东北大学秦皇岛分校本科课程教学大纲

一、课程基本信息

<table>
<tr><td>开课单位</td><td colspan="3">悉尼智能科技学院</td><td>课程代码</td><td colspan="5">3100212002</td></tr>
<tr><td>中文名称</td><td colspan="8">智能数据分析导论</td></tr>
<tr><td>英文名称</td><td colspan="8">Introduction to Data Analytics</td></tr>
<tr><td>总学时</td><td>16</td><td rowspan="2">理论学时</td><td rowspan="2">16</td><td rowspan="2">实验学时</td><td rowspan="2">0</td><td rowspan="2">上机学时</td><td rowspan="2">0</td><td rowspan="2">设计学时</td><td rowspan="2">0</td><td rowspan="2">课外学时</td><td rowspan="2">0</td></tr>
<tr><td>学　分</td><td>1</td></tr>
<tr><td>课程类型</td><td colspan="11">☑理论课程　☐理论（含实验）课程　☐实践类课程</td></tr>
<tr><td>课程类别</td><td colspan="11">□通识类　☑学科基础类　□专业方向类　□实践类</td></tr>
<tr><td>适用专业</td><td colspan="11">计算机科学与技术 CST</td></tr>
<tr><td>先修课程</td><td colspan="11">无</td></tr>
<tr><td>建议开课学期</td><td colspan="11">☑1-1 □1-2 □2-1 □2-2 □3-1 □3-2
□4-1 □4-2 □5-1 □5-2 □*（代表每学期都开设）</td></tr>
<tr><td>考核方式</td><td colspan="3">□考试 ☑考查</td><td>成绩分制</td><td colspan="6">☑百分制 □五级制 □二级制</td></tr>
<tr><td>使用教材</td><td colspan="11">1、 Glenn Brookshear, Dennis Brylow, Computer Science. An Overview, 13th Edition. 人民邮电出版社, 2020 年.</td></tr>
<tr><td>参考书及教学资源</td><td colspan="11">1、Glenn Brookshear, Dennis Brylow. 计算机科学概论(第 12 版). 人民邮电出版社, 2019 年.
2、 佛罗赞. 计算机科学导论(第 4 版). 机械工业出版社, 2020 年.</td></tr>
<tr><td>其他说明</td><td colspan="11">无</td></tr>
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二、课程简介

中文描述

随着数据分析工作越来越重要，它未来在人工智能和大数据产业所带来的效益也会越来越显著。本课程所涉及的核心知识涵盖了数据结构、算法设计、数据库、计算机网络等内容，是人工智能的导论课程，为学习机器学习、深度学习等知识打好必要的技术基础。

课程的目的是通过深入浅出的教学，使学生能够理解和掌握智能数据分析在日常应用中的科学方法，包括但不限于数据的存储与检索，算法的设计与规划，操作系统原理等，让学生掌握有关计算机科学相关知识领域的基本概念、基本现象、基本规律和基本方法，并建立应用计算机技术解决实际问题的能力。此外，课程还致力于培养学生科学与工程应用的意识和素质，逐步培养学生的探索精神和创新能力。让学生具备优异的国际化发展能力，通晓世界形势与时代发展规律，深刻认识中国的国际战略构想与举措，具备在全英语、跨文化环境下开展学习、研究、实践的能力，具有迎接未来国际化挑战的坚定信心。

English Description

As the importance of data analysis continues to grow, its potential to drive significant benefits in the artificial intelligence and big data industry will become increasingly evident. The course provides an in-depth overview of core data structures, algorithm design, databases, and other essential topics. This introductory course in artificial intelligence provides the technical foundation required for learning machine learning, deep learning and other related topics.

The objective of this course is to equip students with the ability to comprehend and apply the scientific methods of intelligent data analysis in real-world scenarios. This encompasses a range of areas, including data storage and retrieval, algorithm design and planning, and operating system principles. By mastering these fundamental concepts, phenomena, laws, and methods, students will gain a solid foundation in computer science. The course will also equip students with the ability to apply computer technology to solve practical problems. Furthermore, the course is designed to foster students' awareness and understanding of the application of science and engineering, while also encouraging their spirit of exploration and innovation. Additionally, students are equipped with excellent international development abilities, a good understanding of global affairs and the development of international relations, a deep understanding of China's international strategic ideas and measures, the ability to conduct studies, research and practice in an all-English, cross-cultural environment, and the confidence to meet the challenges of future internationalization.

三、课程目标

1、知识目标：

1-1：掌握布尔运算，门和触发器，十六进制记数法，存储器结构，存储器容量的度量，文本的表示，数值的表示，二进制记数法。

Master Boolean operations, gates and triggers, hexadecimal notation, memory structure, measurement of memory capacity, representation of text, representation of numerical values, binary notation.

1-2：掌握 CPU 基础知识，存储程序的概念，指令系统，数据传输，算术/逻辑，控制，程序执行，程序与数据，逻辑运算，循环移位运算及移位运算，算术运算

Master the basic knowledge of CPU, concepts of stored programs, instruction system, data transmission, arithmetic/logic, control, program execution, program and data, logical operations, loop shift operations and shift operations, arithmetic operations.

1-3：掌握进程的概念，信号量，死锁

Master the concept of processes, semaphores, and deadlocks.

1-4：掌握因特网体系结构，因特网编址，客户端和服务器端的活动，网络安全防护与对策

Master the Internet architecture, Internet addressing, client and server activities, network security protection and countermeasures.

1-5：掌握数据结构中几个常用算法，循环控制与递归控制

Master several commonly used algorithms in data structures, including loop control and recursive control.

1-6：掌握列表、栈和队列、树的基本运算；数据存储结构；数据库的建立和使用；数据挖掘的应用

Master the basic operations of lists, stacks, queues, and trees; Data storage structure; Establishment and use of databases; Application of Data Mining.

2、能力目标：

2-1：具有扎实的专业基础与学科特长，系统掌握统计与数据分析、智能仿真建模技术及其相关领域专门知识与技能。

Having a solid professional foundation and disciplinary expertise, systematically mastering statistical and data analysis, intelligent simulation modeling technology, and specialized knowledge and skills in related fields.

2-2：具有扎实的专业基础与学科特长，系统掌握信息通信系统、项目管理与决策及其相关领域专门知识与技能。

Having a solid professional foundation and disciplinary expertise, systematically mastering specialized knowledge and skills in information and communication systems, project management and decision-making, and related fields.

2-3：具有扎实的专业基础与学科特长，系统掌握大数据与人工智能系统、项目管理与决策及其相关领域专门知识与技能。

Having a solid professional foundation and disciplinary expertise, systematically mastering specialized knowledge and skills in big data and artificial intelligence systems, project management and decision-making, and related fields.

2-4：掌握有关计算机科学相关知识领域的基本概念、基本现象、基本规律和基本方法，并建立应用计算机技术解决实际问题的能力，为学习后续课程打下基础。

Master the basic concepts, phenomena, laws, and methods related to computer science, and establish the ability to apply computer technology to solve practical problems, laying a foundation for learning subsequent courses.

2-5：在建立计算机科学相关知识领域基础知识体系的同时，通过科学思维方法的训练，培养学生运用科学原理解决实际问题的工程能力，为将来从事计算机设计及研发奠定必要的基础。

While establishing a basic knowledge system in the field of computer science, through training in scientific thinking methods, we aim to cultivate students' engineering abilities to apply scientific principles to solve practical problems, laying the necessary foundation for future computer design and research and development.

2-6：培养科学与工程应用的意识和素质，逐步培养学生的探索精神和创新能力。

Cultivate awareness and quality of scientific and engineering applications, gradually cultivate students' exploratory spirit and innovative ability.

3、德育/素养目标：

3-1：具有良好的团队合作能力、项目管理能力与领导力，通晓本专业相关的法律法规与职业规范，具有优异的创新精神和终身学习能力，学习与运用新技术的能力突出，能够适应持续的环境变化与技术变革。

Has excellent teamwork, project management, and leadership skills, is familiar with relevant laws, regulations, and professional norms in the field, possesses outstanding innovative spirit and lifelong learning ability, outstanding ability to learn and apply new technologies, and can adapt to continuous environmental and technological changes.

3-2：具备优异的国际化发展能力，通晓世界形势与时代发展规律，深刻认识中国的国际战略构想与举措，具备在全英语、跨文化环境下开展学习、研究、实践的能力，具有迎接未来国际化挑战的坚定信心。

Having excellent international development capabilities, familiar with the world situation and the laws of the times, deeply understanding China's international strategic ideas and measures, possessing the ability to conduct learning, research, and practice in an all English and cross-cultural environment, and having firm confidence in meeting future international challenges

3-3：了解数据结构及数据库对国家数据安全存储及应用的重要性，为各行各业大数据安全存储和应用创造更多价值。

Understanding the importance of data structures and databases for the secure storage and application of national data, and creating more value for the secure storage and application of big data in various industries.

3-4：了解计算理论关键问题，提出高适用性的优化算法，推动先进科学技术的发展。

Understand key issues in computational theory, propose highly applicable optimization algorithms, and promote the development of advanced science and technology.

表 1 课程目标与毕业要求的对应关系

毕业要求	指标点	课程目标	关联 (H/M/L)
1、工程知识：能够将数学、自然科学、工程基础和专业知识用于解决计算机相关工程问题。	指标点 1-1：掌握数学、自然科学、工程基础和专业知识，并使用其建立正确的数学、物理学等模型以解释复杂工程问题	1-1,1-2,1-3, 1-4,1-5,1-6	H
	指标点 1-2：掌握程序设计、数据结构、算法分析与设计、计算机数字系统、操作系统等专业知识，具备计算机程序设计开发能力和计算机与信息系统设计开发与维护能力	2-1,2-2,2-3,	L
2、问题分析：能够应用数学、	指标点 2-1：专业知识掌握扎实，了	2-1,2-1,	M

自然科学和工程科学的基本原理，识别、表达、并通过文献研究分析计算机工程问题，以获得有效结论。	解中国和世界经济领域及其研究的最新动态和发展趋势；能够应用数学、自然科学和工程科学的基本原理、方法和手段，分析、识别、表达本专业相关的复杂工程问题	2-3,3-1,3-2	
	指标点 2-2：能够应用数学、自然科学和工程科学的基本原理、方法和手段，针对实际复杂工程问题设计针对性的技术方案，并综合运用文献、科学理论和技术手段予以解决	2-4,2-5,2-6,3-1,3-2,3-3	M
10、沟通：能够就本专业复杂工程问题与业界同行及社会公众进行有效沟通和交流，包括撰写报告和设计文稿、陈述发言、清晰表达或回应指令。具备一定的国际视野，能够在跨文化背景下进行沟通和交流	指标点 10-2：熟练掌握英语，能够在本专业相关领域进行有效的技术沟通和交流。	2-5,2-6,3-2,3-4	L

四、主要教学内容

（一）理论教学

第 1 章：Introduction Data Storage（支撑教学目标 1-1、2-1、2-4、2-5、2-6、3-1）

【1】知识点：

(1) The Role of Algorithms, The History of Computing, The Overarching Themes of Computer Science.

(2) Bits and Their Storage, Main Memory, Mass Storage.

(3) Representing Information as Bit Patterns, The Binary System.

(4) Storing Integers, Storing Fractions, Data Compression

【2】学习目标：

理解：Representing Images, Representing Sound, Fractions in Binary, Two's Complement Notation, Addition in Two's Complement Notation, The Problem of Overflow, Excess Notation, Floating-Point Notation, Truncation Errors, Generic Data Compression Techniques.

掌握：Boolean Operations, Gates and Flip-Flops, Hexadecimal Notation, Memory Organization, Measuring Memory Capacity, Representing Text, Representing Numeric Values, Binary Notation.

【3】重点内容：

(1) Boolean Operations, Gates and Flip-Flops, Hexadecimal Notation.

(2) Memory Organization, Representing. Numeric Values, Binary Notation.

【4】难点内容：

(1) Two's Complement Notation, Addition in Two's Complement Notation.

(2) The Problem of Overflow, Excess Notation.

【5】思政案例：

Since the late 1980s, China has spearheaded a surge in independent research and development of domestic databases. Following years of investment and innovation, some domestic databases have successfully entered the market. These domestic databases have made significant strides in performance,

security, scalability, and other areas, gaining recognition and adoption among users at home and abroad. By showcasing the development history and achievements of the domestic database, students can be encouraged to develop a sense of scientific and technological independence, and to recognize the importance of independent research and development. Guide students to pay attention to and support the development of domestic databases, and cultivate a sense of patriotism and national pride.

第 2 章：Data Manipulation（支撑教学目标 1-2、2-4、2-5、2-6、3-1）

【1】知识点：

(1) Computer Architecture, Machine Language.

(2) Program Execution, Arithmetic/Logic Instructions.

(3) Communicating with Other Devices, Other Architectures.

【2】学习目标：

理解：The Role of Controllers, Direct Memory Access, Handshaking.

掌握：CPU Basics, The Stored-Program Concept, The Instruction Repertoire, Data Transfer, Arithmetic/Logic, Control, Program Execution, Programs Versus Data, Logic Operations, Rotation and Shift Operations, Arithmetic Operations.

【3】重点内容：

CPU Basics, The Stored-Program Concept, The Instruction Repertoire, Program Execution, Programs Versus Data, Logic Operations, Arithmetic Operations.

【4】难点内容：

Direct Memory Access, Handshaking, Pipelining, Multiprocessor Machines.

【5】思政案例：

The CPU is the central processing unit, or "brain," of a computer system. It is responsible for executing program instructions, processing tasks such as data computation and logical judgment, and facilitating the overall performance of the computer. The performance of the CPU directly affects the speed and efficiency of the computer. For an extended period, China's CPU market has been dominated by foreign brands such as Intel and AMD. To address this, our government and enterprises have invested significantly in CPU independent research and development. In recent years, China has seen the emergence of several leading domestic CPU enterprises, including Longson, Zhaoxin, and Feiteng. These companies have made notable advancements in CPU design, manufacturing, and application, with some products achieving domestic substitution. By showcasing the development history and achievements of domestic CPUs, it instills a sense of national pride and self-confidence in students, encouraging their active participation in the field of scientific and technological innovation.

第 3 章：Operating Systems（支撑教学目标 1-3、2-4、2-5、2-6、3-2）

【1】知识点：

(1) The History of Operating Systems, Operating System Architecture.

(2) Coordinating the Machine’s Activities, Handling Competition Among Processes

(3) Security.

【2】学习目标：

理解：Software Survey, Components of an Operating System, Getting It Started, Process Administration.

掌握：The Concept of a Process, Semaphores, Deadlock.

【3】重点内容：

The Concept of a Process, Semaphores, Deadlock.

【4】难点内容：

Process Administration, Attacks from the Outside, Attacks from Within.

【5】思政案例：

The "Philosopher Dining Problem" illustrates that when there are no established rules and individuals approach the problem from their own perspectives, the likelihood of achieving an effective solution is significantly reduced. Once the fundamental theoretical principles have been grasped, students also comprehend that each "philosopher" must adhere to the established regulations in order to ensure the optimal functioning of the entire system and guarantee its stability. Throughout the entire process, students can not only intuitively grasp the professional knowledge of computers, but also understand the importance of core socialist values such as the rule of law and integrity.

第 4 章：Networks and The Internet（支撑教学目标 1-4、2-2、2-4、2-6、3-2）

【1】知识点：

(1) Network Fundamentals.

(2) The Internet.

(3) The World Wide Web.

(4) Security.

【2】学习目标：

理解：Protocols，Methods of Process Communication，Forms of Attack, HTML.

掌握：Internet Architecture，Internet Addressing，Client-Side and Server-Side Activities, Network Security Protection and Cures Encryption.

【3】重点内容：

The Internet Architecture and Addressing.

【4】难点内容：

Internet Addressing, HTML.

【5】思政案例：

In 1989, Tim created the first web server and client, called the World Wide Web. Tim didn't patent the web. He made it free for everyone and worked to make the technology standard. Tim is still working on the future of the World Wide Web. He is regarded as the pride of the British people and commands respect worldwide. In the 70 years since New China was founded, many scientists have emerged in China. They have sacrificed their lives to explore science and made contributions to benefit mankind. As young students, we should learn from their dedication to science. We should take up the responsibility given to us by the Party and the people and contribute to the Chinese dream.

第 5 章：Algorithms（支撑教学目标 1-5、2-1、2-4、2-5、3-3）

【1】知识点：

(1) The Concept，Representation of an Algorithm.

(2) Iterative Structures, Recursive Structures.

(3) Algorithm Efficiency.

【2】学习目标：

理解：The Abstract Nature of Algorithms, Algorithm Discovery.

掌握：Introduction to Common Algorithms，Loop Control and Recursive Control.

【3】重点内容：

Algorithm Representation，Search Algorithm，Sort Algorithm.

【4】难点内容：

Iterative Structures,Recursive Structures.

【5】思政案例：

In the modern digital era, the sorting algorithm is a fundamental and crucial component of computer science. The quicksort algorithm is currently the most widely used and efficient sorting algorithm, offering high flexibility and performance. In implementing the quicksort algorithm, it is essential for the programmer to pay close attention to every detail, including the selection of reference elements, the

implementation of the partition procedure, and the handling of recursive calls. By introducing the implementation details and optimization direction of the quicksort algorithm, students are guided to understand that every detail in programming may affect the performance and stability of the program. Therefore, in the study and work, we should always maintain a rigorous attitude and the spirit of excellence, and constantly improve their professional quality and comprehensive ability. This approach to work is not only reflected in programming, but also runs through all aspects of life, such as academic research, work practice and so on.

第 6 章：Data Abstractions and Database Systems（支撑教学目标 1-6、2-4、2-5、2-6、3-4）

【1】知识点：

(1) Basic Data Structures and the Implement.

(2) Customized Data Types、Classes and Objects.

(3) Database Fundamentals and Social Impact.

(4) The Relational Model and Object-Oriented Databases.

【2】学习目标：

理解：Relevant Knowledge of Lists, Stacks and Queues, Trees; Static Versus Dynamic Structures; Distinctions of Classes and Objects; the Relational Model; Establish and Use Object-Oriented Databases; Data Mining Technology.

掌握：Basic Operations of Lists, Stack sand Queues, Trees; Data Storage Structure; Classes and Objects; Establish and Use Databases; Application of Data Mining.

【3】重点内容：

Characteristic of Lists, Stacks and Queues, Trees; Data Storage Structure; Design Procedure of Classes and Objects; Establish and Use Databases; Data Mining Technology.

【4】难点内容：

Basic Operations of Lists, Stacks and Queues, Trees; Appropriate application of Data Storage Structures; Database establishment for special application; Application of Data Mining Technology.

【5】思政案例：

The advent of the era of big data has seen enterprise cloud disks become an indispensable tool for data storage and sharing, playing an increasingly pivotal role in modern enterprise management. However, the continuous growth of data volume and the wide application of cloud storage services have also highlighted significant security challenges for enterprise cloud disks, including data leakage, data loss, and data tampering. By introducing the importance of cloud storage security, students are guided to understand the necessity of complying with relevant national laws and regulations on data security. In the context of the big data era, it is essential for enterprises to adhere to privacy protection laws and regulations, not only to safeguard their own privacy information, but also to prevent the disclosure of the privacy information of others.

五、教学安排与学时分配

This course is primarily conducted in a traditional classroom environment and is designed to provide a comprehensive introduction to the fundamental concepts, theories, principles and practical applications relevant to the course content. This course employs an integrated teaching methodology that combines offline classroom learning, online educational resources and case studies to facilitate effective learning and development. This approach enables us to transfer theoretical knowledge, provide practical experience and offer guidance on added value. Furthermore, this course will enable students to develop excellent international development skills, insight into global trends and the evolution of international relations, and a comprehensive understanding of China's international strategic ideas and actions. Students will gain the skills to study, research and practice in an all-English, cross-cultural environment,

and will be confident in their ability to meet the challenges of internationalization in the future. Please refer to Table 2 for details of the offline class time.

表 2 学时分配表

讲 课 内 容		学时				
		讲课	实验	上机	设计	课外
第 1 章	Introduction Data Storage	3	0	0	0	0
第 2 章	Data Manipulation	3	0	0	0	0
第 3 章	Operating Systems	2	0	0	0	0
第 4 章	Networks and The Internet	2	0	0	0	0
第 5 章	Algorithms	2	0	0	0	0
第 6 章	Data Abstractions	2	0	0	0	0
第 7 章	Data Storage	2	0	0	0	0
小计		16	0	0	0	0
总计	16					

六、教学方法

1、Multi-media-based lecturing.
2、Combining theory with industrial practical problems.
3、Knowledge delivery with ethic education.
4、Problem-based learning.

七、成绩评定

1、Classroom tests are conducted during or after class, which accounts for 30% of the total score of this course.

2、Homework accounts for 20% of the total score of this course.

3、The report accounts for 50% of the total score of this course.

八、评价及持续改进

1、**Subject Syllabus**

Check Period: 4 years; **Revise Period:** 4 years.

Improvement Measures: The subject coordinator shall be responsible for the syllabus discussion and improvement, and the revised version shall be submitted to deputy dean (teaching affairs) for reviewing then to executive dean for approval.

2、Performance Evaluation and Assessment

Assessment Cycle: 1 academic year; **Evaluation Basis:** comprehensive analysis of students' final grades.

Improvement measures: Based on the distribution of students' final grades, adjust and optimize the content accordingly, and improve teaching methods.

撰写： 史闻博

审核： 韩鹏

批准：　　史闻博

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