FACULTY OF SCIENCE
THE UNIVERSITY OF HONG KONG
香港大學理學院

Master of Science in ARTIFICIAL INTELLIGENCE

Nurturing talents in artificial intelligence

2025-26 (September 2025 intake)

SCIENCE CREATES KNOWLEDGE

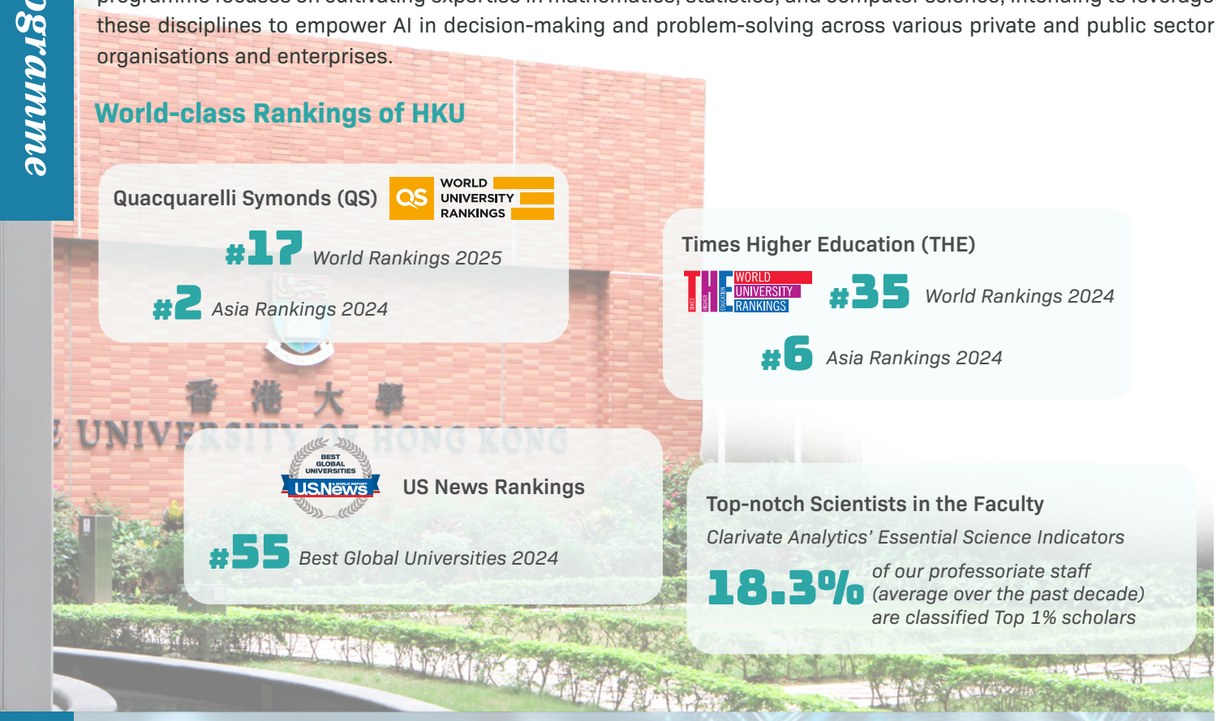
IS THE PROGRAMME FOR YOU

Why this Programme

In today's technologically advanced era, the indispensability of artificial intelligence (AI) in our daily lives is undeniable. With intelligent machines permeating every aspect of society, the advantages of enhanced efficiency and the augmentation of human capabilities have become apparent. One notable facet of AI is machine learning, enabling machines to observe, analyse, and even make mistakes, akin to the human brain, without explicit programming. As a result, AI has found its applications in diverse fields, including scientific research, transportation, and marketing. As we look ahead, the demand for AI professionals is expected to continue growing.

The Master of Science in Artificial Intelligence [MSc(AI)] is an interdisciplinary taught postgraduate programme jointly offered by the Department of Mathematics (host) and the School of Computing and Data Science. This programme focuses on cultivating expertise in mathematics, statistics, and computer science, intending to leverage these disciplines to empower AI in decision-making and problem-solving across various private and public sector organisations and enterprises.

World-class Rankings of HKU



Quacquarelli Symonds (QS)

#17 *World Rankings 2025*

#2 *Asia Rankings 2024*

Times Higher Education (THE)

#35 *World Rankings 2024*

#6 *Asia Rankings 2024*

US News Rankings

#55 *Best Global Universities 2024*

Top-notch Scientists in the Faculty

Clarivate Analytics' Essential Science Indicators

18.3% *of our professoriate staff (average over the past decade) are classified Top 1% scholars*

Programme Features

Interdisciplinary and well-balanced curriculum

- ◊ Solid training in diverse techniques used in AI from the core courses
- ◊ Electives over related topics from mathematics, statistics and computer science
- ◊ A capstone project with real-life applications
- ◊ Guest lectures by distinguished scholars and industry experts
- ◊ Internship opportunities in the AI industry and academia

Learning within and beyond AI

- ◊ Students will learn the AI-related applications of mathematics, statistics and computer science to solve real-life problems
- ◊ The theoretical elements in the curriculum will help students develop essential intellectual capacity at large

Industry connections and career prospects

- ◊ The teaching team has strong connections with high-tech industries in the Greater Bay Area
- ◊ Our graduates are expected to be well prepared for careers such as software engineers, consultants and research scientists in AI and related fields such as big data and financial technology

Programme Information

Tuition fees
Composition fee: HK$360,000# (subject to approval)
Students are required to pay Caution Money (HK$350, refundable on graduation subject to no claims being made) and Graduation Fee (HK$350). All full-time students will be charged a student activity fee of HK$100 per annum to provide support for activities of student societies and campus-wide student events.

Programme duration
Full-time: 1.5 years

Medium of instruction
English

Study load
Credits: 72 credits
Learning hours: 1,440 – 2,160 hours (including 240 - 360 hours for project and contact hours of 264 - 396 hours)

Class schedule
Teaching takes place mainly on weekdays. Classes may also be arranged on Saturdays if needed.

Scholarships

- Master of Science in Artificial Intelligence Entrance Scholarship (HK$20,000)
- Master of Science in Artificial Intelligence Outstanding Performance Scholarship (HK$20,000 – HK$30,000)

Assessment

- Mainly written and programming coursework, and/or examinations
- A Capstone Project on a topic of student's choice

 # The fee shall generally be payable in 3 instalments over 1.5 years

Where will this Programme Lead You

Transferable skills

- ◊ Equip students with the solid foundation in both theory and practice in artificial intelligence and the underlying mathematical and statistical tools
- ◊ The practical elements in the courses help students develop essential intellectual capacity and skills, including but not limited to image processing, pattern recognition, financial technology, robotics and quantum computing and so on
- ◊ Students will learn the applications of mathematics, statistics and computer science to decision-making and problem-solving in organisations and enterprises within the private and public sectors
- ◊ Students will be able to apply the methodologies learnt ethically and effectively in different academic or professional disciplinary areas

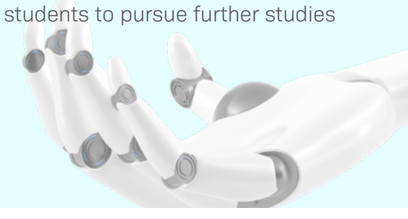
Host

Department of Mathematics

Addressing the need for talents in the field of artificial intelligence, the Department of Mathematics, in collaboration with the School of Computing and Data Science, launched the Master of Science in Artificial Intelligence Programme. We adopt an interdisciplinary academic focus to make our programme a comprehensive study of artificial intelligence.

Who should Take this Programme

- ◊ Candidates with a bachelor's degree in subjects including but not limited to mathematics, statistics, computer science and engineering disciplines
- ◊ University graduates and young professionals who aspire to pursue a career in this booming field
- ◊ Scholastically superior students to pursue further studies in the relevant fields



Programme structure

Design of curriculum (72 credits)
Compulsory courses (42 credits)
ARIN7001 Foundations of artificial intelligence *(6 credits)* ARIN7011 Optimization in artificial intelligence *(6 credits)* ARIN7013 Numerical methods in artificial intelligence *(6 credits)* ARIN7101 Statistics in artificial intelligence *(6 credits)* ARIN7102 Applied data mining and text analytics *(6 credits)* COMP7404 Computational intelligence and machine learning *(6 credits)* DASC7606 Deep learning *(6 credits)*
Disciplinary electives (18 credits) with at least 6 credits from each of the following lists
List A: ARIN7014 Topics in advanced numerical analysis *(6 credits)* ARIN7015 Topics in artificial intelligence and machine learning *(6 credits)* MATH7224 Topics in advanced probability theory *(6 credits)* MATH7502 Topics in applied discrete mathematics *(6 credits)* MATH7503 Topics in advanced optimization *(6 credits)* **List B:** STAT6011 Computational statistics and Bayesian learning *(6 credits)* STAT7008 Programming for data science *(6 credits)* STAT8020 Quantitative strategies and algorithmic trading *(6 credits)* STAT8021 Big data analytics *(6 credits)* **List C:** COMP7308 Introduction to unmanned systems *(6 credits)* COMP7309 Quantum computing and artificial intelligence *(6 credits)* COMP7409 Machine learning in trading and finance *(6 credits)* COMP7502 Image processing and computer vision *(6 credits)* ARIN7017 Legal issues in artificial intelligence and data science *(6 credits)*
Capstone project (12 credits)
ARIN7600 Artificial intelligence project *(12 credits)*

Remarks:
1. Students who have completed the same or similar courses in their previous studies may, on submission of relevant transcripts, be permitted to select up to 18 credits of disciplinary electives from the other two lists if they are not able to find any untaken options from any one of the lists of disciplinary electives.
2. The programme structure will be reviewed from time to time and is subject to change.

Compulsory Courses

ARIN7001 Foundations of artificial intelligence

This course introduces foundational knowledge, methods and tools in mathematics, statistics and computer science for the purpose of studying and applying artificial intelligence.

ARIN7011 Optimization in artificial intelligence

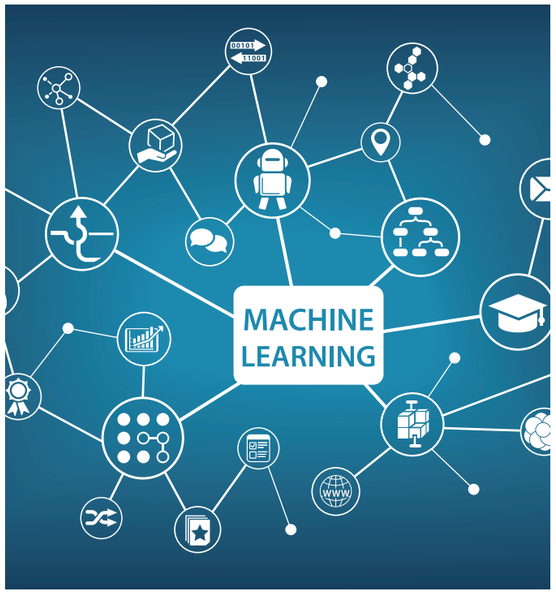
This course introduces students to the topics in theory and algorithms of optimization that play important roles in artificial intelligence and machine learning. Topics include: 1) Fundamental optimization models in AI (linear programming models, integer programming models, network models, kernel learning and deep learning models, etc.), 2) Optimization theory in AI (optimality conditions, constraint qualification, global landscape analysis of deep neural networks, approximation algorithms, duality, complexity analysis, etc.), and 3) Optimization algorithms in AI: (a) Classic algorithms (simplex method, interior point method, cutting plane method, gradient type methods, projection methods, Lagrange methods, Newton type methods and Nesterov acceleration), (b) Stochastic algorithms (stochastic gradient descent (SGD), stochastic coordinate descent methods, stochastic variance reduced gradient, adaptive gradient methods, adaptive moment estimation (ADAM), etc.), (c) Algorithms for large-scale optimization problems (Operator splitting algorithms (BCD type algorithms, ADMM, primal-dual type algorithms, etc.), centralized/decentralized algorithms, etc.) and (d) Algorithms for nonconvex optimization and training deep neural networks.

ARIN7013 Numerical methods in artificial intelligence

This course introduces students to the numerical methods that are instrumental in artificial intelligence and machine learning. Topics include: 1) Notions and concepts in numerical analysis (convolution matrix (related to CNN), kernel methods, direct methods for sparse matrices); 2) Numerical method for solving linear systems (Jacobi Method, Gauss-Seidel method, singular value decomposition (SVD), low-rank matrix approximation with applications in artificial intelligence and machine learning); 3) Principal component analysis, tensor decomposition and their applications to computer vision, image processing and artificial intelligence and machine learning in general; 4) Compute eigenvalues and eigenvectors (Rayleigh quotient, with applications in artificial intelligence and machine learning); 5) Numerical methods for ordinary differential equations (stability, convergence analysis, relation between the SGD and Euler method, using DNN to compute ODEs).

ARIN7101 Statistics in artificial intelligence

The development of artificial intelligence has revolutionized the theory and practice of statistical learning, while novel statistical learning approaches are becoming an integral part of artificial intelligence. By focusing on the interplay between statistical learning and artificial intelligence, this course reviews the main concepts underpinning classical statistical learning, studies computer-intensive methods for conducting statistical learning, and examines important issues concerning statistical learning drawn upon modern artificial intelligence technologies. Contents include classical frequentist and Bayesian inferences, resampling methods, large-scale hypothesis testing, regularization, introduction on Markov chain and Markov decision process.



ARIN7102 Applied data mining and text analytics

With the rapid developments in computer and data storage technologies, the fundamental paradigms of classical data analysis are mature for change. Data mining aims at automated discovery of underlying structure and patterns in large amounts of data, especially text data. This course takes a practical approach to acquaint students with the new generation of data mining tools and techniques, and show how to use them to make informed decisions. Topics include data preparation, feature selection, association rules, decision trees, bagging, random forests and gradient boosting, cluster analysis, neural networks and introduction to text mining.

COMP7404 Computational intelligence and machine learning

This course will teach a broad set of principles and tools that will provide the mathematical, algorithmic and philosophical framework for tackling problems using Artificial Intelligence (AI) and Machine Learning

(ML). AI and ML are highly interdisciplinary fields with impact in different applications, such as biology, robotics, language, economics, and computer science. AI is the science and engineering of making intelligent machines, especially intelligent computer programmes, while ML refers to the changes in systems that perform tasks associated with AI. Ethical issues in advanced AI and how to prevent learning algorithms from acquiring morally undesirable biases will be covered. Topics may include a subset of the following: problem solving by search, heuristic (informed) search, constraint satisfaction, games, knowledge-based agents, supervised learning (e.g., regression and support vector machine), unsupervised learning (e.g., clustering), dimension reduction learning theory, reinforcement learning, transfer learning and adaptive control and ethical challenges of AI and ML.

DASC7606 Deep learning

Machine learning is a fast-growing field in computer science and deep learning is the cutting-edge technology that enables machines to learn from large-scale and complex datasets. Ethical implications of deep learning and its applications will be covered, and the course will focus on how deep neural networks are applied to solve a wide range of problems in areas such as natural language processing and image processing. Other applications such as financial predictions, game playing and robotics may also be covered. Topics covered include linear and logistic regression, artificial neural networks and how to train them, recurrent neural networks, convolutional neural networks, generative models, deep reinforcement learning and unsupervised feature learning.

Disciplinary Electives

ARIN7014 Topics in advanced numerical analysis

This course delves into advanced topics in numerical analysis, providing students with a comprehensive understanding of key concepts and methods. The course covers a diverse range of topics that include: 1) Numerical methods for linear algebra, such as QR method, Krylov subspace methods, generalized minimal residual method (GMRES), robust PCA, and dimensional reduction methods; 2) Numerical methods for partial differential equations, including both traditional numerical methods and deep-learning methods; 3) Stochastic computational methods, such as the Monte Carlo method and its variants, and their applications in artificial intelligence and machine learning; 4) Fourier analysis, approximation theory, and high-dimensional approximation in the field of deep learning. The specific topics covered in the course may be subject to change on an annual basis, ensuring that students receive the most up-to-date and relevant education.

ARIN7015 Topics in artificial intelligence and machine learning

Selected topics in artificial intelligence that are of current interest will be discussed in this course.

MATH7224 Topics in advanced probability theory

Selected topics in probability theory will be discussed in this course.

MATH7502 Topics in applied discrete mathematics

This course aims to provide students with the opportunity to study some further topics in applied discrete mathematics. A selection of topics in discrete mathematics applied in combinatorics and optimization (such as algebraic coding theory, cryptography, discrete optimization, etc.) The selected topics may vary from year to year.

MATH7503 Topics in advanced optimization

A study in greater depth of some special topics in mathematical programming or optimization. It is mainly intended for students in Operations Research or related subject areas. This course covers a selection of topics which may include convex programming, nonconvex programming, saddle point problems, variational inequalities, optimization theory and algorithms suitable for applications in various areas such as machine learning, artificial intelligence, imaging and computer vision. The selected topics may vary from year to year.

STAT6011 Computational statistics and Bayesian learning

This course aims to give students an introduction tomodern computationally intensive methods in statistics, with a strong focus on Bayesian methods. The role of computation as a fundamental tool in data analysis and statistical inference will be emphasized. The course will introduce topics including the generation of random variables, optimization techniques, and numerical integration using quadrature and Monte Carlo methods. This course will then cover the fundamental Bayesian framework, including prior elicitation, posterior inference and model selection. For posterior computation, Monte Carlo methods such as importance sampling and Markov chain Monte Carlo will be introduced. Methods for approximate inference such as variational Bayes will also be covered. Advanced Bayesian modeling with nonparametric Bayes will then be explored, with applications in machine learning. This course is particularly suitable for students who intend to pursue further studies or a career in research.

STAT7008 Programming for data science

Capturing and utilising essential information from big datasets poses both statistical and programming challenges. This course is designed to equip students with the fundamental computing skills required to use Python for addressing these challenges. The course will cover a range of topics, including programming syntax, files IO, object-oriented programming, scientific data processing and analysis, data visualization, data mining and web scraping, programming techniques for machine learning, deep learning, computer vision, and natural language processing, etc.

STAT8020 Quantitative strategies and algorithmic trading

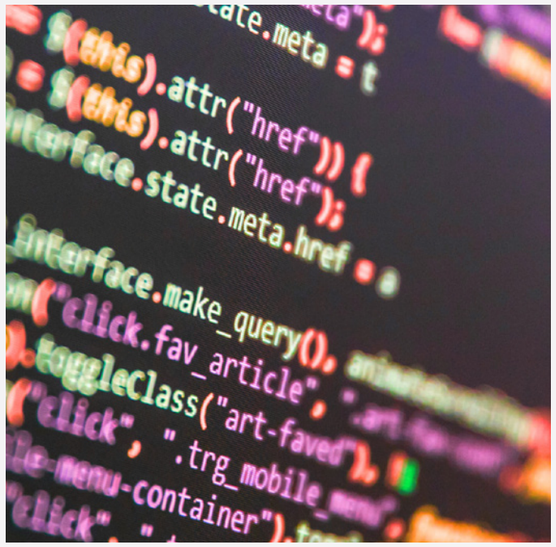
Quantitative trading is a systematic investment approach that consists of the identification of trading opportunities via statistical data analysis and implementation via computer algorithms. This course introduces various methodologies that are commonly employed in quantitative trading.

The first half of the course focuses on strategies and methodologies derived from the data snapshotted at daily or minute frequency. Some specific topics are: (1) techniques for trading trending and mean-reverting instruments, (2) statistical arbitrage and pairs trading, (3) detection of 'time-series' mean reversion or stationarity, (4) cross-sectional momentum and contrarian strategies, (5) back-testing methodologies and corresponding performance measures, and (6) Kelly formula, money and risk management. The second half of the course discusses statistical models of high-frequency data and related trading strategies. Topics that are planned to be covered are: (7) introduction of market microstructure, (8) stylized features and models of high frequency transaction prices, (9) limit order book models, (10) optimal execution and smart order routing algorithms, and (11) regulation and compliance issues in algorithmic trading.

STAT8021 Big data analytics

The recent explosion of social media and the computerization of every aspect of life resulted in the creation of volumes of mostly unstructured data (big data): weblogs, e-mails, videos, speech recordings, photographs, tweets and others. This course aims to provide students with knowledge and skills in big data analytics, especially natural language processing (NLP). Topics will include basic information retrieval, text classification, word embedding, neural networks, sequence models, encoder-decoder, transformer, contextualized world representation, and language model. Students are required to be familiar with Python programming.

Course Description



COMP7308 Introduction to unmanned systems

To study the theory and algorithms in unmanned systems. Topics include vehicle modeling, vehicle control, state estimation, perception and mapping, motion planning, and deep learning related techniques.

COMP7309 Quantum computing and artificial intelligence

This course offers a theoretical overview of selected topics from the interdisciplinary fields of quantum computation and quantum AI. The scope of the lectures encompasses an accessible introduction to the fundamental concepts of quantum computation. Importantly, the introduction does not require preliminary knowledge of quantum theory. Detailed comparisons of computational principles and related phenomena in the classical and quantum domains outline the potential and challenges of quantum theory for fundamentally novel algorithms with enhanced processing power. The theoretical capability of quantum computers is illustrated by analyzing a selection of milestone algorithms of quantum computation and their potential applications to artificial intelligence and optimization.

COMP7409 Machine learning in trading and finance

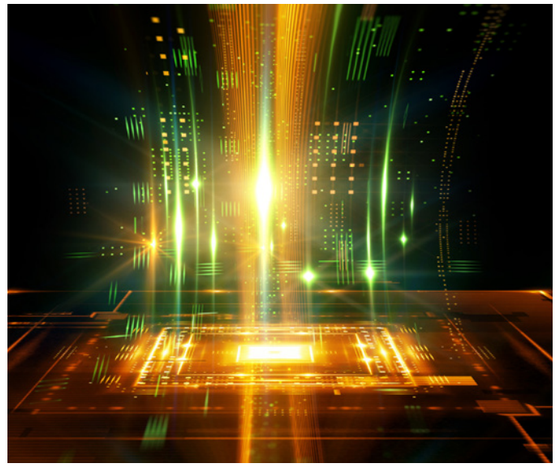
The course introduces students to the field of Machine Learning and helps them develop skills of applying Machine Learning, or more precisely, applying supervised learning, unsupervised learning and reinforcement learning to solve problems in Trading and Finance. This course will cover the following topics: (1) Overview of Machine Learning and Artificial Intelligence; (2) Supervised Learning, Unsupervised Learning and Reinforcement Learning; (3) Major algorithms for Supervised Learning and Unsupervised Learning with applications to Trading and Finance; (4) Basic algorithms for Reinforcement Learning with applications to optimal trading, asset management, and portfolio optimization; (5) Advanced methods of Reinforcement Learning with applications to high-frequency trading, cryptocurrency trading and peer-to-peer lending.

COMP7502 Image processing and computer vision

This course is to study the theory and algorithms in image processing and computer vision. Topics include image representation, image enhancement, image restoration, mathematical morphology, image compression, scene understanding and motion analysis.

ARIN7017 Legal issues in artificial intelligence and data science

This course introduces students to the growing legal, ethical and policy issues associated with artificial intelligence, data science and the related issues of security and assurance. In particular, the relationship of AI and data science to personal autonomy, information assurance and privacy are analyzed and legislative responses are studied. Class participation, research, writing, and oral/electronic presentations are integral components of the course. The course contributes to the following goals: written communication and life-long learning. It includes coverage of the following goals: problem analysis, problem solving and teamwork.



Capstone Project

ARIN7600 Artificial intelligence project

The students will be expected to carry out independent work on a research project under the supervision of staff members. A written report and an oral presentation on the research work are required.

More course information at:
https://www.scifac.hku.hk/prospective/tpg/ArtificialIntelligence

Course Description

Hear from our graduates

Yicheng FU
MSc(AI) Graduate 2024

'Enrolling in the Master of Science in Artificial Intelligence programme at HKU has been transformative for my future career aspirations. The programme's unique strength lies in its diverse faculty members from Mathematics, Statistics & Actuarial Science, and Computer Science backgrounds, offering a rich pool of expertise for further research opportunities. The collaborative environment created by these professors has opened doors for engaging in cutting-edge research projects, enriching my understanding of AI.
Moreover, HKU's AI programme goes beyond academia by organising a myriad of career events that cater to both research and industry pathways. From hosting finance giants like Goldman Sachs to tech powerhouses like Huawei, these events provide invaluable networking opportunities and insights into various career avenues. This exposure has not only broadened my horizons but has also equipped me with the necessary skills and connections to thrive in the dynamic world of AI.
I am grateful for the holistic approach of the HKU AI programme, which not only nurtures academic excellence but also fosters a supportive environment for professional growth and development.'

Zirong LIU
MSc(AI) Graduate 2024

'In the past one and a half years in the AI programme of HKU, but more importantly, I have met many like-minded friends. Classmates in our programme are open-minded and outstanding, and also I have learnt a lot from them. Even though we may come from different places and may have had different study experiences in the past, this does not prevent us from becoming like-minded friends. Therefore, I am grateful to HKU and the Department of Mathematics for giving me the opportunity to further my studies at this prestigious university.'

Zhongrui FENG
MSc(AI) Graduate 2024

'Here, I learn knowledges, I meet friends, and I become a better person. Your intuition will tell you where to go, while your courage and efforts will lead you there.'

YOUR PROGRAMME EXPERTS

'Tapping into the AI expertise of our teaching team, we set out to nurture talents who will be geared up to meet the mounting demand for AI professionals both in Hong Kong and worldwide.'

Programme Director

Professor Xiaoming YUAN
BSc, MPhil *Nanjing U*; PhD *City U*

Academic staff

Department of Mathematics

Professor W K CHING	BSc, MPhil *HK*; PhD *CUHK*
Professor G HAN	BSc, MSc *Peking*; PhD *Notre Dame*
Professor B KANE	BSc, MSc *Carnegie Mellon*; PhD *Wisconsin*
Professor L LAI	BSc *HK;* PhD *Columbia*
Professor Y LEI	BSc, *Hunan*; PhD *Wuhan*
Professor D LI	BSc *HKBU*; PhD *Princeton*
Professor G LI	MS *Fudan*; PhD *Texas A&M*
Professor X YUAN	BSc, MPhil *Nanjing*; PhD *City*
Professor W ZANG	BSc *NUDT*; MSc *Academia Sinica*; PhD *Rutgers*
Professor Z ZHANG	BS, PhD *Tsinghua*

School of Computing and Data Science

Professor Y CAO	BS *Fudan*; MS, PhD *Princeton*
Professor F Y L CHIN	BASc *Toronto;* MSc, MA, PhD *Princeton*
Professor K P CHOW	MA, PhD *UC Santa Barbara*
Professor K HAN	PhD *HK*
Professor T KOMURA	PhD *Tokyo*
Professor L KONG	PhD *Carnegie Mellon*
Dr A S M LAU	BEng *City*; MSc *HK*; PhD *CUHK*
Dr E A L LI	BSc *HK*; MEcon, PhD *Syd*
Professor G D LI	BSc, MSc *Peking*; PhD *HK*
Professor P LUO	PhD *CUHK*
Professor J PAN	PhD *UNC-Chapel Hill*
Professor R RAMANATHAN	PhD *NUS*
Professor D SCHNIEDERS	PhD *HK*
Professor W WANG	BSc, MEng *Shandong*; PhD *Alberta*
Professor K K Y WONG	BEng *CUHK*; MPhil, PhD *Cambridge*
Professor C WU	PhD *Toronto*
Professor D XU	PhD *USTC*
Professor G S YIN	MA *Temple*; MSc, PhD *UNC*
Professor L Q YU	BEng *ZJU*; PhD *CUHK*

School of Computing and Data Science

Professor Y Z YU	PhD *UC Berkeley*
Dr C Y ZHANG	PhD *HK*
Professor H S ZHAO	PhD *CUHK*
Professor Q ZHAO	PhD *Tsinghua*
Professor D F ZOU	PhD *UCLA*

Admissions

Requirements

- ◊ A Bachelor's degree or an equivalent qualification;
- ◊ Applicants should possess knowledge of linear algebra, calculus, probability theory, introductory statistics, and computer programming; and
- ◊ Fulfil the University Entrance Requirements.

How to apply

Application deadlines:
Main round: **12:00 noon (GMT +8), December 13, 2024**
Candidates who apply within main round will have priority

Clearing round: **12:00 noon (GMT +8), January 24, 2025**

Online application:
admissions.hku.hk/tpg

Expected degree conferment will take place in

July 2027 (Summer Congregation)

Further Information

Programme details

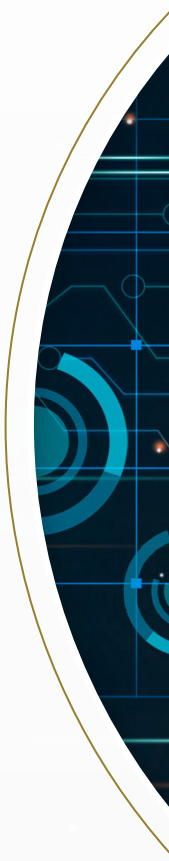
bit.ly/3nOcBZa

Support for students

www.cedars.hku.hk

Enquiries

Department of Mathematics
Tel: (852) 3917 2258 Email: mscai@maths.hku.hk



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HKU Science