SYLLABUSES FOR THE DOUBLE DEGREE OF
BACHELOR OF ARTS [BA] AND
BACHELOR OF ENGINEERING IN ARTIFICIAL INTELLIGENCE AND DATA SCIENCE [BEng(AI&DataSc)]

These syllabuses apply to students admitted to the BA&BEng(AI&DataSc) curriculum in the academic year 2025-26 and thereafter.

The BA&BEng(AI&DataSc) curriculum comprises 300 credits of courses as follows:

(a) 78 credits for the Major in Artificial Intelligence and Humanity comprising 42 credits of core courses in AI and Humanity (including 6 credits of capstone experience), and 36 credits of Humanities electives in any single Arts programme*;
(b) 144 credits of Professional Core in Artificial Intelligence and Data Science comprising 36 credits of Foundation Courses, 24 credits of introductory discipline core courses, 30 credits of advanced discipline core courses, 42 credits of discipline elective courses, 12 credits of capstone experience and a non-credit bearing internship;
(c) 42 credits of University requirements, including 6 credits of "CAES1000. Core University English", 6 credits in an "English in the Discipline" course and 6 credits in the Chinese language enhancement course, and 24 credits of Common Core courses; (to be updated)
(d) 36 credits of free electives (any courses from Arts, Computing and Data Science, or any other disciplines); and
(e) any other non-credit bearing courses as required.

* an Arts programme refers to a programme offered by the School of Chinese, School of English, School of Humanities, School of Modern Languages and Cultures, and the Centre of Buddhist Studies

Major in Artificial Intelligence and Humanity (AIH) (78 credits)

AIH Core Courses
Year 1
AIHU1001 Foundations of AI and humanity (6 credits)
AIHU1002 Ethics, society and law of Artificial Intelligence (6 credits)

Year 2 to 3
AIHU2001 Human and machine cognition (6 credits)
AIHU2002 Modelling, assessment, and benchmarking (6 credits)
AIHU2003 Creativity and generative AI (6 credits)

Year 3 to 5
AIHU3001 Advanced topics in AI and humanity (6 credits)
AIHU4001 Research project in AI and humanity (capstone experience) (6 credits)

AIH Humanities Electives
Year 1 to 5
36 credits of advanced courses, except language-learning courses (e.g. "FREN2001. French II.1"), in any single Arts programme (e.g. Philosophy, General Linguistics)

[Note: The Major in in Artificial Intelligence and Humanity is not offered to students from other curricula.]

Professional Core in Artificial Intelligence and Data Science (144 credits)

Foundation Courses

Year 1

COMP1110	Computing and data science in everyday life (6 credits)
COMP1117	Computer programming (6 credits)
COMP2113	Programming technologies (6 credits)
MATH1013	University mathematics II (6 credits)
MATH2012	Fundamental concepts of mathematics (6 credits)

Year 2

MATH2014	Multivariable calculus and linear algebra (6 credits)

Introductory Disciplinary Core Courses

Year 2

COMP2119	Introduction to data structures and algorithms (6 credits)
COMP2501	Introduction to data science (6 credits)
SDST2601	Probability and statistics I (6 credits)
SDST2602	Probability and statistics II (6 credits)

Advanced Disciplinary Core Courses

Year 3 to 5

COMP3270	Introduction to artificial intelligence (6 credits)
COMP3278	Introduction to database management systems (6 credits)
COMP3312	Law and ethics in data science (6 credits)
COMP3314	Introduction to machine learning (6 credits)
COMP3340	Introduction to deep learning (6 credits)

Capstone Experience & Internship

Year 3 to 4

COMP3510	Internship (0 credits)
COMP3522	Real-life AI and data science (6 credits)

Year 5

COMP4503	AI and data science in humanity project (6 credits)

Disciplinary Elective Courses

Year 3 to 5	42 credits to chosen from the following list:
COMP3317	Introduction to computer vision (6 credits)
COMP3323 / FITE3010	Advanced database systems / Big data and data mining (6 credits)
COMP3353	Bioinformatics (6 credits)
COMP3355	Cyber security (6 credits)
COMP3361	Natural language processing (6 credits)
COMP3362	Hands-on AI: experimentation and applications (6 credits)
COMP3407	Scientific computing (6 credits)
COMP3513	Big data systems (6 credits)
COMP3516	Data analytics for IoT (6 credits)
COMP3520	Special topics in data science (6 credits)
COMP3521	Visualization for data analytics (6 credits)
COMP3523	Security and privacy in artificial intelligence (6 credits)
COMP3524	Web intelligence (6 credits)
COMP4510	Principles of machine learning (6 credits)
COMP4511	Principles of deep learning (6 credits)
COMP4512	Advanced computer vision (6 credits)

FITE2010	Distributed ledger and blockchain (6 credits)
SDST3600	Linear statistical analysis (6 credits)
SDST3612	Statistical machine learning (6 credits)
SDST3621	Statistical data analysis (6 credits)
SDST4601	Time-series analysis (6 credits)
SDST4602	Multivariate data analysis (6 credits)

Common Core Courses (24 credits) (to be updated)

Candidates are required to complete 24 credits of courses in the Common Core Curriculum within the first three years of studies, comprising one course from each Area of Inquiry.

Language Enhancement Courses (18 credits) (to be updated)

- "CAES1000. Core University English" (6 credits) in Year 1

- Take *one* of the following "English in the Discipline" courses (6 credits) in Year 2:
  - CAES9201. Academic English: Countries and Cultures
  - CAES9202. Academic English: Literary Studies
  - CAES9203. Academic English: Philosophy and the History of Ideas
  - CAES9204. Academic English: History
  - CAES9205. Academic English: Language Studies
  - CAES9206. Academic English: Creative and Visual Arts
  - CAES9542. Technical English for Computer Science

- Take *one* of the following Chinese language enhancement courses (6 credits) in Year 3:
  - CART9001. Practical Chinese for Arts Students
  - CENG9001. Practical Chinese for engineering students
  - CUND9001. Basic Spoken and Written Cantonese for Mandarin Speakers
  - CUND9002. Practical Chinese and Hong Kong society
  - CUND9003. Cantonese for non-Cantonese Speaking Students
  - CUND9004. Practical Applied Chinese Writing and Effective Presentation Skills for Non-local Mandarin Speaking Students

  Note: CUND9XXX courses are for Putonghua-speaking students only.

Free electives (36 credits)

Candidates are required to complete 36 credits of free electives in Year 1 to 5. Free electives are courses offered by the Faculty of Arts, School of Computing and Data Science and other teaching units of the University.

Notes:

1. A course cannot be counted towards more than one requirement relating to a major and/or a minor. Suitable Arts courses will be counted as "AIH Humanities electives" to fulfil the requirements of "Major in Artificial Intelligence and Humanity" by default. Hence, if students wish to declare an Arts minor during their degree studies, they may be required to take extra courses from the Programme concerned.

2. Candidates may be required to take additional course(s) to fulfil the pre-requisite(s) or co-requisite(s) of an AIH Humanities elective or a free elective. Please refer to the relevant Programme's syllabuses for course descriptions and enrollment conditions.

<Course description>

Artificial Intelligence and Humanity courses

AIHU1001. Foundations of AI and humanity (6 credits)

Foundations of AI and Humanity is an interdisciplinary course that explores how the integration of artificial intelligence and humanistic inquiry can lead to new insights, innovations, and critical understandings. The course focuses on how scholars and practitioners have successfully bridged AI with the humanities to create meaningful and beneficial applications. Students will learn about interdisciplinary collaborations between technologists and humanists that have led to significant, disruptive, and yet responsible advancements. The course prepares students to contribute thoughtfully and innovatively to the ongoing dialogue between AI and the humanities, equipping them with the skills to collaborate across disciplines, and design and deploy AI in ways that enrich society and the human experience.
Assessment: 100% coursework.

AIHU1002. Ethics, society and law of Artificial Intelligence (6 credits)

Ethics, Society, and Law of AI is an interdisciplinary course that critically examines the ethical, societal, and legal challenges posed by the rapid development and deployment of artificial intelligence. The course provides students with the tools to analyze and address key issues such as fairness, accountability, transparency, privacy, and the societal impact of AI. Students will explore how AI can perpetuate or mitigate social inequalities, the ethical dilemmas inherent in AI decision-making, and the potential for AI to challenge traditional legal frameworks. The course covers foundational ethical theories and principles, applying them to contemporary AI dilemmas and design challenges. In addition, students will critically assess how AI technologies are transforming social structures, influencing public policy, and reshaping notions of privacy and individual rights. The course also explores the global dimensions of AI governance, considering how different cultural, political, and economic contexts influence the development and regulation of AI.
Assessment: 100% coursework.

AIHU2001. Human and machine cognition (6 credits)

Human and Machine Cognition is an interdisciplinary course that explores the similarities and differences between human cognitive processes and machine-based cognition. As artificial intelligence systems increasingly emulate aspects of human thought, understanding how these systems compare to human cognitive abilities is crucial for both technical and ethical considerations. The course offers an in-depth examination of cognitive theories from psychology, neuroscience, and philosophy, and compares them with the principles underlying machine learning, neural networks, and other AI models. Students will explore key topics such as perception, learning, memory, reasoning, language, and decision-making, analyzing how both humans and machines perform these functions. The course also delves into the philosophical implications of machine cognition, including debates about consciousness, free will, and the nature of intelligence. Students will engage with thought experiments and case studies that challenge the boundaries between human and machine cognition. A further focus of the course is the interplay between human and machine cognition in collaborative environments. Students will explore how AI can augment human cognitive abilities, leading to new forms of human-machine

interaction and intelligence.
Assessment: 100% coursework.

AIHU2002. Modelling, assessment, and benchmarking (6 credits)

Modelling, Assessment, and Benchmarking is a comprehensive course that delves into the core methodologies and practices used in the development, evaluation, and comparison of artificial intelligence systems. As AI technologies continue to advance, the ability to accurately model complex systems, assess their performance, and benchmark them against industry and safety standards, ethical and legal guidelines, and user/societal needs is increasingly vital. The course provides students with the theoretical foundations and practical tools needed to assess the effectiveness, and benchmark the performance of AI models in various contexts. The course will also explore the challenges and limitations of evaluation and benchmarking, including issues related to the evolving nature of AI capabilities, alignment, and the complexity of socio-technical systems. Students will investigate how the choice of benchmarks and evaluation metrics can influence the development of AI systems andpotentially leadito unintended consequences. The course encourages a critical examination of how assessment and benchmarking practices can be aligned with broader societal and ethical goals.
Assessment: 100% coursework.

AIHU2003. Creativity and generative AI (6 credits)

The Creativity and Generative AI course is an interdisciplinary course that explores the intersection of artificial intelligence and human creativity, focusing on the capabilities and implications of generative AI systems. As AI technologies increasingly contribute to creative processes in fields such as art, music, literature, and design, understanding how these systems operate, and their impact on human creativity, is essential. This course provides students with a comprehensive understanding of generative AI. Students will explore the technical foundations of these systems, how design of their design can be modulated, while critically examining their role in the production of creative works and creative practice. The course will also delve into the collaborative potential of generative AI, examining how these systems can augment human creativity and serve as co-creators in artistic and design processes. In addition to technical and creative exploration, the course addresses the philosophical, legal, and ethical questions raised by generative AI. Students will discuss issues such as authorship, originality, and the nature of creativity in the context of AI-generated works. What does it mean for a machine to create? How does the use of AI in creative fields challenge traditional notions of artistic expression and intellectual property? Students will examine the broader cultural and societal implications of generative AI, considering how these technologies are reshaping industries, influencing cultural production, and impacting the way we perceive creativity. The course will highlight real-world applications of generative AI in various creative domains, from AI-generated literature and visual art to AI-assisted music composition and architectural design.
Assessment: 100% coursework.

AIHU3001. Advanced topics in AI and humanity (6 credits)

Advanced Topics in AI and Humanity is an interdisciplinary course designed to explore cutting-edge issues at the intersection of artificial intelligence and humanities. The course offers students the opportunity to delve into emerging topics and complex challenges that arise as AI continues to shape and be shaped by human society, culture, and values.
Each iteration of the course will focus on a selection of advanced topics that reflect the latest developments in AI research. The course is designed to be responsive to new trends and debates, allowing students to engage with the most relevant and pressing issues of the time.

Assessment: 100% coursework.

AIHU4001. Research project in AI and humanity (Capstone Experience) (6 credits)

The Research Project in AI and Humanity (Capstone Experience) offers students the opportunity to apply their interdisciplinary knowledge to an original research project that explores the intersection of artificial intelligence and the humanities. This capstone course is designed to allow students to synthesize the concepts, theories, and methodologies they have learned throughout the programme and to contribute meaningfully to the ongoing dialogue between AI and humanistic inquiry.
In this course, students will identify a specific research question or challenge that lies at the crossroads of AI and one or more humanities disciplines. They will then design and execute a research project that rigorously investigates this question, employing a combination of qualitative and/or quantitative research methods as appropriate to their topic. By completing this course, students will have demonstrated their ability to conduct independent, interdisciplinary research that bridges the gap between AI and the humanities. They will emerge from the program with a Capstone research experience that showcases their intellectual capabilities and readiness to contribute to academic, professional, or creative endeavours in the rapidly evolving field of AI and humanity.
Assessment: 100% coursework.

Artificial Intelligence and Humanity – Humanities electives

Please find the course descriptions and enrollment conditions of the eligible courses on the BA syllabuses (https://arts.hku.hk/current-students/undergraduate/BA/regulations-syllabuses).

Professional Core in Artificial Intelligence and Data Science

Foundation Courses

COMP1110. Computing and data science in everyday life (6 credits)

In this course, students will dive into the dynamic world of computing and data science, focusing on real-world problem-solving skills. The course will explore the latest advancements and innovations in computing, big data analytics and artificial intelligence technologies, and examine how they shape our daily lives. Students will also recognize the challenges and opportunities faced by computing and data science professionals. Through hands-on projects and teamwork, students will gain firsthand experience in creating data-driven solutions to solve practical challenges in computing and data science.
Assessment: 100% continuous assessment

COMP1117. Computer programming (6 credits)

This is an introductory course in computer programming. Students will acquire basic Python programming skills, including syntax, identifiers, control statements, functions, recursions, strings, lists, dictionaries, tuples and files. Searching and sorting algorithms, such as sequential search, binary search, bubble sort, insertion sort and selection sort, will also be covered.
Mutually exclusive with: ENGG1111 or ENGG1330 or IIMT2602
Assessment: 50% continuous assessment, 50% examination

COMP2113. Programming technologies (6 credits)

This course covers intermediate to advanced computer programming topics on various technologies and tools that are useful for software development. Topics include Linux shell commands, shell scripts, C/C++ programming, and separate compilation techniques and version control. This is a self-learning course; there will be no lecture and students will be provided with self-study materials. Students are required to complete milestone-based self-assessment tasks during the course. This course is designed for students who are interested in Computer Science / Computer Engineering.
Prerequisite: COMP1117 or ENGG1330
Mutually exclusive with: ENGG1340 or COMP2123
Assessment: 70% continuous assessment, 30% examination

MATH1013. University mathematics II (6 credits)

This course aims at students with Core Mathematics plus Module 1 or Core Mathematics plus Module 2 background and provides them with basic knowledge of calculus and some linear algebra that can be applied in various disciplines. It is expected to be followed by courses such as MATH2012, MATH2101, MATH2102, MATH2211, and MATH2241. Topics include: Functions; graphs; inverse functions; Limits; continuity and differentiability; Mean value theorem; Taylor's theorem; implicit differentiation; L'Hopital's rule; Higher order derivatives; maxima and minima; graph sketching; Radian, calculus of trigonometric functions; Definite and indefinite integrals; integration by substitutions; integration by parts; integration by partial fractions; Complex numbers, polar form, de Moivre's formula; Applications: Solving simple ordinary differential equations; Basic matrix and vector (of orders 2 and 3) operations, determinants of 2x2 or 3x3 matrices.
Prerequisite: Level 2 or above in Module 1, or Module 2 of HKDSE Mathematics or equivalent, or Pass in MATH1009 or MATH1011, or pass in MATH1853 or MATH1851
Not for students who have passed MATH1821, or (MATH1851 and MATH1853), or have already enrolled in this course.
Assessment: 10% Assignments, 40% Test, 50% examination

MATH2012. Fundamental concepts of mathematics (6 credits)

To provide students with solid background on fundamental concepts of mathematics and methods of mathematical proofs. Such concepts and methods are important for subsequent studies in all higher level courses in mathematics. This course can be taken concurrently with other Level 2 or above courses. Topics include: elementary set theory, statement calculus, mathematical proofs, relations and functions, finite and infinite sets, natural numbers and mathematical induction, real numbers and the limits of sequences, and examples of groups.
Prerequisite: MATH1013 or MATH1821 or (MATH1851 and MATH1853).
Assessment: 50% continuous assessment, 50% examination

MATH2014. Multivariable calculus and linear algebra (6 credits)

To provide students with a solid foundation in calculus of several variables and linear algebra, which they will need in the study of mathematics related subjects. Topics include:
- Vectors and Matrices: Vectors in space, dot product and cross product, determinants (with geometric interpretations).
- Partial Derivatives: Functions of several variables, partial derivatives, extreme values and Lagrange multipliers, Taylor's formula.
- Multiple Integrals: Double and triple integrals, substitution in multiple integrals.
- Matrix Algebra: Matrix addition and multiplication, system of linear equations as a matrix equation.

- Vector Spaces: The Euclidean spaces as vector spaces, its subspaces, span of vectors, linear independence, basis and dimension.
- Eigenvalues and Eigenvectors: Diagonalization and computing powers.
- Numerical Methods: Bisection method and Newton's method for finding roots of equations, Simpson's rule and Trapezoidal rule for numerical integration.

Prerequisite: MATH1013 or (MATH1851 and MATH1853)
Mutually exclusive: MATH2822 or [(MATH2101 or MATH2102) and MATH2211]
Assessment: 50% continuous assessment, 50% examination

Introductory Disciplinary Core Courses

COMP2119. Introduction to data structures and algorithms (6 credits)

Arrays, linked lists, trees and graphs; stacks and queues; symbol tables; priority queues, balanced trees; sorting algorithms; complexity analysis.
Prerequisite: COMP2113 or COMP2123 or ENGG1340
Mutually exclusive with: COMP2118
Assessment: 40% continuous assessment, 60% examination

COMP2501. Introduction to data science (6 credits)

The course introduces basic concepts and methodology of data science. The goal of this course is to provide students with an overview and practical experience of the entire data analysis process. Topics include: data source and data acquisition, data preparation and manipulation, exploratory data analysis, statistical and predictive analysis, data visualization and communication.
Prerequisite: COMP1117 or ENGG1330
Mutually exclusive with: SDST1005 or SDST1015 or SDST1018
Assessment: 50% continuous assessment, 50% examination

SDST2601. Probability and statistics I (6 credits)

The discipline of statistics is concerned with situations in which uncertainty and variability play an essential role and forms an important descriptive and analytical tool in many practical problems. Against a background of motivating problems this course develops relevant probability models for the description of such uncertainty and variability.

Prerequisite/Co-requisite: MATH2014, or (MATH2101 and MATH2211)
Mutually exclusive with: ELEC2844 or MATH3603 or SDST1603 or SDST2901
Assessment: 40% continuous assessment, 60% examination

SDST2602. Probability and statistics II (6 credits)

This course builds on SDST2601, introducing further the concepts and methods of statistics. Emphasis is on the two major areas of statistical analysis: estimation and hypothesis testing. Through the disciplines of statistical modelling, inference and decision making, students will be equipped with both quantitative skills and qualitative perceptions essential for making rigorous statistical analysis of real-life data.

Prerequisite: SDST2601
Mutually exclusive with: SDST3902

Assessment: 40% continuous assessment, 60% examination

Advanced Disciplinary Core Courses

COMP3270. Introduction to Artificial intelligence (6 credits)

This course provides an introduction to the fundamental concepts and techniques of artificial intelligence (AI). Students will learn about intelligent agents, problem solving, uncertain knowledge, and logical agents. The course combines theoretical foundations with practical applications to equip students with the tools needed to understand and develop intelligent systems.
Prerequisite: COMP2119 or COMP2118 or FITE2000 or COMP2502
Mutually exclusive with: ELEC4544 or IIMT3688
Assessment: 50% continuous assessment, 50% examination

COMP3278. Introduction to database management systems (6 credits)

This course studies the principles, design, administration, and implementation of database management systems. Topics include: entity-relationship model, relational model, relational algebra, database design and normalization, database query languages, indexing schemes, integrity and concurrency control.
Prerequisite: COMP2119 or COMP2118 or COMP2502 or ELEC2543 or FITE2000
Mutually exclusive with: IIMT3601
Assessment: 50% continuous assessment, 50% examination

COMP3312. Law and ethics in data science (6 credits)

The primary objective of this course is to explore the legal and ethical challenges and ramifications in the modern practice of data science. Using a case-based approach, students will analyse contemporary controversies from a techno-legal and ethical perspectives. The focuses are data privacy and the regulation of using data in specific areas of law. Topics include basic privacy protection techniques, such as encryption and data anonymization data privacy laws, open data policy, data protection process and technology, issues in the usage of sensitive personal data and public data.
Assessment: 100% continuous assessment

COMP3314. Introduction to machine learning (6 credits)

This course introduces basic concepts, algorithms, practices, tools, and applications of machine learning. Topics include classical methods in supervised learning (classification and regression), such as perceptrons, linear regression, decision trees, logistic regression, support vector machines, and KNN; classical methods in unsupervised learning, such as K-means clustering and principal component analysis; common practices in data pre-processing, feature selection, hyper-parameter tuning, and model evaluation; tools/libraries/APIs such as scikit-learn and multi/many-core CPU/GPU programming; applications such as flower species prediction, tumor cell classification, and handwritten digit recognition.
Prerequisites: MATH1853 or MATH2014 or MATH1013; and COMP2119 or COMP2118 or COMP2502 or ELEC2543 or FITE2000
Assessment: 50% continuous assessment, 50% examination

COMP3340. Introduction to deep learning (6 credits)

This course provides practical skills and foundational knowledge in deep learning, emphasizing hands-on experience and computational principles. Students will explore key models, including Convolutional Neural Networks (CNNs), Transformer Networks, Generative Adversarial Networks (GANs), and Diffusion Models. They will apply these models to real-world challenges like object detection, language tasks, and reinforcement learning. The course also covers cutting-edge applications, such as autonomous driving and AI in scientific research. By working directly with source code, students will understand model implementation and optimization deeply. The course culminates in a project where students apply their skills to a practical problem, showcasing their ability to utilize deep learning technologies.
Prerequisites: COMP2119 or COMP2118 or COMP2502 or ELEC2543 or FITE2000; and MATH1853 or MATH2014 or MATH1013
Mutually exclusive with: ELEC4544
Assessment: 50% continuous assessment, 50% examination

Capstone Experience & Internship

COMP3510. Internship (0 credit)

The course consists of two components: internship and professionalism. Internship requires students to spend a minimum of four weeks employed, full-time, as IT interns or trainees. During this period, they are engaged in work of direct relevance to their programme of study. The Internship provides students with practical, real-world experience and represents a valuable complement to their academic training. Professionalism exposes students to social and professional issues in computing. Students need to understand their professional roles when working as data science professionals as well as the responsibility that they will bear. They also need to develop the ability to ask serious questions about the social impact of data science and engineering and to evaluate proposed answers to those questions. Topics include: intellectual property, privacy, social context of computing, risks, safety and security concerns for data science professionals, professional and ethical responsibilities, and continuing professional development.
Assessment: 100% continuous assessment

COMP3522. Real-life AI and data science (6 credits)

In this course, students will learn data science step by step through real analytics example: data mining, modelling, tableau visualization and more. Unlike many classes where everything works just the way it should and the training is smooth sailing, this course will give students a data science odyssey through experiencing the pains a data scientist goes through on a daily basis. Corrupt data, anomalies, irregularities, etc. Upon completing this course, the students will enhance their data wrangling skills and learn how to 1) model their data, 2) curve-fit their data, and 3) how to communicate their findings. The students will develop a good understanding of Tableau, SQL, SSIS, and Gretl that give them a safe ride in data lakes. With no final exam, the students will be given practical exercises that prepare them to be at the helm for real-world challenges.
Prerequisite: ENGG1330 or COMP1117
Assessment: 100% continuous assessment

COMP4503. AI and data science in humanity project (6 credits)

Students will work on a capstone project which is on data science in the context of humanity. Students are required to identify a data-intensive problem within the realm of humanity, and to implement a data-driven solution for the problem. Students will undergo a complete data science project life cycle, from

problem understanding, data collection, data exploration to data modelling, analysis and interpretation, and finally deliver a data science solution.
Mutually exclusive with: COMP4501, COMP4502
Assessment: 100% continuous assessment

Disciplinary Elective Courses

COMP3317. Introduction to computer vision (6 credits)

This course introduces the basic concepts, mathematical models, and methods of computer vision. In the first half of this course, we will focus on 2D computer vision tasks and cover topics in image formation and representation, digital image processing, feature extraction, and image recognition. In the second half of this course, we will look into 3D computer vision tasks and cover topics in camera models, camera calibration, stereo vision, and motion analysis.
Prerequisites: COMP2119 or COMP2118; and MATH1853 or MATH2014 or MATH2101 or MATH1013
Assessment: 50% continuous assessment, 50% examination

COMP3323. Advanced database systems (6 credits)

The course will study some advanced topics and techniques in database systems, with a focus on the system and algorithmic aspects. It will also survey the recent development and progress in selected areas. Topics include: query optimization, spatial-spatiotemporal data management, multimedia and time-series data management, information retrieval and XML, data mining.
Prerequisite: COMP3278
Mutually exclusive with: FITE3010
Assessment: 50% continuous assessment, 50% examination

FITE3010. Big data and data mining (6 credits)

The course will study some advanced topics and techniques in big data, with a focus on the algorithmic and system aspects. It will provide students with both theoretical and hands-on experience in big data and data mining. Topics include MapReduce, textual data management, graph data management, uncertain data management, association rule mining, and state-of-the-art data mining techniques.
Prerequisites: FITE1010 or MATH1853 or MATH2101 or MATH1013; and COMP2119 or COMP2118 or COMP2502 or ELEC2543 or FITE2000
Mutually exclusive with: COMP3323
Assessment: 50% continuous assessment, 50% examination

COMP3353. Bioinformatics (6 credits)

The goal of the course is for students to be grounded in basic bioinformatics concepts, algorithms, tools, and databases. Students will be leaving the course with hands-on bioinformatics analysis experience and empowered to conduct independent bioinformatics analyses. We will study: 1) algorithms, especially those for sequence alignment and assembly, which comprise the foundation of the rapid development of bioinformatics and DNA sequencing; 2) the leading bioinformatics tools for comparing and analyzing genomes starting from raw sequencing data; 3) the functions and organization of a few essential bioinformatics databases and learn how they support various types of bioinformatics analysis.
Prerequisite: COMP1117 or ENGG1330
Assessment: 70% continuous assessment, 30% examination

COMP3355. Cyber security (6 credits)

This course introduces the principles, mechanisms and implementation of cyber security and data protection. Knowledge about the attack and defense are included. Topics include notion and terms of cyber security; network and Internet security, introduction to encryption: classic and modern encryption technologies; authentication methods; access control methods; cyber attacks and defenses (e.g. malware, DDoS).
Prerequisite: COMP2119 or COMP2118 or ELEC2543 or FITE2000
Mutually exclusive with: ELEC4641
Assessment: 50% continuous assessment, 50% examination

COMP3361. Natural language processing (6 credits)

Natural language processing (NLP) is the study of human language from a computational perspective. The course will be focusing on machine learning and corpus-based methods and algorithms. We will cover syntactic, semantic and discourse processing models. We will describe the use of these methods and models in applications including syntactic parsing, information extraction, statistical machine translation, dialogue systems, and summarization. This course starts with language models (LMs), which are both front and center in natural language processing (NLP), and then introduces key machine learning (ML) ideas that students should grasp (e.g. feature-based models, log-linear models and then the neural models). We will land on modern generic meaning representation methods (e.g. BERT/GPT-3) and the idea of pretraining / finetuning.
Prerequisites: COMP3314 or COMP3340; and MATH1853 or MATH1013
Assessment: 50% continuous assessment, 50% examination

COMP3362. Hands-on AI: experimentation and applications (6 credits)

This course comprises two main components: students first acquire the basic know-how of the state-of-the-art AI technologies, platforms and tools (e.g., TensorFlow, PyTorch, scikit-learn) via example-based modules in a self-paced learning mode. Students will then identify a creative or practical data-driven application and implement an AI-powered solution for the application as the course project. Students will be able to experience a complete AI experimentation and evaluation cycle throughout the project.
Prerequisite: COMP3314
Mutually exclusive with: COMP3359
Assessment: 100% continuous assessment

COMP3407. Scientific computing (6 credits)

This course provides an overview and covers the fundamentals of scientific and numerical computing. It focuses on topics in numerical analysis and computation, with discussions on applications of scientific computing.
Prerequisites: COMP1117 or ENGG1330; and COMP2121
Assessment: 50% continuous assessment, 50% examination

COMP3513. Big data systems (6 credits)

The objective of this course is to study the design and implementation of Big Data systems. Topics include: data analytics pipelines, data processing framework, distributed and parallel data systems, network attached storage, data storage virtualization, query language support, data center architecture, fault tolerance, and recovery.
Prerequisites: COMP2501; and COMP3278
Assessment: 50% continuous assessment, 50% examination

COMP3516. Data analytics for IoT (6 credits)

This course introduces basic concepts, technologies, and applications of the Internet of Things (IoT). The course covers a range of enabling techniques in sensing, computing, communication, and learning for IoT and connects them to exciting applications in smart homes, healthcare, security, etc. The course will center around intelligent perception via innovative sensing technologies, with various topics from the fundamentals (e.g., signal processing, statistical analysis, machine learning) to real-world systems. Billions of things are connected today, and this course helps students understand how IoT will evolve into AIoT (Artificial Intelligence of Things) with sensing and data intelligence.
Prerequisite: MATH1853 or MATH2014 or MATH1013; and COMP2119 or COMP2118 or COMP2502
Assessment: 60% continuous assessment, 40% examination

COMP3520. Special topics in data science (6 credits)

Computing and data science are rapidly evolving fields. Selected topics in computing and data science that are of current interest will be covered. Topics may vary from year to year. Specific titles and course descriptions are available on the school website.
Prerequisites: MATH1013; and COMP1117; and COMP2113
Assessment: 60% continuous assessment, 40% examination

COMP3521. Visualization for data analytics (6 credits)

This course aims to give an overview of the basic principles and techniques for visualization and visual analytics. In particular, topics including human visual perception, color and visualization techniques for various data kinds (e.g., spatial, geospatial and multivariate data, graphs and networks, text and document) will be covered. The use of interactive visual interface to facilitate analytical reasoning will also be discussed. Students will use practical tools and apply visualization principles and techniques to perform visual data analysis on large datasets.
Prerequisite: COMP2119 or COMP2118 or COMP2502 or ELEC2543 or FITE2000
Assessment: 50% continuous assessment, 50% examination

COMP3523. Security and Privacy in Artificial Intelligence (6 credits)

This course will equip students with the knowledge and hands-on experience to develop secure, privacy-preserving AI systems. As AI becomes increasingly integrated into our everyday lives, students will explore how seemingly powerful AI systems can be compromised through various attacks that manipulate decision-making processes and steal private information. Students will also learn about cutting-edge defenses designed to protect these systems. By the end of the course, students will be able to assess security and privacy risks when designing AI-driven solutions and implement effective countermeasures.
Prerequisite: COMP3314
Assessment: 50% continuous assessment, 50% examination

COMP3524. Web Intelligence (6 credits)

Web Intelligence is an exciting and rapidly evolving field that explores the intersection of web technologies, data science, and artificial intelligence. In this course, students will dive into the core principles and applications of web intelligence, including web data management, web crawling and extraction, information retrieval, web mining, web analytics, and the integration of large language models and other AI-powered techniques. We will examine the unique characteristics and challenges of web data, and how emerging technologies can be leveraged to extract valuable insights and enable personalized web experiences.
Prerequisite: COMP3270
Assessment: 60% continuous assessment, 40% examination

COMP4510. Principles of machine learning (6 credits)

This course is for students who are familiar with machine learning methods and would like to dive deep into the mathematical foundations of machine learning. This course aims to provide students with the mathematical foundations of machine learning and prepare them for more advanced study and research in machine learning and AI. The course focuses on the design principles of machine learning methods (where they come from) and the analysis principles (how they end up). Topics include statistical machine learning framework, Bayes' rule, MLE/MAP, generative and discriminative learning, regularization, generalization, kernel methods, clustering and mixture models, factor analysis and representation learning, reinforcement learning, and applications.
Prerequisite: COMP3314 or SDST3612
Assessment: 50% continuous assessment, 50% examination

COMP4511. Principles of deep learning (6 credits)

This course aims to provide a rigorous and systematic introduction to the mathematical and computational principles of deep learning. We focus on a common fundamental problem behind almost all modern practices of artificial intelligence: how to effectively and efficiently learn a low-dimensional distribution of data in a high-dimensional space and then transform the distribution to a compact and structured representation. To this end, we will show how to derive all popular neural network architectures from the first principle of data compression. This course aims to truly bridge the theory to practice for the students by providing both written and programming exercises and hands-on projects aiming at applying the learned methods to real-world problems and tasks such as classification, completion, segmentation, generation for both image and text data.
Prerequisite: COMP3340
Assessment: 100% continuous assessment

COMP4512. Advanced computer vision (6 credits)

This course is an advanced course in computer vision, and it covers three fundamental tasks that modern computer vision strives to achieve: image understanding, image generation, and 3D reconstruction. Hence, it consists of three parts and each part consists of a coherent set of topics and methods. For image understanding, we will cover image classification, image segmentation and object detection. For image generation, we cover the typical image generation methods, including Variational Auto-Encoder, Generative Adversarial Networks, Diffusion Models, as well as their typical applications. For 3D reconstruction and generation part, we may cover multiple-view geometry that enables reconstructing 3D geometry from feature points, lines, and planes, as well as from regular textural patterns. We will

also introduce how to represent a 3D scene, both implicit and explicit representations. Other than introducing basic theory and methods, this course emphasizes hands-on implementation and problem-solving skills of the students. The target students are year 4 undergraduate students or year 1 graduate students.
Prerequisite: COMP3340, COMP3317
Assessment: 50% continuous assessment, 50% examination

FITE2010. Distributed ledger and blockchain (6 credits)

This course introduces basic theories of blockchain and distributed ledger, which includes basic cryptography, public key cryptosystem, distributed computing and consensus protocols. Financial applications of blockchain and distributed ledger will be discussed.
Prerequisites: FITE1010 or MATH1853 or MATH2101 or MATH1013; and COMP2119 or COMP2118 or ELEC2543 or FITE2000
Assessment: 40% continuous assessment, 60% examination

SDST3600. Linear statistical analysis (6 credits)

The analysis of variability is mainly concerned with locating the sources of the variability. Many statistical techniques investigate these sources through the use of 'linear' models. This course presents the theory and practice of these models.

Prerequisite: SDST2602
Mutually exclusive with: SDST3907
Assessment: 40% continuous assessment, 60% examination

SDST3612. Statistical machine learning (6 credits)

Machine learning is the study of computer algorithms that build models of observed data in order to make predictions or decisions. Statistical machine learning emphasizes the importance of statistical methodology in the algorithmic development. This course provides a comprehensive and practical coverage of essential machine learning concepts and a variety of learning algorithms under supervised and unsupervised settings.

Prerequisites: SDST3600 or SDST3907; and COMP1117 or ENGG1330 or SDST2604
Mutually exclusive with: SDST4904
Recommended: proficiency in Python, programming assignments will require use of Python
Assessment: 100% continuous assessment

SDST3621. Statistical data analysis (6 credits)

Building on prior coursework in statistical methods and modeling, students will gain a deeper understanding of the entire process of data analysis, using both frequentist and Bayesian tools. The course aims to develop skills of model selection and hypotheses formulation so that questions of interest can be properly formulated and answered. An important element deals with model review and improvement, when one's first attempt does not adequately fit the data. Students will learn how to explore the data, build reliable models, and communicate the results of data analysis to a variety of audiences.

Prerequisite: SDST3600 or SDST3907

Assessment: 50% continuous assessment, 50% examination

SDST4601. Time-series analysis (6 credits)

A time series consists of a set of observations on a random variable taken over time. Time series arise naturally in climatology, economics, environment studies, finance and many other disciplines. The observations in a time series are usually correlated; the course establishes a framework to discuss this. This course distinguishes different type of time series, investigates various representations for the processes and studies the relative merits of different forecasting procedures. Students will analyse real time-series data on the computer.

Prerequisite: SDST3600
Mutually exclusive with: SDST3614, SDST3907
Assessment: 40% continuous assessment, 60% examination

SDST4602. Multivariate data analysis (6 credits)

In many designed experiments or observational studies, the researchers are dealing with multivariate data, where each observation is a set of measurements taken on the same individual. These measurements are often correlated. The correlation prevents the use of univariate statistics to draw inferences. This course develops the statistical methods for analysing multivariate data through examples in various fields of application and hands-on experience with the statistical software SAS.

Prerequisite: SDST3600 or SDST3907
Assessment: 50% continuous assessment, 50% examination
