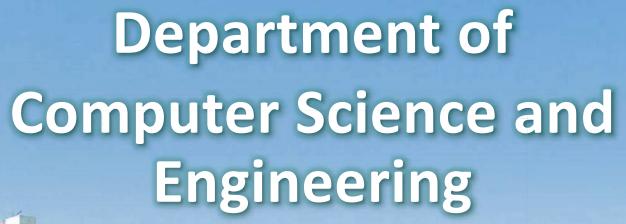


Department of Computer Science and Engineering 計算機科學與工程學系

Artificial Intelligence: Systems and Technologies (AISTN) (JS4468)



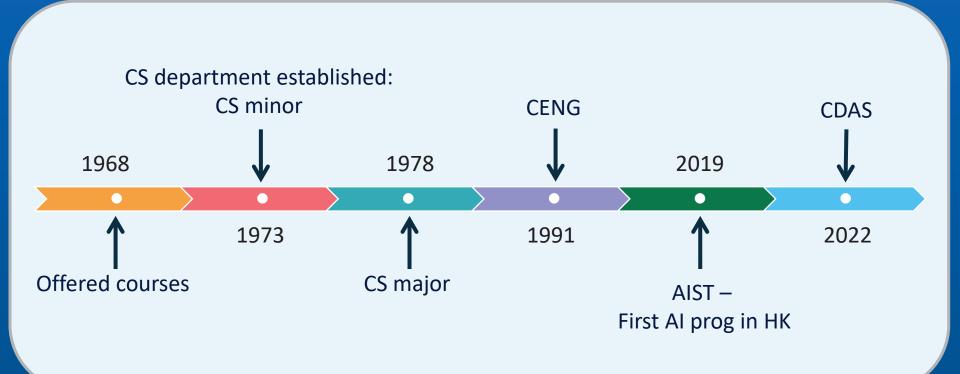






A Long History

- The first computer science department in HK
- A strong alumni network



Our Undergraduate Programmes

Department of Computer Science and Engineering (CSE)

Artificial Intelligence:
Systems and
Technologies
(AIST)

Computer Science and Engineering (BCSE)

(Foundation 1st year)

Computational Data Science

(CDAS)

(Joint Programme with Department of Statistics)

Computer Engineering (CENG) Computer Science (CSCI)

Excellent Teaching and Research Team

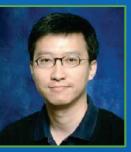










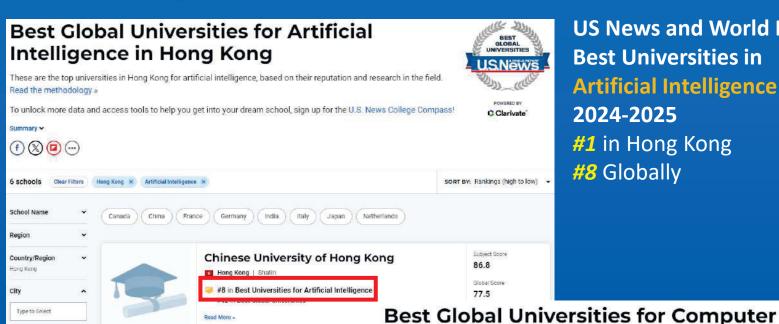




- 2021 Kyoto Prize Laureate and Turing Award Recipient
 Prof. Andrew Yao
- 7 ACM Fellows
 Prof. Benjamin Wah, Prof. John Lui, etc.
- 15 IEEE Fellows
 Prof. Irwin King, Prof. Evangeline Young,
 Prof. Yufei Tao, etc.
- 2022 IEEE CEDA Ernest S. Kuh Early Career Award
 Prof. Bei Yu

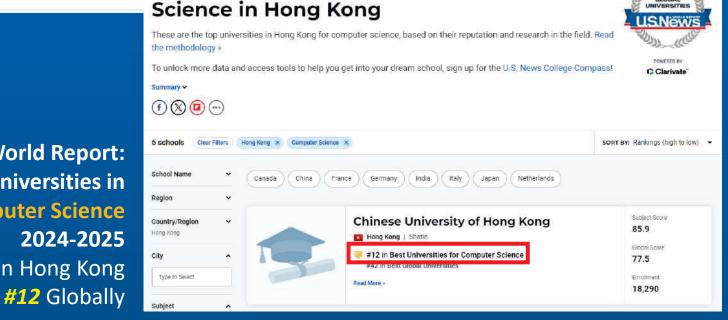
- Hong Kong Academy of Engineering Sciences Fellows 2021 Prof. Michael Lyu
- Forbes 30 Under 30 Asia
 (Healthcare & Science Category) –
 Class of 2022
 Prof. Yu Li
- Distinguished Fellow of the Hong Kong Computer Society 2022
 Prof. Jimmy Lee

Rankings



US News and World Report: Best Universities in Artificial Intelligence 2024-2025 **#1** in Hong Kong **#8** Globally

US News and World Report: Best Universities in Computer Science 2024-2025 **#1** in Hong Kong



Recent Achievements in Intl'/Local Competitions

Champion in ACM-HK Programming Contest 2024

Champion in Robocon Hong Kong Contest in 2021 and 2022

High Honors in the 48th
International Collegiate
Programming Contest (ICPC)
World Finals (2024)



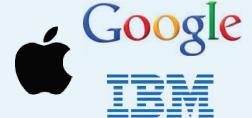




Strong Alumni Network

IT Industry





NOKIA amazon.com



Education















Banking





Morgan Stanley



Deutsche Bank

Deloitte.

Goldman Sachs



Programme



Al is transforming the way we live!

Many disciplines are changing

- A Automotive
- B Bioscience
- C Creative Services
- D Data
- E Education
- F Finance
- G Gaming (note: G may also mean Government)
- H Healthcare
- I Internet of Things

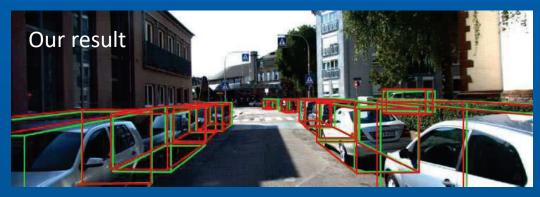
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Al in Automobile

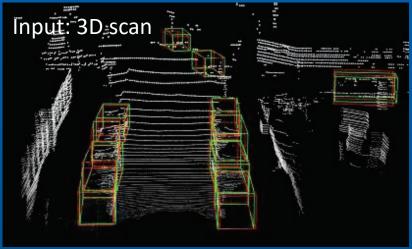
Computer vision enables

- Road line detection
- Traffic sign recognition
- Vehicle / pedestrian detection

• ...





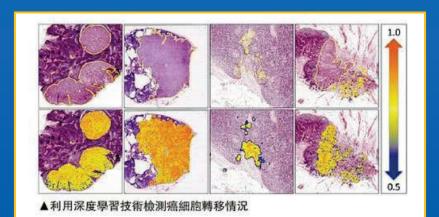


Reference: KITTI dataset

http://www.cvlibs.net/datasets/kitti/eval_object.php?obj_benchmark=3d

Al in Bioscience

Prof. P.-A. Heng





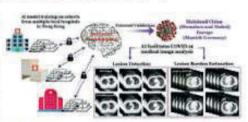
準確診斷患者病況 提升醫生診症效率



▲竇琪教授認為·醫療設備提供AI技術輔助的系統 可提升醫生工作效率及準確性。

退往很多醫生的經驗中掌握到的知識作為AI自 己的知識,然後把這個知識應用到實際的平臺 當中,有效緩解不同醫生之間的差異。

近年新冠肺炎爆發嚴重,中大為協助醫院治療,更研發了人工智能自動新冠肺炎CT影像分析系統,這是一個提供AI技術輔助的系統。為醫生提供一個AI的解決方案。實教授舉例,AI分析CT有兩個方面。第一,它可以自動把新短肺炎病人肺部的相應病患檢測出來,並定性及定量的準確診斷。另外,利用AI系統可自動追蹤及計算是表在使財務的概以,從否領意整件



▲中大最新研發的人工智能自動新冠肺炎CT影像分析系統,除了可自動把新冠肺炎病人肺部的相應病患 析系統,除了可自動把動冠肺炎病人肺部的相應病患 格測出來,並定性及定量的準確診斷。更可自動追蹤 及計算患者疾病收虧的變化。

Reference:

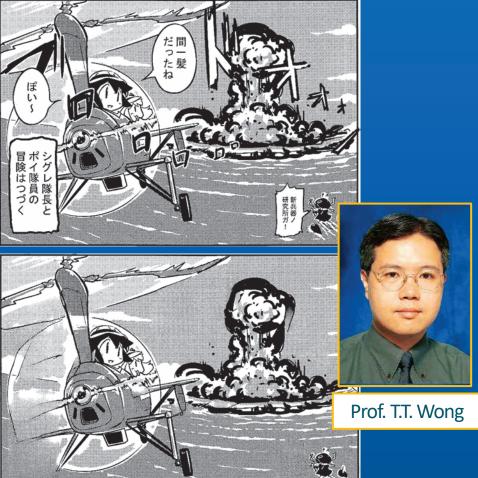
Prof. Dou Qi

https://bit.ly/38ofojs (2021年5月27日明報大學道專題) https://cutt.ly/xEYdPYC (2019年5月10日明報大學道專題)

Al in Creative Services

Al removes & auto-fills word balloon in manga





References:

https://hk.on.cc/hk/bkn/cnt/aeanews/20200208/bkn-20200208180001681-0208_00912_001.html http://www.cse.cuhk.edu.hk/~ttwong/papers/mangainpaint/mangainpaint.html

Al in Data

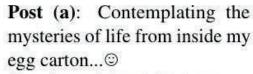
Al can help find insights in data, e.g., social media data, and relate different kinds of data







Can we predict a series of key phrases for a social media post with both texts and images?



#cat #cats #CatsOfTwitter



Post (b): The *<mention>* have the slight lead at halftime!

#NBAFinals





Reference:

Al in Finance

80%銀行未來5年增人工智能投資

HOW MACHINE LEARNING AND AI ARETRAN! By 信報財經新聞 on August 22, 2020 **FINANCE INDUSTRY**

SEPTEMBER 22, 2021 1:38 PM UTC, FINANCEFEEDS EDITORIAL TEAM

Thanks to the wealth of data that are increasingly available to banks and the general public, sophisticated algorithms are enabling improved processes in many areas of finance.



Image Source: Canva Pro

A subfield of artificial intelligence (AI), machine learning (ML) enables systems to learn and improve independently without the need for explicit programming or human involvement. But ML only works when it has access to enormous volumes of data, allowing

【金融科技】本港虛銀:AI及數據應用成發展關 鍵 港具地理優勢

文章日期:2020年1月14日14:16









本港8家處擬銀行料今年陸續開業,當中多家處銀高曆今均出席亞洲金融論增分享行業的 發展看法。平安壹賬通銀行行政總裁馮鈺龍則表示,人工智能(AI)已推動銀行業的整體 發展,例如Chatbox(聊天機械人)、語音機械人等,未來虛銀將致力加強有關應用,又 指香港具有鄰近內地的地理優勢,有利於兩地的人才交流與人才引入。

Like 69 people like this. Sign Up to see what your

原文刊於信報財經新聞



銀行業在人工智能應用上面對困難,包括相關人才不足及監管環境不斷轉變等 資料圖片)

金融科技為近年發展大趨勢,金管局旗下金融學院的香港貨幣及金融研究中心 日)發表研究報告,80%受訪銀行表示,計劃在未來5年內增加對人工智能的 風險管理和提升客戶體驗為最大原因。

References:

https://www.mpfinance.com/fin/instantf2.php?node=1578982602897&issue=20200114 http://startupbeat.hkej.com/?p=91478

Al in Gaming

Some games start to use AI:

- To bring non-player characters (NPC) to life
- To adapt to each player's gameplay
- To create stronger Al players, e.g., E-sport in Starcraft II (not only chess games)
- To create a more dynamic virtual world

References:

https://www.nature.com/articles/d41586-019-03630-0 https://www.nature.com/articles/d41586-019-03298-6





Al in Healthcare

- Radiology
- Imaging
- Disease Diagnosis
- Telehealth
- Electronic Health Records
- Drug Interactions
- Creation of NewDrugs

Reference:

https://inews.hket.com/article/2572760/



中大研發新系統 0.04秒完成評估

AI分析 CT 圖速驗新冠肺炎

由香港中文大學工程學院及醫學院组成的跨學 料團隊、研發一款新型人工智能(AI)系統,可針對 膀部電腦斷層掃植(CT)影像、快速檢測是否感染 新冠肺炎,只需0.04秒內即完成分析,其準確度更 高速96%。該研究成果已發表於Nature旗下綜合 期刊npj Digital Medicine上。

中大醫學院影像及介入放射學系系主任余後第 教授搞出,均簡對新冠肺炎的早期檢測一般採用發 酸測試或CT影像核酸測試靈敏度大的為70.6%3 975%·惟本地曾經有人的測試結果呈陰性,後死 卻成為風形患者。

至於CT影像方面,準確疾高達96%。惟醫至 的檢查一個CT影像,需時5至10分鐘,診斷過程 程時且容易出錯: AI系統僅在0.04秒內即可準確設 估整個三線CT影像。有望輔助醫生應付日常重視 的診斷工作,提高臨床診斷效率。

200患者數據訓練模型

中大團隊在去年1月至4月採集來自本地及 海外醫院的 CT數據,當中包括本港威爾斯親王書 院、瑪嘉烈醫院、屯門醫院,以至北京大學深圳書



高AI的準確度

在保護病人私隱的前提下·團隊成功採集 約200名來自不同醫院的患者數據;另通過 該特定特徵 體一化 (Domain-specific feature 過·日後如有變異確診個案·團隊將分析有關數據

助追蹤腫瘤放射診療

除了應用於新冠肺炎CT影像檢測·AI系統办

Reference (Apr 2021): http://startupbeat.hkej.com/?p=102056/

Prof. Dou Qi



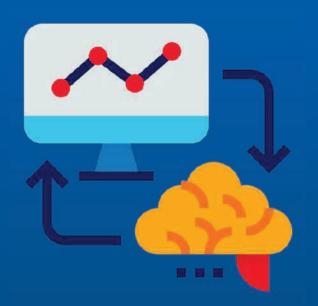
Growing Demand and Opportunities

- Many industries are now looking for the use and advancement of Al to boost up the work efficiency
 - » Opportunities for you to innovate and change the world!
- Many other possible occupations
 - » Al Specialist
 - » Data Scientist
 - » Software Developer
 - » Computer Engineer
 - » R&D for Al
 - **>>** ...



Programme Objective

- Equip students with the capabilities of building AI systems that can analyze and infer knowledge from massive information
- Backed by rigorous foundations like data structures, statistics, machine learning and distributed computing

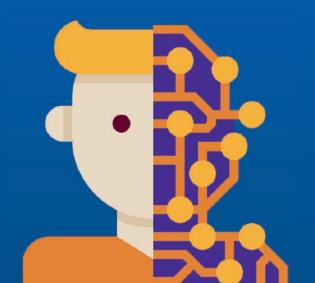


- Emphasize solid trainings on
 - » Mathematical analysis and reasoning on massive data
 - » Large-scale system design and implementation for processing massive data

Special Features

1st Bachelor of Engineering programme in Alin Hong Kong

- 4 specialized streams
 - » Biomedical Intelligence
 - » Intelligent Multimedia Processing
 - » Large-scale Artificial Intelligence
 - Theory and Systems
 - » Intelligent Manufacturing and Robotics



Mission

 Enable students to develop cutting-edge Al solutions that are of practical interest to academics, industry, and society

 Nurture local talents in AI related applications to meet today's tremendous need of well-trained

talents in AI and related specializations



Admission Requirements



AIST Admission Requirements for <u>JUPAS</u>

HKDSE Subject	Minimum Level	Subject Weighting				
HKDSE Core Subjects						
English Language	4	1.25				
Chinese Language	3	1.25				
Mathematics (Compulsory Part)	5^	1.75				
Citizenship and Social Development	A (Attained)	-				
HKDSE Elective Subjects						
Any two subjects	3	#				

Selection is based on the Best 5 HKDSE subjects with subject weighting applied. Bonus points will be awarded to the 6th and 7th subjects, if any.

[^] Applicants with level 4 in Mathematics (Compulsory Part) and good results in other HKDSE subjects will be exceptionally considered on a case-by-case basis.

[#] The AIST programme accepts any subject as elective, with subject weighting of 1.75 for Mathematics M1/M2; 1.5 for Biology, Chemistry, ICT, and Physics; and 1 for any other subjects.

AIST Admission Grades (2024 Entry)

Percentile	СНІ	ENG	MATHS	Citizenship and Social Dev	M1/M2	1 st Elective	2 nd Elective	3 rd Elective	2024 Programme Weighted Total^
Upper Quartile	5	4	5**	Attained	5*	5**	5*		57.25
Median	5**	4	5*	Attained	5	5*	5*		53.5
Lower Quartile	5	4	5*	Attained	5	5*	5*	5	51.125

[^] Category A subjects score conversion scale: $5^{**} = 8.5 \mid 5^* = 7 \mid 5 = 5.5 \mid 4 = 4 \mid 3 = 3 \mid 2 = 2 \mid 1 = 1$; Category C subjects score conversion scale: $A = 5 \mid B = 4 \mid C = 3 \mid D = 2 \mid E = 1$; Subject Weighting: Eng (x 1.25); Chi (x 1.25); Math (x 1.75); M1 or M2 (x 1.75); Bio, Chem, ICT, Phy (x 1.5).

AIST Admission Requirements for Non-JUPAS & International Applicants

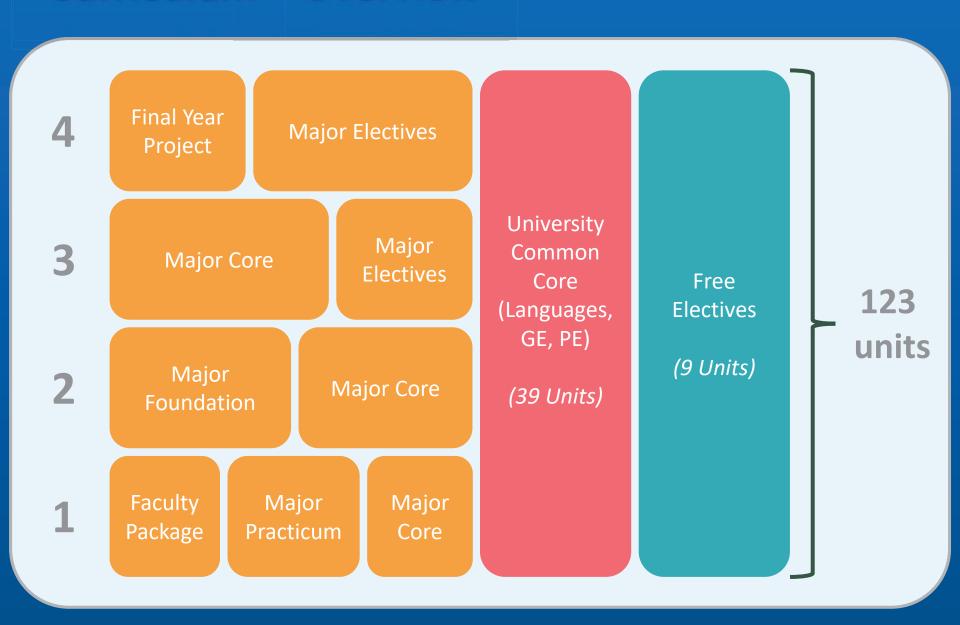
- Applicants seeking admission on the strength of qualifications other than HKDSE examination results (e.g., IB, GCE-AL, overseas qualifications) can apply through Non-JUPAS channels
- Will be considered on the basis of their education background and academic achievements
- Will be expected to demonstrate outstanding abilities in English, mathematics and science subjects

Check out details on the website of CUHK's Office of Admissions and Financial Aid: Non-JUPAS Applications: http://admission.cuhk.edu.hk/non-jupas-yr-1/requirements.html International Applications: http://admission.cuhk.edu.hk/international/requirements.html

Curriculum Structure



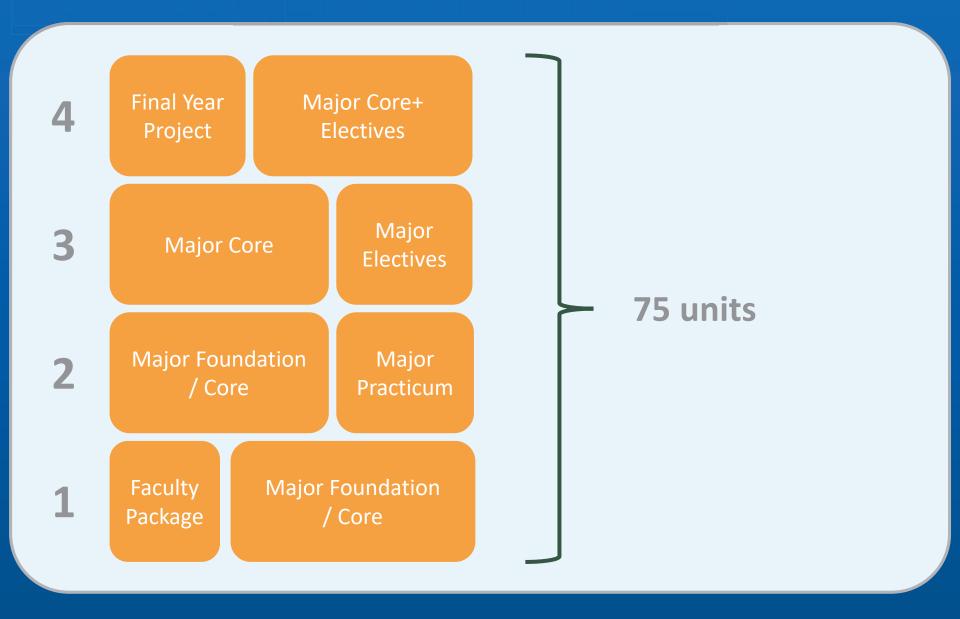
Curriculum – Overview



University Core Requirements

University Core Cour	ses	Units Requirements	
Language	English	8	
	Chinese	5	
General	University Foundation	6	
Education	University GE	7 (At least 2 units in each Area A, C & D)	
	College GE	6	
Understanding China (online course - compinctuding summer tea	olete before graduation in any one term,	1	
	der Constitutional Order (UGCP1002) olete before graduation in any one term, rm)	1	
Digital Literacy and C ENGG1004)	Computational Thinking (ENGG1003 or	3	
Physical Education		2	
	Total of units required	39	

Curriculum – Major Requirements



Major Requirements

Major Requirements	
Faculty Package	9
Foundation Courses	16
Major Required Courses	22
Research Components	6
Stream Requirements	22
Total of units required	75

Curriculum – Faculty Package

Final Year Major Core+ **Electives** Project Major Major Core Electives **Major Foundation** Major / Core Practicum Faculty **Major Foundation** Package / Core

Faculty Package (9 units)

- » Programming (ENGG1110)
- » Linear Algebra (ENGG1120)
- » Multivariable Calculus (ENGG1130)

Curriculum – Major Foundation

Final Year Major Core+ **Electives** Project Major Major Core Electives **Major Foundation** Major / Core Practicum **Major Foundation** Faculty Package / Core

Major Foundation / Core (10 units)

- » Calculus for Engineers (MATH1510)
- » Physics (PHYS1003/1110)
- » Intro to AI & ML (AIST1000)
- » Intro to Computing Using Python (AIST1110)



Curriculum – Major Foundation

Final Year Major Core+ Major Foundation / Core (10 units) **Electives** Project Discrete Maths (ENGG2440) Probability (ENGG2760) Statistics (ENGG2780) Major Major Core Data Structures (CSCI2100) **Electives Major Foundation** DICE CHART Major / Core Practicum Faculty **Major Foundation** / Core Package

PROBABILITY

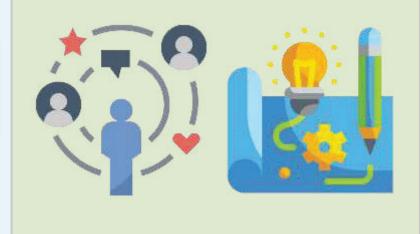
6/36

Curriculum – Major Practicum

Final Year Major Core+ **Electives** Project Major Major Core Electives **Major Foundation** Major / Core **Practicum** Faculty **Major Foundation** Package / Core

Major Practicum (3 units)

- » Technology, Society and Engineering Practice (AIST2601)
- » Engineering Practicum (AIST2602)



Curriculum – Major Core

Final Year Major Core+ **Electives** Project Major Major Core Electives **Major Foundation** Major / Core Practicum Faculty **Major Foundation** Package / Core

Major Core (12 units)

- » Numerical Optimization (AIST3030)
- » Design and Analysis of Algorithms (CSCI3160)
- » Fundamentals of Artificial Intelligence (CSCI3230)
- » Fundamentals of Machine Learning (CSCI3320)



Curriculum – Major Electives

Final Year Major Core+ **Electives** Project Major Major Core **Electives Major Foundation** Major / Core Practicum Faculty **Major Foundation** Package / Core

Major Core (3 units)

» Foundation of Applied Deep Learning (AIST4010)

Major Electives (22 units)

Streams

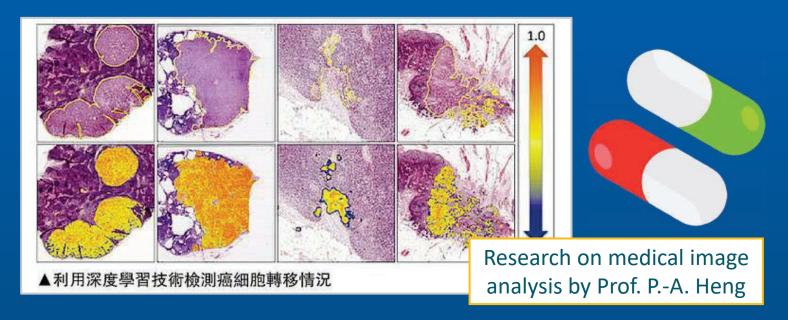
- 1. Biomedical Intelligence
- 2. Intelligent Multimedia Processing
- 3. Large-scale Artificial Intelligence Theory and Systems
- 4. Intelligent Manufacturing and Robotics

Non-Stream

5. General Artificial Intelligence: Systems and Technologies

Stream 1: Biomedical Intelligence

- Study how to build intelligent biomedicine and healthcare applications
- Two emerging markets:
 - » Personalized genomics and precision medicine (e.g., disease prevention, prediction, early diagnosis and treatment)
 - » Clinical record systems (e.g., electronic medical records and pharmacy prescription information and insurance records)



Stream 2: Intelligent Multimedia Processing

- Study how to bridge AI and human brain functions and design models, algorithms, and systems for multimedia processing with high performance and high accuracy.
- Areas: digital image processing, face recognition, computer animation, human-computer interactions, speech and audio processing, computational linguistics





Stream 3: Large-scale AI – Theory and Systems

- Study the advanced techniques of realizing large-scale artificial intelligence from both theory and system perspectives
 - » Theory: machine learning theory, statistical inference, online algorithms, etc.
 - » Systems: high performance computing, distributed storage, big data management, etc.



Stream 4: Intelligent Manufacturing & Robotics

- Study how to integrate manufacturing and robotics with Al for different aspects of human activities.
- Focus on the topics of mechanics, sensing and control, design & manufacturing, human-robot interactions, etc.





Curriculum – Final Year Project (FYP)

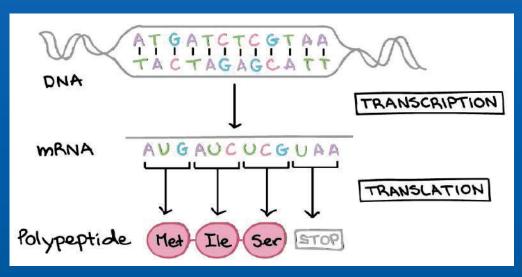


Final Year Project (6 units)

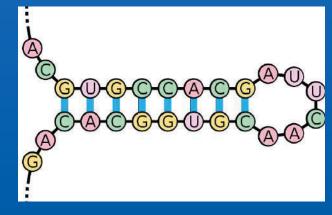
- » Pick an interesting topic
- » Interdisciplinary nature
- » Apply the knowledge learnt in the previous courses
- » Many open topics. Your creativity and discussion with the supervisor
- » Complete a project under the supervision of an advisor

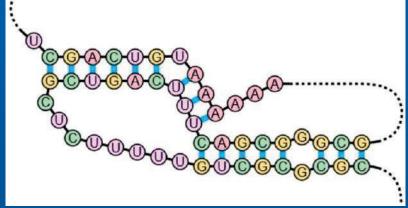
Example of FYP (AI + Bioinformatics)

Apply machine learning to predict RNA-protein interaction



RNA-binding protein (RBP)

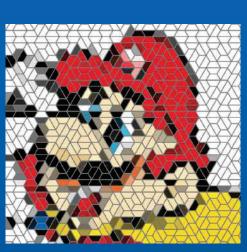




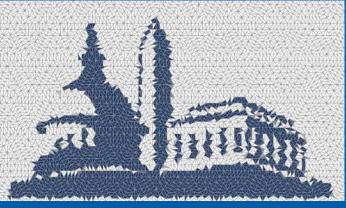
RNA folds to a specific structure to fit into the protein binding site

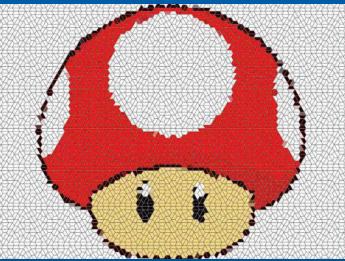
Example of FYP (AI + Multimedia)

Design a neural network that learns to produce a tiling



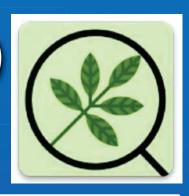


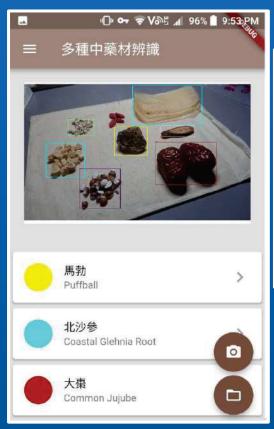




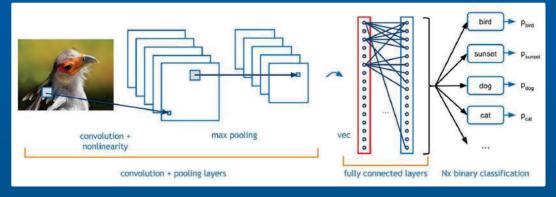
Example of FYP (AI + Computer Vision)

Chinese Medicinal Herb Recognizer









Example of FYP (AI + 3D Vision)

Design the best neural network for 3D car detection



More practical and interesting topics:

- » Machine Learning
- » Deep Learning
- » Large Scale Distributed Computing
- » Intelligent Embedded Systems
- » Knowledge Representation/Inference
- » Human-Computer Interactions
- » Natural Language Processing
- » Big Data Analytics

•••

What's More?

- Chances to create your own project and innovation with support and advice from CSE teachers
- Exchange opportunities to world-class universities
- High competitiveness in job market with 90% of CSE graduates employed within one month of graduation
- CSE teachers usually have the highest teaching evaluation scores

Industrial Visits

 Visit to companies to learn about the latest developments in the industry





Cathay Pacific



Hong Kong Science and Technology
Parks Corporation

Work-Study Scheme

- One-year placement and internship for students to gain practical experience in a real working environment
- 3 years study + 1 year work-study + 1 final year study

Example of Previous Opportunities in CSE











恒生銀行 HANG SENG BANK











Sharing from our AIST Alumni



Long Him CHIU,
AIST 2023 Graduate

Thanks to the invaluable connections knowledge I have gained at CUHK, I have been able to apply my academic expertise in AIST to successfully launch and operate my own startup with some CSE friends I met in the programme. This university has played a pivotal role in shaping my career path and created opportunities for personal growth. With support from CUHK, we have been able to transform our aspirations into reality. I will be forever grateful for the transformative experience and lifelong connections I have gained during my time at CUHK.

Sharing from our AIST Alumni

The special thing about AIST programme is the learning experience which has been eye-opening. I can get to build a solid foundation on not only the problem-solving mindset, but also fundamental knowledge such as calculus and statistics. Although some may find them difficult, they are valuable tools that will help distinguish me from the non-engineering counterparts.



Marco AU YONG,
AIST 2023 Graduate

FAQs



Q: Will there be any interview?



Interview Arrangements for JUPAS Applicants

- Interviews will be arranged in mid/late June every year.
- Not all applicants will be interviewed. We only consider Band A applications when shortlisting interviewees.
- Shortlisted applicants will receive an invitation email by early June for the details, e.g., date, time, format, etc.
- Stay tuned! Check your email regularly for the latest update!



Interview Arrangements for Non-JUPAS & International Students

- Interviews will be conducted in batches from ~Dec. every year.
- You are encouraged to attach adequate supporting documents, e.g., transcripts, predicted grade, certificates, etc., in your application for our holistic review.
- Shortlisted applicants will receive an invitation email for the details, e.g., date, time, format, etc.
- Stay tuned! Check your email regularly for the latest update!

Q: How many students will be admitted to AIST?



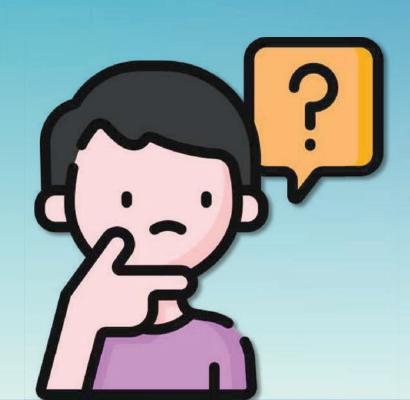
Local Intake Quota (for reference only)

around 30



Note: There is no fixed quota for international students and Mainland students attempting Gao Kao.

Q: Will there be any exchange opportunity?



Exchange to Overseas Universities

- You are encouraged to join the exchange programme to broaden your horizon and learn with peers from diverse background
- List of some overseas universities for the exchange
 - » The University of Sydney, Australia
 - » University of Toronto, Canada
 - » University of Waterloo, Canada
 - » Tsinghua University, China
 - » Seoul National University, Korea
 - » Nanyang Technological University, Singapore
 - » National University of Singapore, Singapore
 - » University College London (UCL), UK
 - » Georgia Institute of Technology, USA
 - » University of Illinois at Urbana-Champaign, USA
 - » ETH Zurich, Switzerland



Submit you application via Office of Academic Links (OAL)!

Q: Will there be any scholarship or financial aid?



Scholarships and Financial Aids

- The Government and the University offer various scholarships and financial aids depending on student's financial situation, or their outstanding performance in academic or other areas
- List of some scholarships and financial aids
 - » Admission Scholarships
 - » Scholarships for Overseas Studies
 - » Government or University Financial Aid
 - » Summer Subsistence and Travel Loan Scheme
 - » Student Residence Bursary Scheme

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Check out more details on the website of CUHK's Office of Admissions and Financial Aid: https://admission.cuhk.edu.hk/finance.html

Q: What are the differences between AIST and CSCI?



AIST vs CSCI?

- AIST and CSCI have related foundation & basic theories
- AIST requires stronger Math foundation since it involves statistics, probability, calculus, linear algebra, etc., which are basis for machine learning and deep learning
- CSCI focuses more on software design and computing solutions, taking care of coding and software architecture



Q: What are the career prospects of AIST graduates?



Career Prospects

- Employers of our graduates include:
 - » Google
 - » Intel
 - » Microsoft
 - » IBM
 - » Apple
 - » Facebook
 - » Yahoo
 - » Deloitte
 - » Hong Kong Government
 - » Investment Banking Institutes

Many disciplines are changing

- A Automotive
- B Bioscience
- C Creative Services
- D Data
- E Education
- F Finance
- G Gaming (note: G may also mean Government)
- H Healthcare
- I Internet of Things



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Q: Can I transfer to CENG / CSCI or other majors in Year 2?



If you look for CENG / CSCI or other majors instead...

- You may submit application for change of major (to CENG / CSCI or other majors), subject to prevailing regulations stipulated by RES and approval by relevant unit(s).
- If you are determined to go for CENG / CCSCI, you may choose Computer Science and Engineering (JS4412) as your choice and select CENG / CSCI in Major Allocation when progressing to Year 2.











Q: Can I declare CENG / CSCI as second major or minor?



Declare Second Major / Minor

- You are not allowed to declare CENG / CSCI as your second major or minor if you are a CSE student.
- However, you are encouraged to broaden your horizons and declare second major / minor offered by other departments.







Q: I am still struggling to choose between AIST / CENG / CSCI. What can I do?



If you are still struggling to choose...

- You can go through our website and admission materials for a better understanding before applying, and write to us via email at ug-admiss@cse.cuhk.edu.hk if you have any further queries.
- You can join our outreach activities in the future and chat with our teachers and student ambassadors.



Contact Us



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