# SDSC6019: EMBODIED AI AND APPLICATIONS

## New Syllabus Proposal

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**Effective Term**
Semester B 2025/26

## Part I Course Overview

**Course Title**
Embodied AI and Applications

**Subject Code**
SDSC - Data Science
**Course Number**
6019

**Academic Unit**
Data Science (DS)

**College/School**
College of Computing (CC)

**Course Duration**
One Semester

**Credit Units**
3

**Level**
P5, P6 - Postgraduate Degree

**Medium of Instruction**
English

**Medium of Assessment**
English

**Prerequisites**
SDSC5001 Statistical Machine Learning I

**Precursors**
Nil

**Equivalent Courses**
Nil

**Exclusive Courses**
Nil

**Additional Information**
Intended Students:
- Upper-level undergraduates or graduate students in computer science, robotics, electrical engineering, or related fields.

- Professionals seeking to transition into Embodied AI or robotics research and development.

# Part II Course Details

**Abstract**

This course explores the interdisciplinary field of Embodied AI, where intelligent agents interact with and learn from physical environments through perception, action, and adaptation. Students will dive into SOTA technologies in robotics, reinforcement learning, and multi-modal learning, with a focus on physical applications such as autonomous navigation, manipulation, and human-robot collaboration. The course integrates theoretical foundations with hands-on projects using simulation platforms and real robotic systems, while examining recent trends like foundation models for robotics, sim-to-real transfer, and humanoid robotic system. **By the end, students will design and implement an Embodied AI system addressing a real-world challenge.**

**Course Intended Learning Outcomes (CILOs)**

| | CILOs | Weighting (if app.) | DEC-A1 | DEC-A2 | DEC-A3 |
|---|---|---|---|---|---|
| 1 | Explain the basic framework of current Embodied AI System | 15 | x | | |
| 2 | Describe the key modules within Embodied AI System | 20 | x | x | |
| 3 | Apply software tools to the key module design | 30 | x | x | |
| 4 | Analysis the experiment results under different case studies | 20 | | x | x |
| 5 | Develop and analsis the Embodied AI system, and evaluate the performance in Sim/Real environments. | 15 | | x | x |

A1: Attitude
Develop an attitude of discovery/innovation/creativity, as demonstrated by students possessing a strong sense of curiosity, asking questions actively, challenging assumptions or engaging in inquiry together with teachers.

A2: Ability
Develop the ability/skill needed to discover/innovate/create, as demonstrated by students possessing critical thinking skills to assess ideas, acquiring research skills, synthesizing knowledge across disciplines or applying academic knowledge to real-life problems.

A3: Accomplishments
Demonstrate accomplishment of discovery/innovation/creativity through producing /constructing creative works/new artefacts, effective solutions to real-life problems or new processes.

**Learning and Teaching Activities (LTAs)**

| | LTAs | Brief Description | CILO No. | Hours/week (if applicable) |
|---|---|---|---|---|
| 1 | Lectures | Learning through teaching is primarily conducted via lectures. Lectures are designed to introduce key concepts, theories, and methodologies related to medical data analysis. | 1, 2, 3, 4 | 30 hours/sem |

| | | | | |
|---|---|---|---|---|
| 2 | Tutorial Sessions | Tutorial sessions provide students with additional exercises and hands-on practice to reinforce their learning. | 1, 2, 3, 4, 5 | 9 hours/sem |

**Assessment Tasks / Activities (ATs)**

| | ATs | CILO No. | Weighting (%) | Remarks ("-" for nil entry) | Allow Use of GenAI? |
|---|---|---|---|---|---|
| 1 | Assignments<br>Questions are designed to evaluate how well students can apply the analytical methods and computational tools learned in class to analyze Embodied AI problems. | 1, 2, 3, 4, 5 | 30 | - | Yes |
| 2 | Midterm Exam<br>The examination will assess students' understanding of analytical methods, tools, and their applications in solving problems. | 1, 2, 3, 4, 5 | 20 | - | No |
| 3 | Project<br>A final group project using real-world health/ healthcare data will evaluate students' ability to collaborate and apply appropriate analytical techniques to solve complex, real-world problems. | 1, 2, 3, 4, 5 | 20 | - | Yes |

**Continuous Assessment (%)**

70

**Examination (%)**

30

**Examination Duration (Hours)**

2

**Minimum Continuous Assessment Passing Requirement (%)**

30

**Minimum Examination Passing Requirement (%)**

30

**Additional Information for ATs**

Final Exam
The examination will cover the general understanding for the whole technical theory and methodology and evaluate the student's problem-solving ability for the embodiment AI tasks.

**Assessment Rubrics (AR)**

**Assessment Task**

Assignments (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Ability to identify suitable models and techniques for specific tasks, apply analytical tools effectively, solve problems with suitable tools and modules.

**Excellent**

(A+, A, A-) High

**Good**

(B+, B, B-) Significant

**Fair**

(C+, C, C-) Moderate

**Marginal**

(D) Basic

**Failure**

(F) Not even reaching marginal levels

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**Assessment Task**

Midterm Exam (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Demonstration of a strong grasp of key concepts, accurate implementation of analytical methods, logical interpretation of results, and appropriate conclusions based on the data provided.

**Excellent**

(A+, A, A-) High

**Good**

(B+, B, B-) Significant

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(C+, C, C-) Moderate

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**Assessment Task**

Project (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Capacity to showcase in-depth knowledge, work collaboratively, select and apply correct analytical methods, provide meaningful interpretations, derive well-reasoned conclusions, and effectively communicate findings in a comprehensive manner.

**Excellent**

(A+, A, A-) High

**Good**

(B+, B, B-) Significant

**Fair**

(C+, C, C-) Moderate

**Marginal**

(D) Basic

**Failure**

(F) Not even reaching marginal levels

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**Assessment Task**

Final Exam (for students admitted before Semester A 2022/23 and in Semester A 2024/25 & thereafter)

**Criterion**

Ability to solve conceptual and operational questions

**Excellent**

(A+, A, A-) High

**Good**

(B+, B, B-) Significant

**Fair**

(C+, C, C-) Moderate

**Marginal**

(D) Basic

**Failure**

(F) Not even reaching marginal levels

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**Assessment Task**

Assignments (for students admitted from Semester A 2022/23 to Summer Term 2024)

**Criterion**

Ability to identify suitable models and techniques for specific tasks, apply analytical tools effectively, solve problems with suitable tools and modules.

**Excellent**
(A+, A, A-) High

**Good**
(B+, B) Significant

**Marginal**
(B-, C+, C) Moderate

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# Part III Other Information

**Keyword Syllabus**
Embodied AI, Robotics, Reinforcement Learning

**Reading List**

**Compulsory Readings**

| | Title |
|---|---|
| 1 | - Reinforcement Learning: An Introduction by Sutton and Barto (2nd Edition). |
| 2 | - Robotics: Modelling, Planning, and Control by Siciliano et al. |

**Additional Readings**

| | Title |
|---|---|
| 1 | - Selected papers from conferences like ICRA, IROS, CoRL, and NeurIPS 2024/2025. |