



人工智能与云计算

Artificial Intelligence and Cloud Computing





1. 课程背景及简介

云计算是分布式计算的一种，指的是通过网络“云”将巨大的数据计算处理程序分解成无数个小程序，然后通过多部服务器组成的系统进行处理和分析这些小程序得到结果并返回给用户。随着科技的发展，云计算逐渐成为人们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。

本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，本并引用人工智能作为示例，最终引导学生开发自己的云计算系统。

2. 项目收获

- 1. 了解云计算系统结构及其运作机制
- 2. 探究人工智能是如何在云计算中的应用
- 3. 学习云计算系统的开发

3. 交叉学科

计算机科学、人工智能



4. 适合人群

- 1. 年级：本科大三及以上和研究生
- 2. 学术背景：计算机科学、编程语言相关专业的学生/掌握一定计算机科学、信息安全等基础的学生
- 3. 语言能力：四级 500 分或六级 480 分以上的学生可达到最佳听课效果

5. 任课教师信息

Prof. Maheswaran

目前是加拿大麦吉尔大学电气与计算机工程学院副教授。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助理教授。教授的主要研究领域是计算机网络、信息安全和分布式系统的一般领域。

Prof. Franchitti

目前是纽约大学计算机科学学院副教授，也就职于纽约大学柯朗数学科学研究所，在众多相关行业的垂直领域拥有 37 年的实战经验，并拥有超过 27 年的教学和培训经验。他曾在大型美国公司担任行政职务，并且是多个行业标准委员会的审查员。教授的教学和研究兴趣包括信息安全、数据库系统、通讯工程、云计算、软件工程等，重点是大规模软件体系结构和业务解决方案。

6. 课程设置

周期	时间	课程设置内容	课时
第一周 学习指南 教授及助教 辅导	7月17日 周一	什么是 PBL 教学方法	1
	7月18日 周二	PBL 教学的常见形式	1
	7月19日 周三	教授课-1 学习目标：了解云计算相关的重要概念 Docker 容器，探索 Docker 容器 课程简介：通过本模块，将学习云计算相关的一些概念，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
	7月21日 周五	助教课-1 知识点查漏补缺	2
	7月22日 周六	教授课-2 学习目标：通信容器和项目扩展 课程简介：学生将在上一节课的基础上扩展第一个项目，学习使用 Docker 容器交换结果、设置容器集群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	7月24日 周一	助教课-2 知识点查漏补缺	2
	7月25日 周二	教授课-3 学习目标：容器终止和小项目完善 课程简介：第三个项目将使管理脚本更加完善。检查 Docker 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
	7月26日 周三	助教课-3 知识点查漏补缺&跟进项目调研进度	2
	7月29日 周六	教授课-4 项目设计跟进、案例分析和答疑	1.5
	7月31日 周一	助教课-4 跟进项目调研进度	2
	8月1日	教授课-5	2

第三周 教授及助教 辅导	周二	学习目标：资源管理器 课程简介：云计算的显着特征之一是资源管理功能。通过本模块，学生将学习如何开展云计算的部署。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。	
	8月3日 周四	助教课-5 跟进项目调研进度	2
	8月4日 周五	教授课-6 学习目标：云计算中的简单应用 课程简介：通过本模块，学生将了解人工智能应用程序、必要的编程机制，以及人工智能应用程序如何做云支持。	2
	8月5日 周六	助教课-6 知识点查漏补缺&指导项目成果展示	2
	8月6日 周日	教授课-7 教授点评项目成果	1.5
第四周 未来展望	8月7日 周一	升学与就业方向展望	1
	8月8日 周二	个人规划及发展建议	1
总课时	32		

7. 建议阅读

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/>

英文版教学大纲

Course Title	Artificial Intelligence and Cloud Computing
Credit Hours	32 (one credit hour is 45 minutes)
Course Objectives	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

	<p>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 could.</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 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</p>

	provide basic load balancing functionality so that containers will be mapped on to the machines that have the minimum load.
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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
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



	<p>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).</p>
Module 4	<p>Objective: Heartbeats, termination of containers & mini-project 3</p> <p>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).</p>
Module 5	<p>Objective: Resource manager & mini-project 4</p> <p>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.</p>
Module 6	<p>Objective: Example application deployment in the simple cloud & mini-project 5</p> <p>Description: An AI application would be used as an example. The necessary hooks will be inserted into the simple cloud so that the</p>



	AI application can be supported by the simple cloud.
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Suggested 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/>

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.