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# Advanced LiDAR Data Processing and Object Detection in Robotics

1 – 5 August 2027
Dubai (UAE)



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## Introduction

The "Advanced LiDAR Data Processing and Object Detection in Robotics" course is meticulously designed to equip participants with in-depth knowledge and practical skills essential for effectively working with LiDAR technology. This course focuses on the latest and most advanced techniques, tools, and frameworks available for LiDAR data processing and object detection in three-dimensional 3D environments. Participants will gain insights into the essential LiDAR data processing steps required to implement successful robotics applications.

By the end of this course, participants will also learn how to apply sensor fusion techniques in analyzing 3D data, improving robotic system performance, and enabling autonomous object detection and classification.

## Course Objectives

- Understand LiDAR specifications and read datasheets accurately to select the right sensor for specific projects.
- Select the most suitable LiDAR sensor for a given robotics application based on project requirements.
- Grasp the fundamentals of LiDAR technology and its diverse applications in robotics.
- Use ROS Robot Operating System to obtain real-time LiDAR data from sensors.
- Save LiDAR data into files for future analysis and processing.
- Analyze LiDAR sensor specifications and evaluate their performance.
- Develop Python and C++ code using ROS and Point Cloud Library PCL to extract meaningful insights from real-time LiDAR data in robotic systems.
- Design and train AI/DNN Artificial Intelligence/Deep Neural Network models for effective object detection and classification in 3D point cloud data.
- Develop algorithms for object detection using LiDAR algorithms and integrate sensors to analyze data with high precision in autonomous robots.



## Course Outlines

### Day 1: Introduction to LiDAR Technology

- Overview of LiDAR principles and applications in robotics.
- Types of LiDAR sensors and their specifications.
- LiDAR sensor selection: Understanding spec sheets and technical specifications, and factors to consider when choosing a LiDAR sensor for a project.
- Setting up sensors on Linux systems: Connecting LiDAR sensors to Linux, installing drivers, and using visualization tools provided by manufacturers.

### Day 2: Real-Time Data Acquisition with ROS

- Introduction to ROS and its pivotal role in robotics.
- Setting up a ROS environment for real-time LiDAR data acquisition.
- Configuring ROS wrappers for specific LiDAR sensors to facilitate real-time data processing.
- LiDAR data storage: Saving LiDAR data into files and understanding file formats for storing point cloud data.

### Day 3: Data Exploration and Visualization

- Introduction to Python packages for data exploration and visualization.
- Using web notebooks for interactive visualization of LiDAR characteristics and properties.

### Day 4: Processing LiDAR Data with ROS and PCL

- Introduction to the Point Cloud Library PCL for efficient LiDAR data processing.
- Developing Python and C++ code using ROS and PCL to extract features and insights from real-time LiDAR data.

### Day 5: Object Detection and Classification in 3D

- Introduction to AI/DNN for analyzing point cloud data.
- Designing object detection and classification algorithms for LiDAR data with a focus on sensor fusion techniques.
- Developing, training, and evaluating AI/DNN models for real-time object detection in 3D point clouds, enabling robots to autonomously identify and classify objects.



## Why Attend This Course: Wins & Losses!

- Advanced LiDAR Data Processing Skills: This training provides you with the ability to grasp the key LiDAR data processing steps, from sensor selection to advanced object detection algorithms.
- Real-Time Object Detection: Learn to develop object detection algorithms for 3D environments using AI/DNN and sensor fusion techniques.
- Autonomous Robotics: Gain the skills needed to build autonomous robots capable of processing LiDAR data and classifying objects in real-time.
- Advanced Analysis and Programming: Learn how to use PCL and ROS for real-time data analysis, extracting meaningful insights to improve robotic performance.
- Future of Robotics and LiDAR: Stay ahead in this rapidly advancing field by learning the latest developments in LiDAR technology, preparing you to apply these skills in real-world scenarios.

**Conclusion**

By the end of this Advanced LiDAR Data Processing and Object Detection course, participants will have a comprehensive understanding of what LiDAR is, the essential steps involved in LiDAR data processing, and how to implement effective object detection algorithms. This course will empower participants to leverage LiDAR technology in robotics, enhancing their expertise to apply these techniques to real-world scenarios, and building proficiency in this rapidly evolving domain.

