

## **Module 1 , 模块 1 : Intro to Artificial Intelligence 人工智能概论**

Artificial Intelligence (AI) got a recent boom thankfully to Machine Learning and Deep Learning Algorithms as well as new applications in computer vision, autonomous vehicles, drones, robotics, social networking, etc.

The module introduces students to classical AI algorithms and current trends in AI world.

The students got an opportunity to work on the project in groups, and learn one of the AI concept in depth.

由于机器学习和深度学习算法以及计算机视觉、自动车辆、无人机、机器人、社交网络等领域的新应用，人工智能（AI）最近获得了蓬勃发展。

本课程向学生介绍经典的人工智能算法和人工智能世界的当前趋势。

学生们有机会以小组的形式参与这个项目，并深入学习人工智能的概念之一。

### **Learning Outcomes 学习成果**

- ✓ Describe the difference between Artificial Intelligence, Machine Learning and Deep Learning 描述人工智能、机器学习和深度学习的区别
- ✓ Apply Artificial Neural Network to solve the problems 应用人工神经网络解决问题
- ✓ Develop the code for Artificial Neural Network in Python 使用 Python 开发人工神经网络代码
- ✓ Apply A\* Search Algorithm for path-finding applications such as robotics 使用 A\*寻路算法为机器人路径选择应用提供解决方案
- ✓ Develop the code for A\* Search Algorithm to solve the maze problems more efficiently 开发 A\*寻路算法代码以高效解决迷宫问题

- ✓ Explain key application for Artificial Intelligence Algorithms 解释人工智能算法的关键应用

## 课程大纲

### 1. What is AI 人工智能简介

- What is AI? History of AI 人工智能的历史
- Turing Test 图灵测试
- The difference between Machine Learning, Deep Learning and Artificial Intelligence.

### 2. Artificial Neural Network 神经网络

- What is ANN? History of ANN. Basic ANN Algorithm (Perceptron)神经网络发展历史及基本算法
- Multi-layered ANN 多层神经网络

### 3. AI in Deterministic Environment 确定性环境下的人工智能

- A\* Search Algorithm A\*寻路算法介绍

### 4. AI Team Activity – Maze Solver & AI Creativity 小组课题：迷宫破解器和人工智能的创造力

- Maze Solver : The missionaries and cannibals are at the (0,0) point on a 2D map and trying to get to point (7,7). But there are some barriers on the map that they want to avoid running into. Please, help them figure out the shortest path by doing A\* Search Algorithm. 利用 A\*寻路算法帮助角色在给定地图中从 ( 0,0 ) 点运动至 ( 7,7 ) 点，并在其运动过程中避开障碍物
- Can Artificial Intelligence be creative? 讨论人工智能是否具有创造力

## 5. Markov Decision Process 马尔可夫决策过程

- Markov Decision/Reward Process 马尔可夫决策/激励过程

## **Module 2 , 模块 2 : Intro to Image Processing 图像处理概论**

Image processing has attracted considerable attention as an important component of a wide range of applications including robots, self-driving cars, virtual reality games, and surgical navigation systems.

The module introduces you to the theory of image formation and commonly used image processing methods. We will also explore the recent progress in image processing achieved using deep learning algorithms.

The students will work in groups on two activity projects of common image processing techniques.

图像处理作为机器人、自动驾驶汽车、虚拟现实游戏和手术导航系统等广泛应用的重要组成部分，已经引起了广泛的关注。

本模块向学生介绍图像形成的理论和常用的图像处理方法。我们还将探讨使用深度学习算法在图像处理方面取得的最新进展。

学生们将分组完成两个常用图像处理技术的活动项目。

### **Learning Outcomes 学习成果**

- ✓ Describe the connections and differences between image processing and computer vision;了解图像处理和计算机视觉中的关系和区别
- ✓ Explain commonly used methods for some image processing tasks;解释一些图像处理任务的常用方法
- ✓ Implement appropriate methods using OpenCV library in Python to achieve the desired image processing goals;在 Python 中使用 OpenCV 库实现适当的方法，以达到预期的图像处理目标

- ✓ Identify key applications and current progress of image processing. 识别图像处理的关键应用和当前进展

## 课程大纲

### 1. Introduction of Image Processing 图像处理简介

- Image Processing vs. Computer vision 图像处理与计算机视觉
- Image formation 成像
- Ideas behind machine learning for computer vision/ image processing 计算机视觉/图像处理的机器学习理念
- Convolutional Neural Network (CNN) 卷积神经网络

### 2. Image Formation 成像

- Image Formation & Image Coordinates 成像与图像坐标
- Color Space 色域
- Open CV

### 3. Image Point Processing 图像点处理

- Image Histograms 图像直方图
- Point Processing 点处理

### 4. Image Convolution 图像卷积

- Canny Edge Detection Canny 边缘检测

### 5. Convolutional Neural Network 卷积神经网络

- Introduction and future of Deep Learning 深度学习的介绍与未来
- Architecture of CNN 卷积神经网络体系结构
- Datasets and tools for CNN 卷积神经网络的数据集和工具

### **Module 3 , 模块 3 : Intro to Big Data 大数据概论**

In big data, we need to find a pattern. Is a company earning more money? Is the test drug really effective? To find a pattern, we must distinguish between randomness (often called noise) and signal.

For example, the state of Washington reports 1,000 cases of Covid-19 one week.

The next week it reports 1,100. Why did the cases increase? There are two reasons:

1. The change is because of randomness (e.g. the doctors were slow to report cases or more people decided to get tests, etc.)
2. The change shows a true increase in infections.

This module will give us a mathematical way to distinguish (1) from (2). Is the change real?

在大数据中，我们需要找到一个模式。公司赚的钱多吗？试验药物真的有效吗？为了找到一个模式，我们必须区分随机性（通常称为噪声）和信号。

例如，华盛顿州一周报告了 1000 例 Covid-19。下个星期它报告了 1100 个。为什么病例增加了？有两个原因：

- 1 这种变化是因为随机性(例如，医生报告病例的速度慢，或者更多的人决定接受检查等等)
- 2 这一变化表明感染人数确实在增加。

这个模块将给我们一个数学方法来区分（1）和（2）。变化是真实的吗？

#### **Learning Outcomes 学习成果**

- ✓ Establish a null hypothesis 建立零假设
- ✓ Determine a p value 测定 P 值
- ✓ Do basic linear regression 完成基本的线性回归分析

- ✓ Fit an exponential curve 拟合指数曲线
- ✓ Resample data 数据重采样

## 课程大纲

### 1. Resampling 重采样

- Intro to Bootstrapping, or Resampling 重采样方法介绍
- Population vs Samples 总体与样本
- Null hypothesis, and p value 零假设和 P 值

### 2. Linear Regression 线性回归

### 3. Curve Fitting 曲线拟合

### 4. P value explanation 对 P 值的进一步解释

## **Module 4 , 模块 4 : Intro to Mobile Apps 手机应用概论**

Mobile devices have become increasingly powerful and essential for everyday activities, bringing advanced computing services to everyone.

This module introduces you to mobile application development. Designing applications for mobile devices is particularly challenging due to screen size, portability, and wide variation in hardware capabilities. This module will present the key mobile-application design challenges, architectural patterns, and current technologies.

We will also explore how mobile operating systems enable exciting new capabilities for augmented reality and artificial intelligence services.

移动设备变得越来越强大，对日常活动至关重要，为每个人带来了先进的计算服务。

本模块向您介绍移动应用程序开发。由于屏幕大小、可移植性和硬件功能的广泛变化，为移动设备设计应用程序尤其具有挑战性。本模块将介绍移动应用程序设计的关键挑战、体系结构模式和当前技术。

我们还将探讨移动操作系统如何为增强现实和人工智能服务提供令人兴奋的新功能。

### **Learning Outcomes 学习成果**

- ✓ Identify core design considerations for mobile applications 确定移动应用程序的核心设计考虑事项
- ✓ Describe key differences between iOS and Android systems 描述 iOS 和 Android 系统之间的主要区别
- ✓ Describe the different mobile-application development models and tradeoffs of each approach 描述不同的移动应用程序开发模型和每种方法的权衡



- ✓ Explain core concepts of augmented reality 解释增强现实的核心概念
- ✓ Explain key uses of machine learning in mobile applications 解释机器学习在移动应用程序中的主要用途

## 课程大纲

### 1. Team Activity - App Design 小组课题——应用程序设计

### 2. Intro to Mobile Applications 手机应用概述

- Native -v- hybrid mobile development 移动开发模式：Native 与 Hybrid
  - ✧ Hybrid Apps v/s Native Apps Native 与 Hybrid 应用对比
  - ✧ Practice Kotlin 编程练习 ( Kotlin 语言 )
  - ✧ Practice Swift 编程练习 ( Swift 语言 )

### 3. UI Design 用户界面设计

- Guide to Mobile Design 手机应用界面设计指南

### 4. Architecture 架构

### 5. Advanced features 高级功能

- Augmented Reality 增强现实