

NUS SOC Summer Workshop 2021

Analytics & IoT / AI & FinTech

Artificial Intelligence of Things

Course Information

Learning content and Teaching

What will be covered during “trial” lectures?

The trial lecture will cover the following three main topics. Out of the three topics, one topic will be the course introduction, and the other two topics will focus on IoT.

Topic 1 – Introduction to Artificial Intelligence of Things (AIoT):

- Introduction to Internet of Things (IoT)
- Overview of IoT architecture and IoT system design
- Introduction to Artificial Intelligence (AI)
- Overview of implementing AI with machine learning
- Putting IoT and AI together – The whole is greater than the sum of the parts.

Topic 2 – Single-board Microcontroller (I)

- Overview of single-board microcontrollers.
- Overview of the micro:bit.
- Technical characteristics and features of micro:bit.
- Programming micro:bit with JavaScript.
- Working with micro:bit onboard sensors.
- Working with micro:bit computational and communication capabilities.

Topic 3 – Single-board Microcontroller (II)

- How to work with external peripherals via the micro:bit’s edge connector.
- What is an Analogue to Digital Converter.
- How to write and read analogue and digital values to/from the micro:bit.
- Programming peripherals directly with micro:bit’s pins, and indirectly with edge connector breakout board and shield device.

Assessment:

- Quiz including multiple-choice question (MCQ) and short-structured question.
- Coding assignment using micro:bit online emulator.

What will be covered during the “advanced” seminars?

The advanced seminars will cover the following five main topics. Out of the five topics, two topics will focus on IoT and the remaining three topics will focus on AI and machine learning.

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Topic 4 – Single-board Computer

- Overview of the Raspberry Pi single-board computer.
- General purpose programming with Python on Raspberry Pi.
- Basic electronic component concepts.
- Basic Raspberry Pi GPIO programming using digital signal.
- Basic Raspberry Pi GPIO programming using analogue signal.
- Working with other external devices.
- UART communication with Raspberry Pi over GPIO pins.
- BLE communication with Raspberry Pi.
- Using Raspberry Pi to control micro:bit devices with BLE and radio.
- Working with Raspberry Pi's advanced interfaces.

Topic 5 – Server-side Backend Integration

- What is Service-Oriented Architecture.
- What is RESTful web service.
- How to create RESTful web service in Python with Flask and Connexion.
- How to test RESTful web service in Postman.
- How to consume RESTful web service in Python.
- Persisting the data to a relational database.

Topic 6 – Data Preparation

- Basic data structures in Python and their limitations.
- How to use Python SciPy data science libraries to perform common data analytics tasks easily:
- Basic numerical processing using NumPy.
- Data preparation and exploration using Pandas.
- Data visualisation using Matplotlib.

Topic 7 – Machine Learning (I) – Supervised Learning

- Regression analysis – Simple linear regression, multiple linear regression
- Classification – Decision tree, Naive Bayes, logistic regression, Support Vector Machine

Topic 8 – Machine Learning (II) – Unsupervised Learning

- Clustering – Partitioning methods, hierarchical methods
- Association rules mining – Apriori algorithm

Assessment:

- Group Project on AIoT – Project must demonstrate both elements of IoT and AI.

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- 👤 What will be the nature of the project work? How do you intend to split students into project groups, each consisting of 3 or 4 students?

The group size of the project is 4 students. The group project involves IoT hardware and thus students working on the hardware might need to meet-up physically. The recommended group configuration is 2 students on hardware development, and 2 students on software development and AI.