**Title**: Principles and Frontiers of Robotic Intelligent Perception  
**Duration**: 2 Weeks (10 Days) | **Final Exam**: Day 10  
**Language**: English & Mandarin

**Course Description & Objectives**

This course explores the theoretical foundations and cutting-edge advancements in robotic perception, focusing on multi-sensor fusion, SLAM (Simultaneous Localization and Mapping), and their applications in autonomous systems. Students will gain hands-on experience through seminars, paper critiques, and a lab introduction, while developing critical insights into sensor calibration, spatial transformations, and optimization frameworks.

**Key Objectives**:

1. Understand the principles of robotic perception systems, including sensor fusion and SLAM.
2. Analyze state-of-the-art algorithms for autonomous navigation and embodied AI.
3. Critically evaluate research papers on multi-modal perception and wearable intelligence.
4. Apply theoretical knowledge to real-world scenarios (e.g., autonomous vehicles, AR/VR).

**Learning Outcomes**

By the end of the course, students will be able to:

1. **Explain** the role of sensor fusion in enhancing robotic perception accuracy.
2. **Understand** basic SLAM workflows using simulation tools.
3. **Compare** filtering-based and graph-optimized SLAM methodologies.
4. **Design** a conceptual framework for wearable intelligent perception systems.
5. **Critique** recent advancements in robotic perception research.

**SCHEDULE**

**Week 1: Foundations of Perception & Registration**

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| **Day** | **Key Topics** | **Activities** |
| **1** | **Introduction to Robotic Perception** - Robotic systems  - Multi-sensor systems (trackers, LiDAR, camera, IMU) - Applications in autonomy, AR/VR | Lecture + Seminar |
| **2** | **Spatial Transformations & Sensor Calibration** - Coordinate systems - Registration Basics | Lecture + Seminar + Workshop |
| **3** | **Advanced Registration & Perception** - Unknown data associations - Iterative registration | Lecture + Seminar |
| **4** | **Lab Introduction & Visit** | Lecture + Workshop |
| **5** | **Introduction to SLAM (Simultaneous Localization and Mapping)** | Lecture + Seminar |

**Week 2: Advanced Topics / Frontiers & Applications**

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| **Day** | **Key Topics** | **Activities** |
| **6** | **Optimized SLAM** - Basics and Frontiers | Lecture + Seminar |
| **7** | **Wearable Perception Systems (AR/VR)** | Lecture + Seminar |
| **8** | **Embodied AI & Applications** - Principles and Frontiers | Lecture + Seminar |
| **9** | **Perception and intelligent navigation/wearables/robotics** | Lecture + Seminar |
| **10** | **Final Exam** | Wrap up + Seminar |