feature Detection: Filters, SIFT, HOG.

{ [Robotics edx](https://www.edx.org/course/robotics-vision-intelligence-and-machine-learning?index=product&queryID=b6bd1863e22739db40393b58ae4d631c&position=2) }

**Advanced Concepts of Robotics:** Optical Flow Estimation, Image Morphing, Image Blending, Image Carving, Probability and Statistics.

{ [Robotics edx](https://www.edx.org/course/robotics-vision-intelligence-and-machine-learning?index=product&queryID=b6bd1863e22739db40393b58ae4d631c&position=2) }

**Image Processing and Parallel Programming**: GPU Programming, CUDA C/C++/Python, Accelerated Image Processing, nvJPEG, Numba.

**Introduction to Machine Learning - Supervised:** Introduction to Supervised Learning, Linear Model, RAPIDS acceleration: Linear Regression, Overfitting and Cross Validation, Decision Tree, Visualizing Classification: {ROC, AUC, Confusion Matrix}, Bagging, Random Forests, RAPIDS Acceleration: Random Forest, Boosting, RAPIDS acceleration: K-NN, XGBoost.

**Practicals Labs:**

* Introduction to Dockers & Containers, Introduction to NVIDIA GPU Cloud (NGC).
* Image Processing tools
* Practical on Traditional Data Science packages (Numpy, Pandas, Scipy, Scikit-Learn).
* CUDA C/C++ for Accelerated Computing.

**{DLI Online Course Section:** **Fundamentals of Accelerated Computing with CUDA C/C++}**

* Numba to compile CUDA kernels for Numpy Acceleration in Python.

**{DLI Online Course Section: Fundamentals of Accelerated Computing with CUDA Python}**

* Getting started with Accelerated Data Science with RAPIDS AI (cuPy, cuDF, cuSignal, cuML).
* Decision Tree Classification Clustering in RAPIDS.
* Random Forest Classification in RAPIDS.

**{DLI Online Course Section: Fundamentals of Accelerated Data Science with RAPIDS, Section 2: GPU-accelerated Machine Learning}**

**Course Learning Outcomes (CLO) / Course Objective (CO):**

After the completion of this course, the students will be able to:

1. Comprehend different theoretical aspects & terminologies of Robotics and Edge Computing.
2. Understand the concept of Neural Networks and its implementation in the context of Machine Learning.
3. Understand GPU computing for building advanced data science applications.
4. Deep understanding Machine Learning, Data Analytics and Data Science Toolkits with optimized acceleration using RAPIDS Framework.
5. Working with Deep Neural Networks using Transfer Learning Toolkit, Pytorch and Tensorflow.

**Text Books:**

1. Mitchell M., T., Machine Learning, McGraw Hill (1997) 1st Edition.
2. Alpaydin E., Introduction to Machine Learning, MIT Press (2014) 3rd Edition.
3. Vijayvargia Abhishek, Machine Learning with Python, BPB Publication (2018)

**Reference Books:**

1. Bishop M., C., Pattern Recognition and Machine Learning, Springer-Verlag (2011) 2nd Edition.
2. Michie D., Spiegelhalter J. D., Taylor C. C., Campbell, J., Machine Learning, Neural and Statistical Classification. Overseas Press (1994).