



# 人工智能与云计算

Artificial Intelligence and Cloud Computing



### #1. 课程背景及简介



云计算正在成为日常生活的重要组成部分，因为它为银行、社交媒体、新闻、娱乐等领域的关键应用程序提供动力。这是一门项目驱动的课程，旨在介绍云计算的概念，教授还将引入人工智能的概念在云计算中。

本课程 Mahesh 教授将逐步引导学生开发自己的云计算系统。这是“云计算简介”的课程。该课程介绍了云计算背后的概念、架构和算法，同时使用实验性动手操作的方法，让学生更加直观的了解云计算背后的概念。另外，本课程还将使用 Docker 容器框架作为基本构建块。学生将获得 Docker 容器的基本介绍，并引导他们参与小型项目，这些项目将逐步开发一个近乎成熟的云计算系统。除了 Docker 容器，这些项目还将使用 Python 编程语言，本课程还会引用人工智能作为示例。

### #2. 学习目标



本课程将解决许多挑战，如：

- ★ 云计算系统结构，及它如何运作
- ★ 如何一步步实现云计算系统的开发
- ★ 人工智能是如何应用到云计算中

### #3. 任课教师信息



Prof. M M

授课教师目前是加拿大麦吉尔大学电气与计算机工程学院的副教授。  
Mahesh 教授于 2003 年 1 月加入麦吉尔。在加入麦吉尔之前，于 1998 年到 2002 年在曼尼托巴大学工作了四年。是曼尼托巴大学计算机科学系的助理教授。主要研究兴趣是计算机网络、信息安全和分布式系统的一般领域。

### #4. 课程设置



周期	时间	课程设置内容	课时
第一周 学习指南 教授及助	1 月 28 日 周六	什么是 PBL 教学方法	1
		PBL 教学的常见形式	1



教辅导	1 月 29 日 周日	教授课-1 交叉学科 PBL 课程设计及知识点学习 学习目标：重要概念回顾；Docker 容器和小项目 1 描述：通过本模块，学生将学习课程相关的一些概念，例如虚拟机、容器、网络概念；学习容器概念的具体化——对 Docker 容器概念的全面探索。在要求的配置下，编写 Python 脚本开发容器。	3
	1 月 30 日 周一	助教课-1 知识点查漏补缺	2
	1 月 31 日 周二	教授课-2 制定项目方向 学习目标：通信容器和小项目 2 描述：通过本模块，学生将在上一节课的基础上扩展第一个项目，以便容器交换他们的结果。学生设置容器集群，以便容器知道集群的配置以及如何访问特定容器（即 IP 地址等）。	3
第二周 教授及助教辅导	2 月 1 日 周三	助教课-2 知识点查漏补缺	2
	2 月 2 日 周四	教授课-3 交叉学科课程知识点学习 学习目标：容器终止和小项目 3 描述：第三个项目将使管理脚本更加完善。检查容器的活跃度，并且还能够关闭选定的容器。学生将使用适当的接口实现所需的功能，并使用虚拟工作负载演示该功能。	3
	2 月 3 日 周五	助教课-3 知识点查漏补缺&跟进项目调研进度	2
	2 月 4 日 周六	教授课-4 互动与项目设计跟进答疑	1.5
	2 月 6 日 周一	助教课-4 跟进项目调研进度	2



	2月7日 周二	教授课-5 交叉学科课程知识点学习 学习目标: 资源管理器和小项目 4 描述: 云计算的显着特征之一是资源管理功能。通过本模块, 学生将学习云计算系统可以随着需求的增加或减少而扩展部署。在这个项目中, 学生将创建一个简单的资源管理器, 允许容器扩展。	2
第三周 教授及助教 辅导 未来展望	2月8日 周三	助教课-5 跟进项目调研进度	2
	2月9日 周四	教授课-6 交叉学科课程知识点学习 学习目标: 简单云计算中的示例应用和小项目 5 描述: 通过本模块, 学生将了解人工智能应用程序将用作示例。必要的编程机制将引入到简单云中, 以便人工智能应用程序可以被简单云支持。以及所有概念的总结。	2
	2月10日 周五	助教课-6 知识点查漏补缺& 指导项目成果展示	2
	2月11日 周六	教授课-7 教授点评项目成果	1.5
	2月12日 周日	升学与就业方向展望	1
		个人规划及发展建议	1
总课时	32		

#5. 阅读材料



- ★ Matthes, Eric. Python crash course: A hands-on, project-based introduction to programming. no starch press, 2019.
- ★ <https://docker-py.readthedocs.io/en/stable/>

#6. 项目主题



本课程使用 PBL 教学法，PBL 即项目式学习，是一种以学生为中心的教学方法，教师提供关键素材构建学习环境，学生通过在此环境里解决一个开放式项目的经历来学习。以下为本课程可选的项目主题：

- 使用 Docker 容器来模拟虚拟机
- 使用 Python 编程语言，并引入人工智能
- 开发一个近乎成熟的云计算系统

英文版教学大纲

PBL

Course Title	Artificial Intelligence and Cloud Computing
Credit Hours	32 (one credit hour is 45 minutes)
Course Objectives	<p>This course would use the Docker container framework as the basic building block. The students will be given a basic introduction to Docker containers and led into small projects that would be incrementally developing a near full-fledged cloud computing system.</p> <p>In addition to Docker containers, the projects would use the Python programming language and employ artificial intelligence into the cloud.</p>
Course Description	<p>The central idea of cloud computing is to deliver computing capacity as a commodity that can be bought on-demand. By using cloud computing, users can avoid making large investments in computing infrastructure and obtain the necessary computing resources at the required scale when they need it. To meet the highly fluctuating demands presented to a cloud, it must be architected at an extremely large scale and yet accessible as tiny slices. This course will be developing a simple but full-fledged cloud by walking the students through a series of small projects. The simple cloud will use Docker containers to emulate the virtual machines. That is the most fundamental unit of the</p>



	<p>simple cloud would be a container. Because the container is very good in mimicking a virtual machine (the building block in most industry standard clouds), the simple cloud is highly realistic. The students would use the Python software development framework (SDK) provided by the Docker containers in developing the simple cloud. The simple cloud development will happen by completing a sequence of mini projects. The mini projects are sequenced such that the students need to complete them one after the other. The later projects will build on the earlier ones.</p> <p>The simple cloud created in this course will be like Kubernetes. It will allow users to launch applications that are already packaged as Docker containers. The simple cloud can be deployed in a single machine or multiple machines and the application can be distributed across all the machines. The simple cloud would provide basic load balancing functionality so that containers will be mapped on to the machines that have the minimum load.</p>
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**Brief introduction of the course**

Cloud computing is becoming an important part of every-day lives because it is powering critical applications from banking, social media, news, entertainment, and much more. This is a project-driven course to introduce the concepts of cloud computing.

This is a companion course to the course titled “ Introduction to Cloud Computing.” That course goes into the concepts, architectures, and algorithms behind cloud computing while this uses an experimental hands-on methodology to introduce the notions behind cloud computing.

	Topics
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Module 1	Objective: A review of important concepts Description: Virtual machines, containers, networking concepts, creating clusters using containers
Module 2	Objective: Docker containers & mini-project 1 Description: Concretization of the container concept – a full exploration of the docker container concepts. Assignment of first mini project that requires the instantiation of containers and running many instances of sample workloads. The project primarily involves writing Python scripts to launch the containers in the requested configuration.
Module 3	Objective: Communicating containers & mini-project 2 Description: In the previous class the containers were not communicating with each other. For most real applications, the containers need to communicate to share partial results at different stages of this execution. In the second mini project, the students would extend the first one so that the containers are exchanging their results. We want the students to setup the cluster of containers such that a container would know the configuration of the cluster as well how to reach a particular container (i.e., the IP addresses, etc).
Module 4	Objective: Heartbeats, termination of containers & mini-project 3 Description: The third project is going to make the management script more full-fledged. It will check the containers for liveness and would also be capable of shutting down selected containers. The students will implement the required functionality with appropriate interfaces and demonstrate the functionality by using dummy workloads. The workloads will run example programs that are independent (no communication) and dependent (with significant communication among the containers).
Module 5	Objective: Resource manager & mini-project 4 Description: One of the distinguishing features of cloud computing is the resource management functionality. In particular, cloud computing systems can scale the deployment as the demand increases or decreases. In this mini project, the students would create a simple resource manager that would allow the scaling of containers.
Module 6	Objective: Example application deployment in the simple cloud & mini-project 5



	Description: An AI application would be used as an example. The necessary hooks will be inserted into the simple cloud so that the AI application can be supported by the simple cloud.
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**Required Readings**

- 1.Matthes, Eric. Python crash course: A hands-on, project-based introduction to programming. no starch press, 2019.
- 2.<https://docker-py.readthedocs.io/en/stable/>

**Suggested list of the topics for the final project**

- 1.Uses an experimental hands-on methodology to introduce the notions behind cloud computing
- 2.Uses the Docker container framework as the basic building block. In addition to Docker containers, the projects would use the Python programming language.
- 3.Developing a near full-fledged cloud computing system.

**Criteria**

The course will have 5 mini projects that will develop a simplified cloud system and deploy it to run some example applications. The students would complete the mini projects in the suggested order to create the cloud system. The lecture recordings will give the required background for each mini project. The lecture recordings will also provide pointers for additional material that can be helpful for completing the projects. Each project is worth 20 points.

**Class Expectation**

Cloud computing is one of the most important parts of the modern infrastructure that is impacting our daily lives. After completing this course, you will have a good grasp of the anatomy of a cloud computing system. With the instructions provided as part of the projects, you will develop a simple cloud that in a simplified way would do many functions that are actually implemented in a real cloud. By completing the series of mini projects, you will gain significant knowledge about the inner workings of a cloud computing system.