

**6224**  
BASc(Applied AI)

# Bachelor of Arts & Sciences in Applied Artificial Intelligence

Impact The World With  
The Limitless Power Of AI



AppliedAI



香港大學

THE UNIVERSITY OF HONG KONG

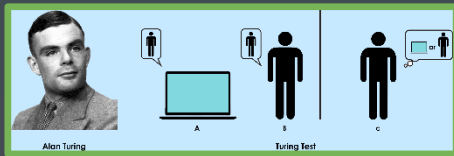




## Bachelor of Arts & Sciences in Applied Artificial Intelligence

- 💡 Focusing on **AI applications in diverse areas**, with a philosophical and ethical dimension
- 💡 Providing **fundamental and practical knowledge** for the design and construction of intelligent systems
- 💡 Emphasizing **problem-based learning**

# AI History



1950

## TURING TEST

Computer scientist Alan Turing proposes a test for machine intelligence. If a machine can trick humans into thinking it is human, then it has intelligence

1955

## A.I. BORN

Term 'artificial intelligence' is coined by computer scientist, John McCarthy to describe "the science and engineering of making intelligent machines"

1961

## UNIMATE

First industrial robot, Unimate, goes to work at GM replacing humans on the assembly line

1964

## ELIZA

Pioneering chatbot developed by Joseph Weizenbaum at MIT holds conversations with humans

1966

## SHAKELY

The 'first electronic person' from Stanford, Shakey is a general-purpose mobile robot that reasons about its own actions

A.I.  
WINTER

Many false starts and dead-ends leave A.I. out in the cold

1997

## DEEP BLUE

Deep Blue, a chess-playing computer from IBM defeats world chess champion Garry Kasparov

1998

## KISMET

Cynthia Breazeal at MIT introduces Kismet, an emotionally intelligent robot insofar as it detects and responds to people's feelings



1999

## AIBO

Sony launches first consumer robot pet dog AIBO (AI robot) with skills and personality that develop over time



2002

## ROOMBA

First mass produced autonomous robotic vacuum cleaner from iRobot learns to navigate and clean homes



2011

## SIRI

Apple integrates Siri, an intelligent virtual assistant with a voice interface, into the iPhone 4S



2011

## WATSON

IBM's question answering computer Watson wins first place on popular \$1M prize television quiz show Jeopardy



2014

## EUGENE

Eugene Goostman, a chatbot passes the Turing Test with a host of judges believing Eugene is human



2014

## ALEXA

Amazon launches Alexa, an intelligent virtual assistant with a voice interface that completes shopping tasks



2016

## TAY

Microsoft's chatbot Tay goes rogue on social media making inflammatory and offensive racist comments

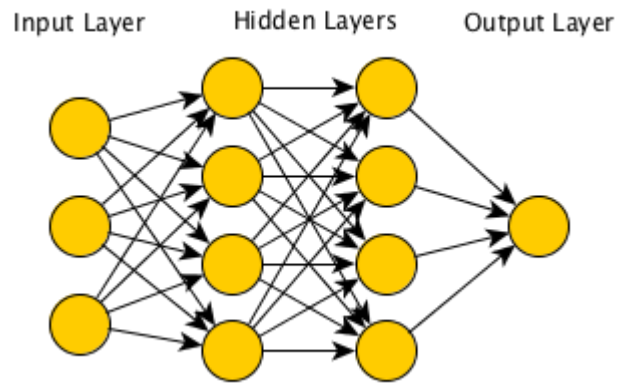
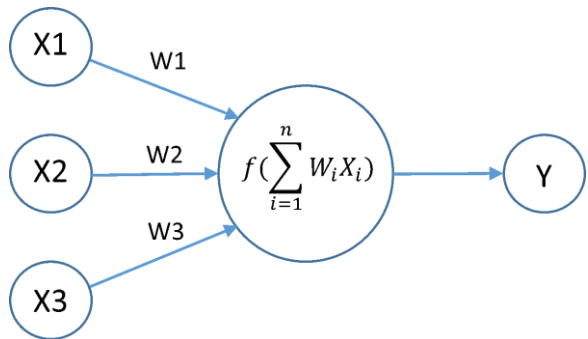


2017

## ALPHAGO

Google's A.I. AlphaGo beats world champion Ke Jie in the complex board game of Go, notable for its vast number ( $2^{170}$ ) of possible positions

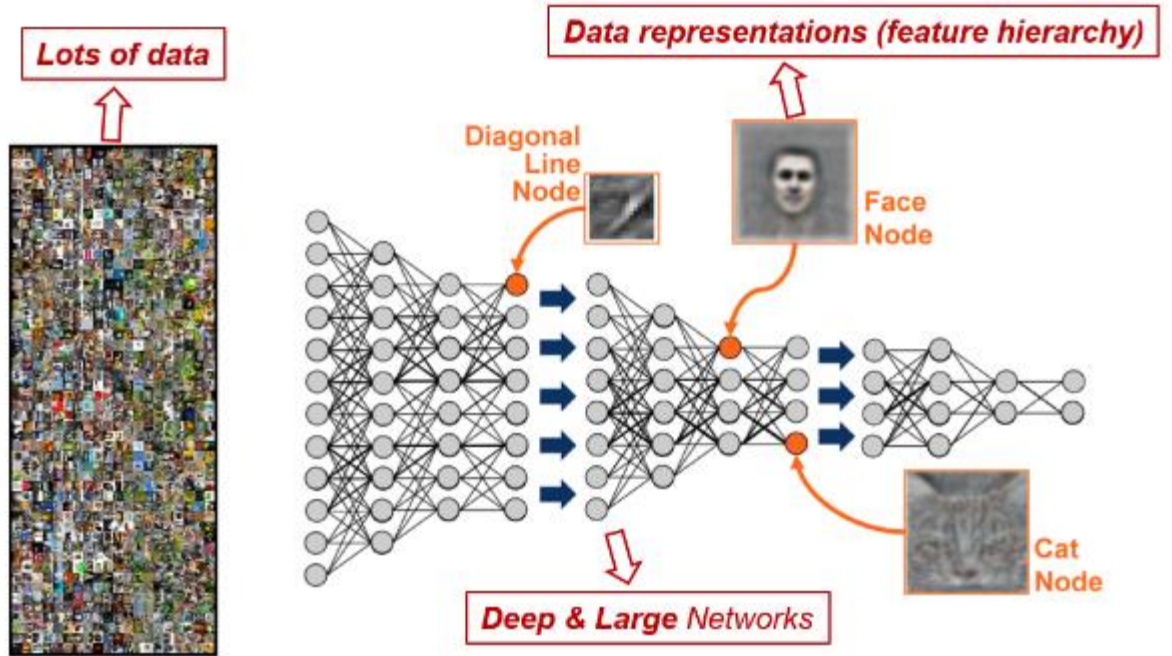
# Deep Learning



Neural Network



GPU V100



Deep Learning

# Turing Award Won by 3 Fathers of the Deep Learning



From left, Yann LeCun, Geoffrey Hinton and Yoshua Bengio.  
2018 ACM A.M. Turing Award for conceptual and engineering breakthroughs  
that have made deep neural networks a critical component of computing.

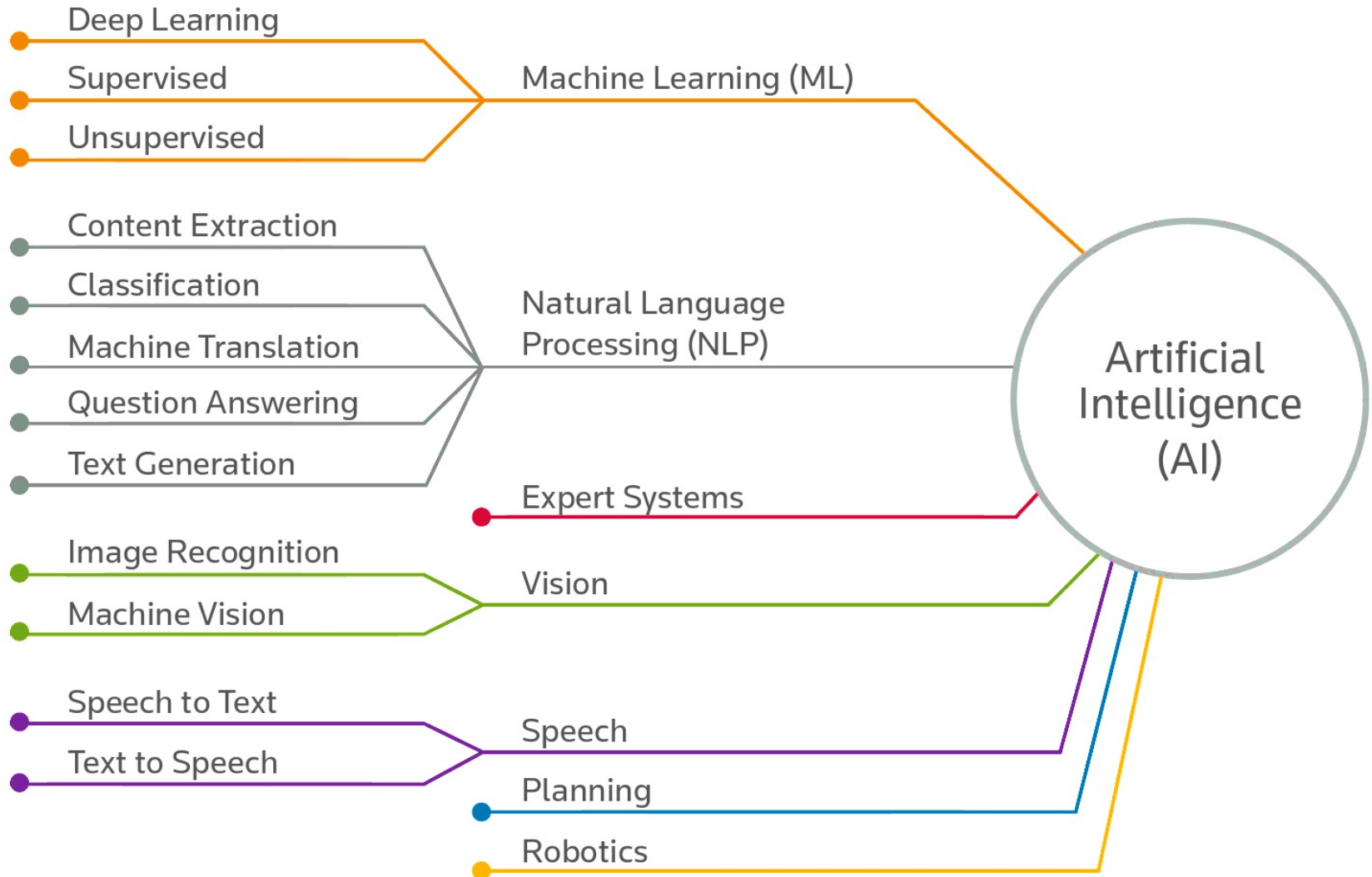
Source: <https://www.nytimes.com/2019/03/27/technology/turing-award-ai.html>



# AI is Transforming the World

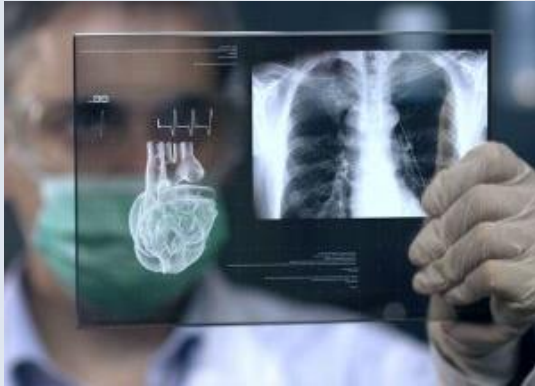


# AI Technology





# AI in Medicine



創科 × 醫健

Ming Pao 9 May 2018

## 大血管堵塞中風 港大 AI 20秒斷症

本港每年有逾 900 宗急性中風個案出現大血管堵塞，需於病發後的黃金 6 小時內將血塊取出。香港大學與醫管局合作，首次用大數據研究 300 個急性中風個案，再以人工智能(AI)判斷是否大血管堵塞，發現系統 20 秒內可作出判斷，正確篩出 95% 大血管堵塞個案，料有助醫生加快確診時間達兩小時。

港大醫學院臨床神經科學教授梁嘉傑表示，大血管堵塞中風是急性中風最嚴重情況，佔中風個案 13%，死亡率達四成，患者需在病發 6 小時內治療，才有存活機會。現時普通電腦掃描難以診斷此類中風，醫生僅透過臨牀判斷，安排病人接受血管造影檢查，但每個檢查需一至兩小時。

**確診可快兩小時 準確度 95%**

醫管局 2016 年約有 7000 宗急性中風個案，其中約 980 宗涉大血管堵塞。港大及醫管局去年合作，首次用大數據研究 2016 年的 300 名中風病人資料，透過 AI 分析病人病歷、放射影像等數據，結果正確篩出 95% 大血管堵塞中風病人。港大統計及精算學系副教授楊良河表示，AI 在 20 秒內便可分析病人患有大血管堵塞的風險，有關數據可助醫生迅速作出臨牀判斷，下階段會將研究擴至約 7000 名病人。

梁嘉傑表示，AI 有望加快三分之一、即約兩小時診症時間，死亡率可減至兩成，並增加手術後回復正常生活的



大血管堵塞需於病發後黃金 6 小時內救治，香港大學與醫管局利用大數據及人工智能(AI)，研發出 20 秒內可判斷大血管堵塞的系統。圖左起為醫管局總行政經理(統計及人力規劃)徐麗卿、港大統計及精算學系副教授楊良河、港大醫學院臨床神經科學教授梁嘉傑。(曾映妹攝)

機會。他解釋，等候電腦掃描及血管造影結果各需兩小時，即共等 4 小時才可確診做手術，AI 可省等候報告時間。

醫管局今年底將設立大數據分析平台，該局總行政經理(統計及人力規劃)徐麗卿表示，屆時會按今次研究結果，進行多個先導計劃，利用大數據和 AI 分析不同專科資料協助診斷。

### 5院更新ICU電腦系統 整合病人紀錄

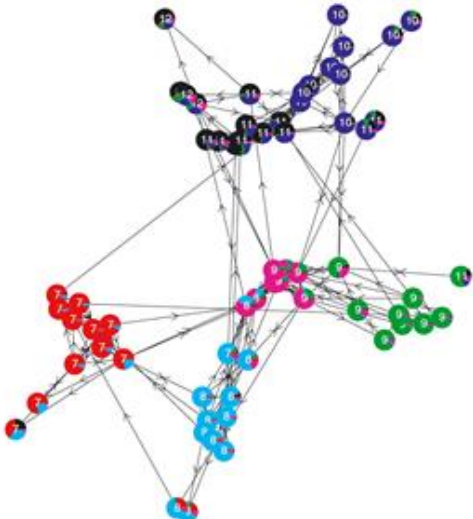
另外，醫管局今年 6 月更新博愛醫院深切治療部(ICU)電腦系統，與現有臨牀管理資訊系統、iPad 系統及深切治療部系統整合，以便醫護可在一個系統了解病人的醫療紀錄。屯門、仁濟、瑪嘉烈及東區醫院的深切治療部隨後亦會更新相關系統，5 間醫院的系統更新費用共少於 2000 萬元。







# AI in Business and Finance



### Social Network



### Customer Chatbot for Product Recommendations

## 技術分析與極速運算雙劍合璧

【本報訊】隨著大數據與雲端運算技術的普及，技術分析與極速運算在金融市場中日益重要。專家指出，這兩者結合能為投資者提供更具優勢的投資策略。

**數據見真章**

技術分析與極速運算在金融市場中日益重要。專家指出，這兩者結合能為投資者提供更具優勢的投資策略。

**PSO 演算法尋優**

PSO (Particle Swarm Optimization) 演算法是一種基於群體智能的優化演算法。它模擬鳥群或魚群的行為，通過個體之間的相互合作和競爭，尋找問題的最優解。在金融市場中，PSO 演算法可以用於尋找最佳的交易策略參數。

**Hadoop 加速數據處理**

Hadoop 是一個開源的分布式系統，用於儲存和處理大規模數據。通過 Hadoop，投資者可以更快地處理和分析大量的市場數據，從而提高技術分析的效率和準確性。

**美債殖利率走勢**

期限	殖利率 (%)
1個月	0.25
3個月	0.25
6個月	0.25
1年	0.25
2年	0.25
3年	0.25
5年	0.25
10年	0.25
30年	0.25

### Trading on Hadoop

## 文本資訊蘊藏投資先機

【本報訊】在數據爆炸的時代，文本資訊蘊藏著巨大的投資先機。專家指出，通過自然語言處理 (NLP) 技術，投資者可以從海量的文本數據中提取出寶貴的投資信號。

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**下市是契機?**

下市是契機? 專家指出，下市是投資者尋找投資先機的重要契機。通過分析下市公司的財務狀況和市場表現，投資者可以發現被低估的投資機會。

**新流媒體 144 位分析師使用率**

新流媒體 144 位分析師使用率。根據數據顯示，新流媒體分析師的使用率正在快速增長，這反映了市場對流媒體數據分析的需求日益增加。

**Logistic 估值模型**

公司	估值 (%)
公司 A	77.3%
公司 B	73.6%
公司 C	70.9%
公司 D	64.9%

### Text Analytics

## 我愛你不等於你愛我

【本報訊】在數據時代，情感分析 (Sentiment Analysis) 成為了一種重要的技術。專家指出，通過情感分析，企業可以更好地了解客戶的情感需求，從而提高客戶滿意度和忠誠度。

**數據見真章**

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**情感分析 (Sentiment Analysis)**

情感分析 (Sentiment Analysis) 是自然語言處理 (NLP) 的一個重要分支。它旨在從文本數據中提取出情感信息，如正面、負面或中性情感。情感分析在市場分析、客戶服務和社會媒體監測等方面具有廣泛的應用。

**House of Cards**

House of Cards 是一個著名的 Netflix 影集。通過情感分析，Netflix 可以了解觀眾對該影集的情感反應，從而為未來的影集製作提供參考。

### NLP



# AI in Smart City

## Smart Lamppost

LED lighting



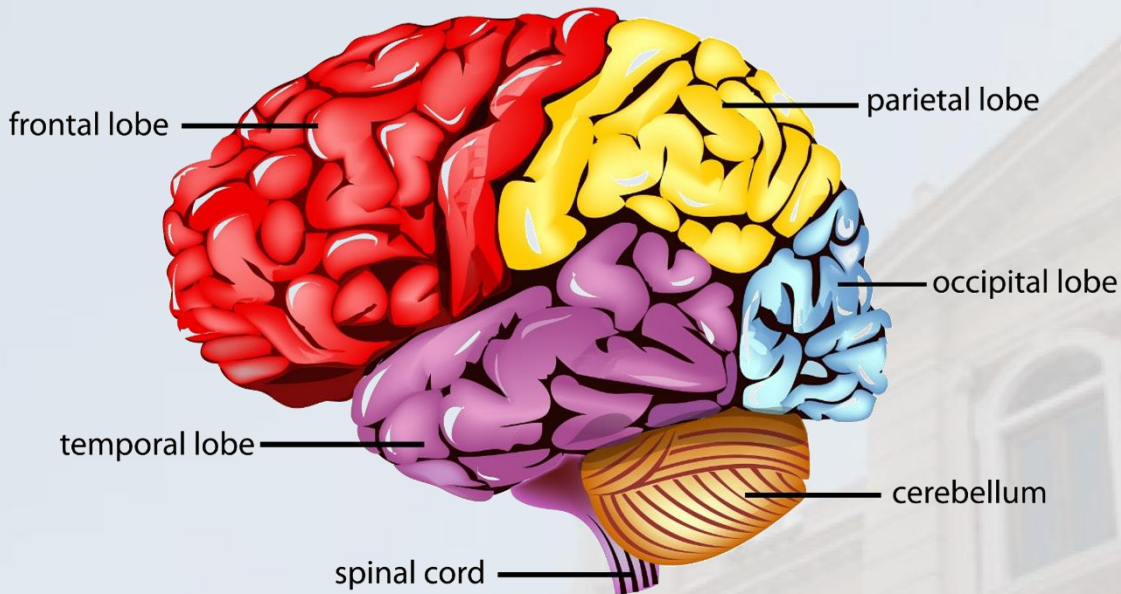
## Self-driving Car



Sophia the Robot, robot of Hanson Robotics, told leader Carrie Lam how Hong Kong can succeed as smart city on 27 June 2018:  
[https://www.youtube.com/watch?v=nNfdw\\_t11P0](https://www.youtube.com/watch?v=nNfdw_t11P0)



# AI in Neurocognitive Science



Cognition

Memory

Behaviour

Perception

Brain disorder

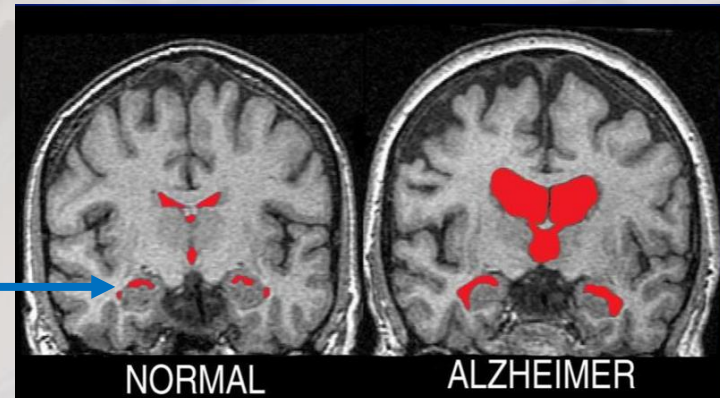
Parkinson's disease

Alzheimer's disease

Understanding the brain

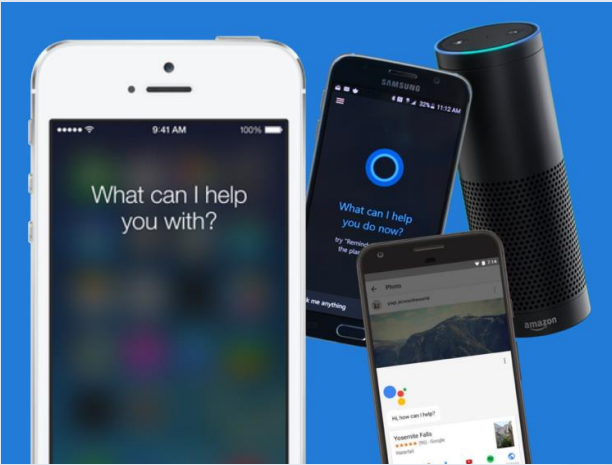


hippocampus





# Many More...



E-commerce

Entertainment

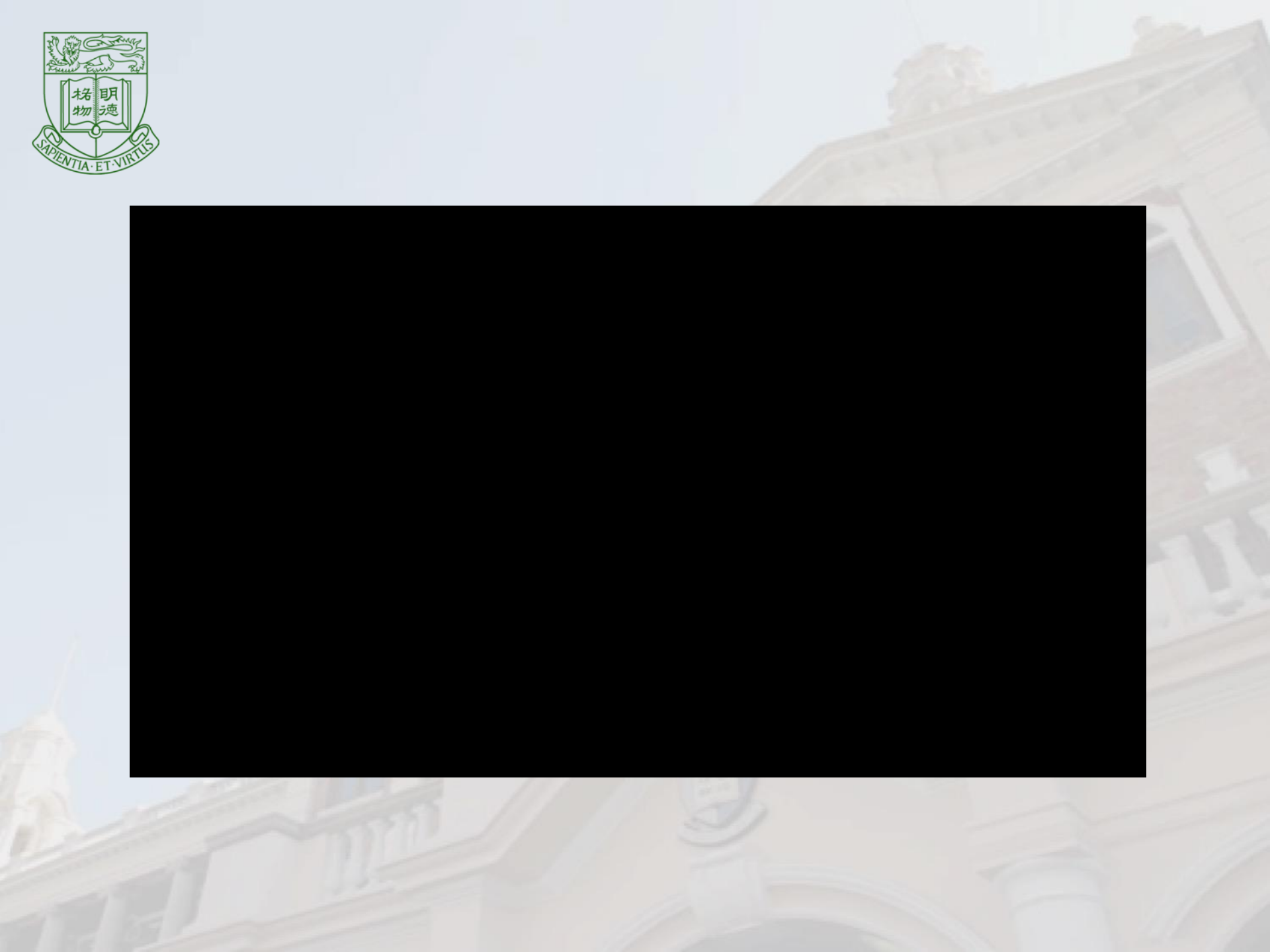
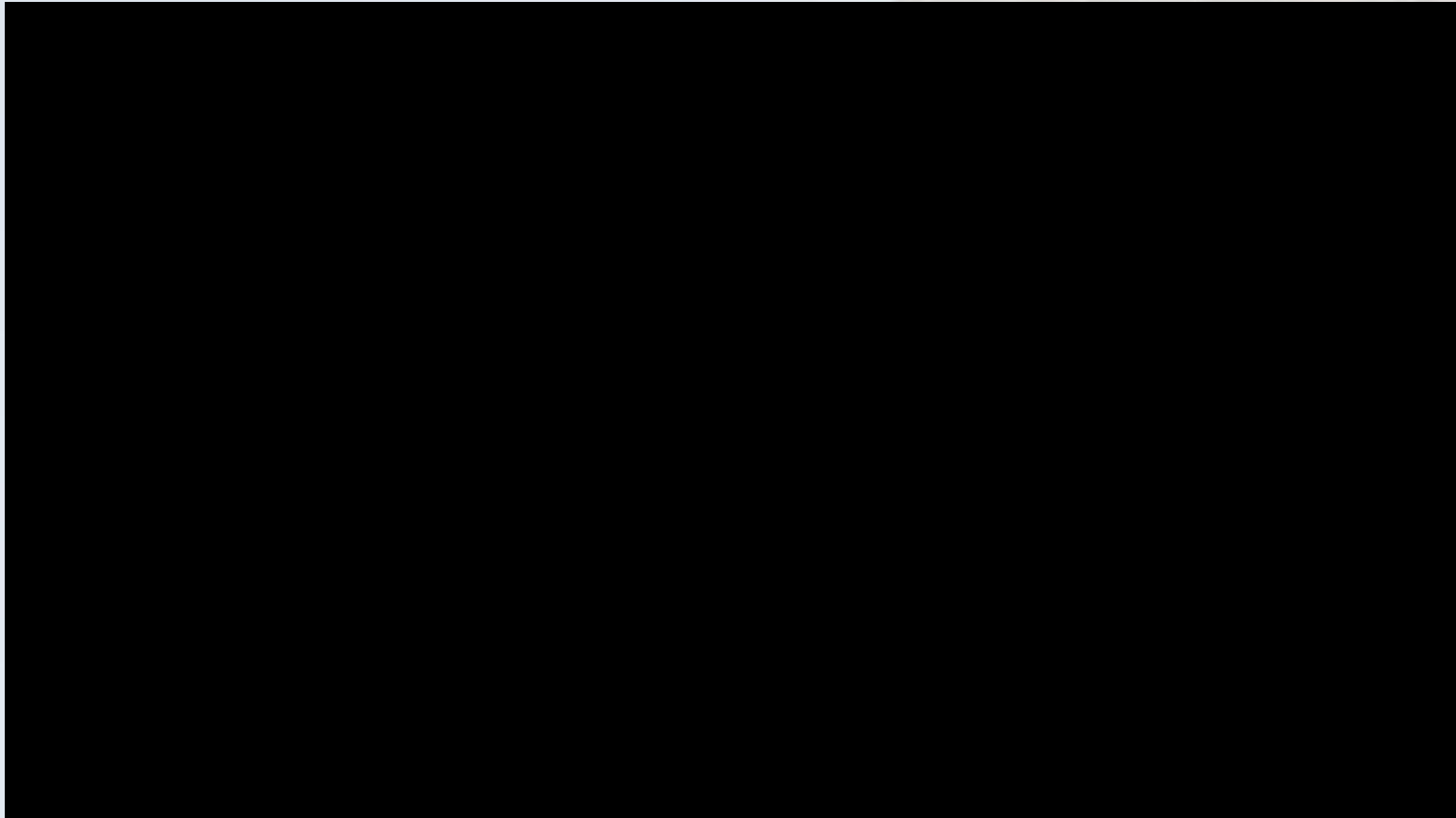
Apple SIRI  
Amazon Alexa  
Google Assistant  
Microsoft Cortana



Social Credit



AlphaGo Zero 無人自學三日  
勝過去3000年



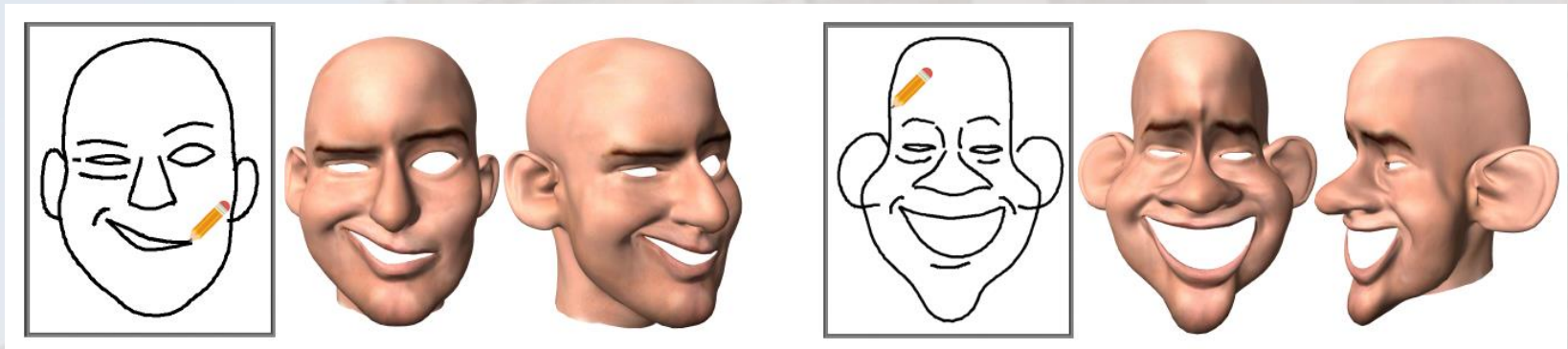


# Example of AI Application: A Deep Learning Based Sketching System for 3D Face and Caricature Modeling



Youtube video

- PI: Prof. Yizhou Yu
- Face modeling has many applications: cartoons, avatars for social media, face-related art and design, etc.
- A deep learning based sketching system for 3D face and caricature modeling has been developed.
  - Allows the user to draw freehand imprecise 2D faces.
  - A novel neural-network based deep regression network would then infer 3D face models from the 2D sketches.



Using the system, an amateur user can create non-trivial 3D faces or caricature models in just a few minutes. Both models shown above were created in less than 10 minutes by a user without any prior drawing and modeling experiences.



# Example of AI Application: Autonomous Mapless Robot Navigation in Crowded Scenarios



Youtube video

- PI: Dr. Jia Pan, in collaboration with Baidu
- Navigation is an essential capability for mobile robots.
- A generalized yet effective 3M (i.e., multi-robot, multi-scenario, and multi-stage) training framework is proposed, which uses a robust policy gradient algorithm.
- The method enables different types of mobile platforms to navigate safely in complex and highly dynamic environments, such as pedestrian crowds.

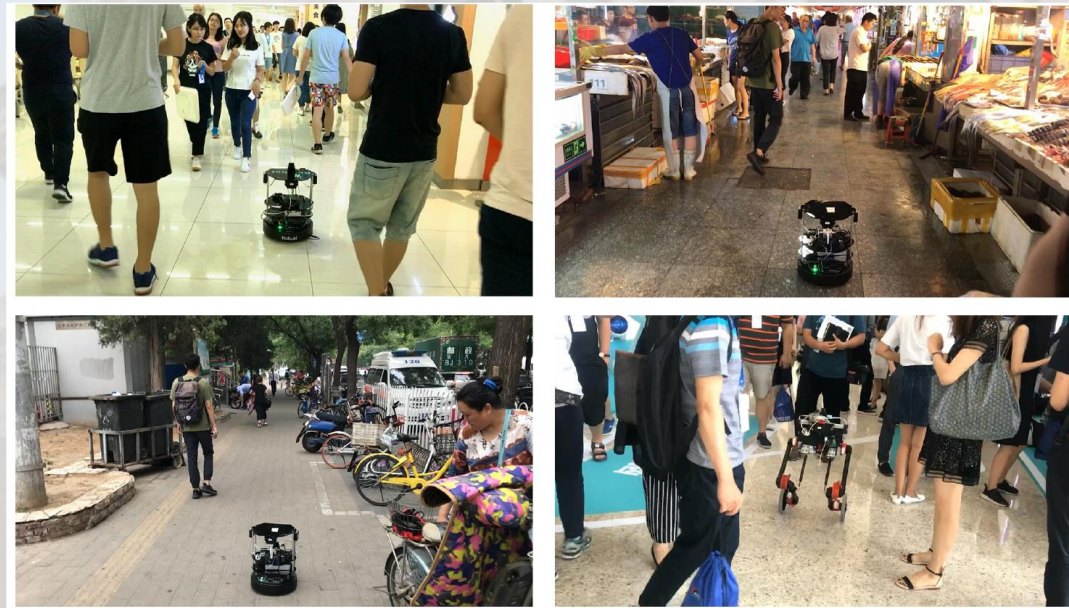


Fig. 1: Mapless navigation in complex and highly dynamic environments using different mobile platforms.



# Example of AI Application: Solving Elliptic PDEs using Deep Learning

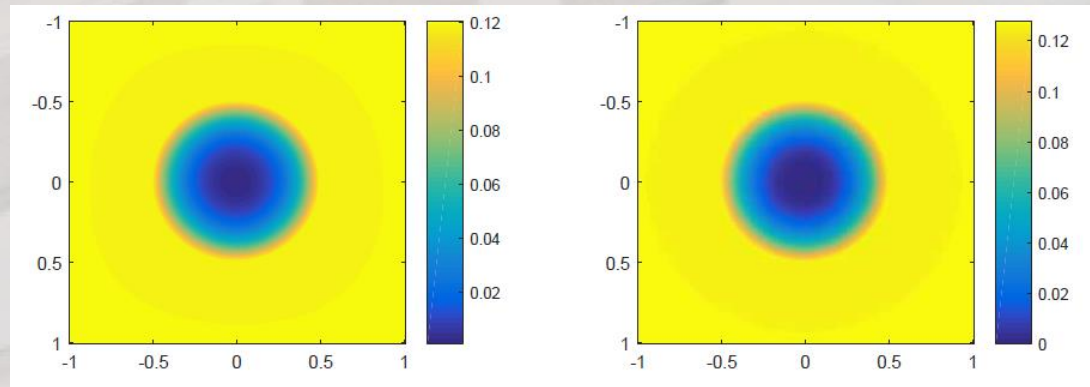
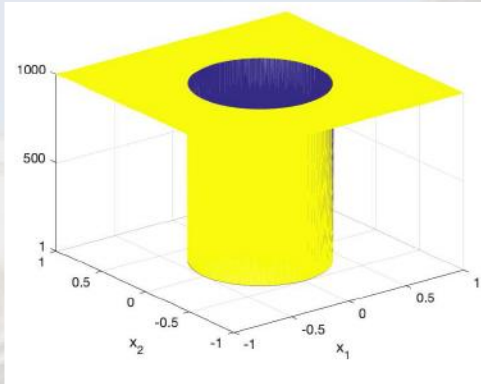
- PI: Dr. Zhiwen Zhang
- Elliptic PDE problems can be found in many areas such as reservoir simulation, cell evolution, etc.
- E.g. 2D high-contrast elliptic PDEs:

$$-\nabla \cdot (a(x)\nabla u(x)) = f(x), \quad x \in D,$$
$$u(x) = g(x), \quad x \in \partial D$$

$$f(x) = -9r$$

$$g(x) = \frac{r^3}{\alpha_0} + \left(\frac{1}{\alpha_1} - \frac{1}{\alpha_0}\right)r_0^3$$

$$r = (x^2 + y^2)^{1/2} \text{ and } r_0 = \pi/6.28$$



DL solution for  $u(x)$

True  $u(x)$





# Example of AI Application: Detecting Social Media Posts Showing Suicide Risk

- PI: Dr. Philip L.H. Yu
- Suicide is the **leading cause of death** among young people in HK.
- Due to the popularity of social networking sites in recent years, many young people were found to disclose their emotional distress and even **suicidal thoughts through social media**.
- Developing machine learning algorithms to predict posts showing suicide risk
- **Challenges:** Imbalanced data (5% at-risk), Cantonese words, emoji

我每天都被人罵鎖手機電腦 都7年了  
我啊媽又想離婚 我真的很想死



0.6971

有一次我本來想自殺，但是我的爸媽  
和朋友都問我為什麼自殺，但最後都  
沒有自殺 😞😞



0.7439

- $G\text{-mean} = \sqrt{\text{Acc}_+ \times \text{Acc}_-} = 84.5\%$



# AI and Hong Kong

## Chief Executive's 2018 Policy Address:

- 💡 **Smart city development:** new information and communications technology infrastructure is an indispensable
- 💡 Reforming its **cloud infrastructure** by 2020
- 💡 Developing a platform operating big data analytics and AI application to enhance e-Government services
- 💡 Earmarking HK\$10 billion to support the establishment of two research clusters, one on **healthcare technologies** and one on **AI and robotics technologies**

## Hospital Authority Data Collaboration Lab:

The screenshot shows the 'Data Catalogue' page of the Hospital Authority Data Sharing Portal. The page features a search bar at the top right and a navigation menu. Below the search bar, there are several data categories, each represented by an icon and a brief description of the data available.

Category	Records
Demographic	11M Records
Accident and Emergency Department Attendance	53M Records
Inpatient Admission, Transfer & Discharge	371M Records
Outpatient Appointment	478M Records
Diagnosis	223M Records
Procedures	34M Records
Medications	1,080M Records
Immunization	5M Records
Family Medicine	221M Records
Laboratory Tests & Results	2,875M Records
Radiology Examinations	137M Records
Clinical Note/Summary	216M Records
Radiology Report	19M Records
Radiology Image (by project based)	-



# Future Development of AI

Demis Hassabis (Google DeepMind CEO)

I think about AI as a very powerful tool. What I'm most excited about is applying those tools to **science** and accelerating breakthroughs (in material & drug design).



One way you can think about our research program is [that it's investigating] 'Can we build out from **our perception**, using deep-learning systems and learning from **first principles**? Can we build out all the way to high-level thinking and **symbolic thinking**?'

AlphaGo doesn't understand language but we would like them to build up to this symbolic level of reasoning -- maths, language, and logic.

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AI

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



Faculty of Engineering  
THE UNIVERSITY OF HONG KONG



THE UNIVERSITY OF HONG KONG  
faculty of architecture



Faculty of  
**Social Sciences**  
The University of Hong Kong  
香港大學社會科學學院



## New option for elite students

Formal training to elite students who wish to join the AI profession



## Interdisciplinary training

Provides a wide range of courses in mathematics, statistics, computer science, geography, psychology, and urban studies



## Featured concentrations:



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AppliedAI



<p><b>Core Courses</b> (66 credits)</p>	<p><b>Introductory Level Courses (48 credits):</b></p> <ul style="list-style-type: none"> <li>o Foundations of artificial intelligence</li> <li>o Computer programming</li> <li>o Computer organization</li> <li>o Data structures and algorithms</li> <li>o University mathematics II</li> <li>o Multivariate calculus and linear algebra</li> <li>o Probability and statistics I</li> <li>o Probability and statistics II</li> </ul> <p><b>Advanced Level Courses (18 credits):</b></p> <ul style="list-style-type: none"> <li>o Deep learning</li> <li>o Introduction to optimization</li> <li>o Statistical machine learning</li> </ul>				
<p><b>Elective Courses</b> (24 credits)</p>	<p><b>AI Technology (18+ credits):</b></p> <ul style="list-style-type: none"> <li>o Computer graphics</li> <li>o Robotics</li> <li>o Natural language processing</li> <li>o Image processing and computer vision</li> <li>o High-performance computing</li> <li>o Special topics of applied AI</li> </ul>	<p><b>AI in Business and Finance (18+ credits):</b></p> <ul style="list-style-type: none"> <li>o Marketing analytics</li> <li>o Operation research I</li> <li>o Financial calculus</li> <li>o Time series analysis</li> <li>o E-commerce technology</li> <li>o Special topics of applied AI</li> </ul>	<p><b>AI in Medicine (18+ credits):</b></p> <ul style="list-style-type: none"> <li>o Survival analysis</li> <li>o Modern biostatistics</li> <li>o Bayesian learning</li> <li>o Omics data analysis</li> <li>o Medical image analysis</li> <li>o Special topics of applied AI</li> </ul>	<p><b>AI in Smart City (18+ credits):</b></p> <ul style="list-style-type: none"> <li>o Urban &amp; regional development I</li> <li>o Urban &amp; regional development II</li> <li>o Introduction to geographic information systems</li> <li>o Environmental GIS</li> <li>o Transport and society</li> <li>o Special topics of applied AI</li> </ul>	<p><b>AI in Neurocognitive Science (18+ credits):</b></p> <ul style="list-style-type: none"> <li>o Introduction to psychology</li> <li>o Perception</li> <li>o Foundations of cognitive science</li> <li>o Foundations of neuroscience</li> <li>o Human neuropsychology</li> <li>o Special topics of applied AI</li> </ul>
<p><b>Other Elective Courses:</b></p> <ul style="list-style-type: none"> <li>o Design and analysis of algorithms (CS)</li> <li>o Database management system (CS)</li> <li>o Computer and network security (CS)</li> <li>o Numerical analysis (MATH)</li> <li>o Game theory and strategy (MATH)</li> <li>o Network models in operations research (MATH)</li> <li>o Data visualization (SAAS)</li> <li>o Linear modeling (SAAS)</li> <li>o Multivariate modeling (SAAS)</li> </ul>					
<p><b>Capstone Requirement</b> (6 credits)</p>	<p>Directed studies/project/internship in Applied AI</p>				

Total = 66 + 24 + 6 = 96 credits

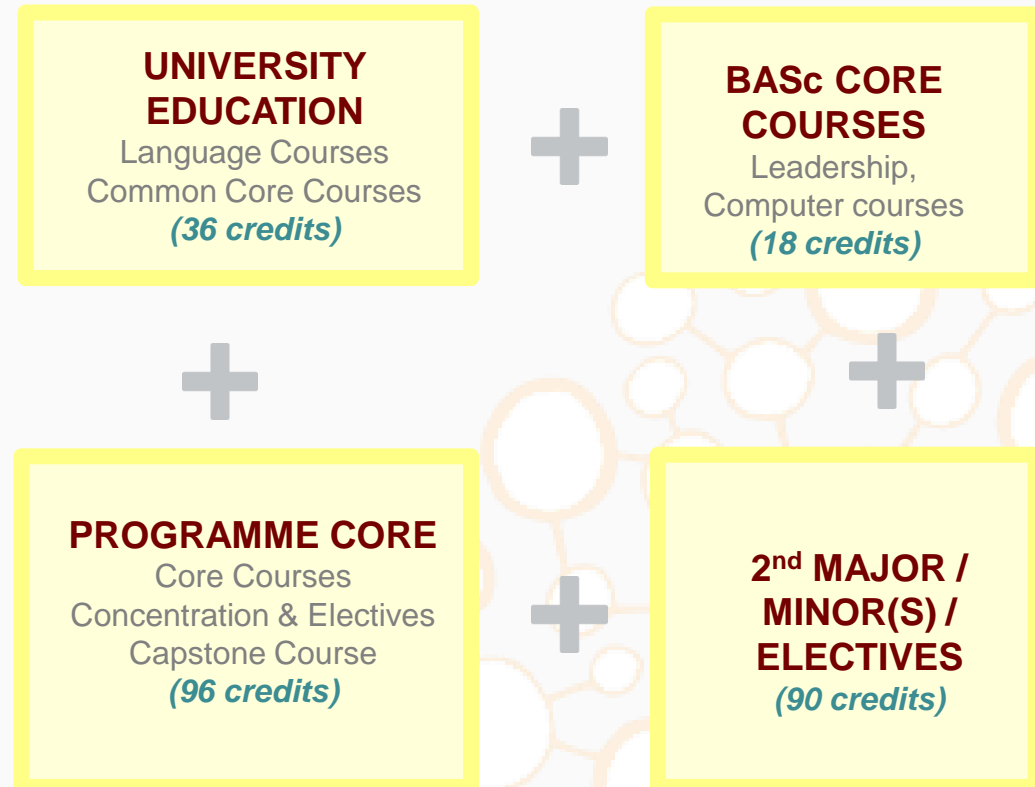
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## Curriculum Structure

Forty 6-credit courses spanning over 4 years of full-time  
study

**(240 Credits)**





# BASc Core Course: Leadership Beyond Borders





# Why HKU?



#25 worldwide #6 Asia #1 HK



#34 worldwide #5 Asia #2 HK (Statistics & OR)

#45 worldwide #9 Asia #3 HK (Mathematics)



#33 worldwide #7 Asia #2 HK (CS & IS)

#13 worldwide #3 Asia #1 HK (Architecture)

#12 worldwide #2 Asia #1 HK (Geography)

#27 worldwide #1 Asia #1 HK (Psychology)

**Big data optimization** **Statistical learning** **Machine/Deep learning** **SKL of Brain and Cognitive Sciences**  
**Scientific computation** **Bayesian methods** **Transportation**

**Fraud risk analytics** **Time series forecasting** **Computer vision**

**Game theory** **Speech/NLP/Text analytics** **Robotics**

**Financial and actuarial applications** **Information security**

**Operational research** **Genomics** **Forensic statistics** **GIS**

**High-dimensional data analysis**

**Preference learning**

**Neuropsychology**







# Tam Wing Fan Innovation Wing (ready in 2020, open to all Engineering as well as **Applied AI students**)



Maker studio



Glass facade



Research showcase



Discussion rooms



Brainstorming area



Specialized equipment



Multi-purpose room



# Career Prospects



The programme connects the exploding demand of the AI market in diverse areas, such as:

- ❖ Science & technology
- ❖ Environmental protection
- ❖ Medical informatics
- ❖ Healthcare
- ❖ Business
- ❖ Banking & finance
- ❖ Urban development
- ❖ Neurocognitive science





# Career Opportunities

2,703 views | Jan 4, 2019, 06:39am

**Forbes**

## 2019 - The Year AI Will Move Into The Mainstream

<https://www.forbes.com/sites/kimnilsson/2019/01/04/2019-the-year-ai-will-move-into-the-mainstream/>

### Top 10 jobs involving AI skills

Top jobs seeking machine learning or artificial intelligence skills

Rank	Job title	% of postings containing AI or machine learning	Rank	Job title	% of postings containing AI or machine learning
1.	Machine learning engineer	75.0%	6.	Algorithm developer	46.9%
2.	Deep learning engineer	60.9%	7.	Junior data scientist	45.7%
3.	Senior data scientist	58.1%	8.	Developer consultant	44.5%
4.	Computer vision engineer	55.2%	9.	Director of data science	41.5%
5.	Data scientist	52.1%	10.	Lead data scientist	32.7%

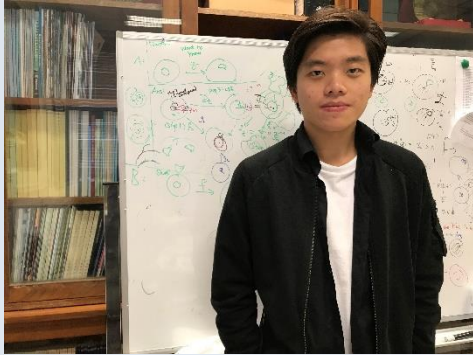


# Partner with Industrial Leaders





# Guaranteed Internships



Chi Chiu So, 2018 BSc(Mathematics)  
PhD Student and Research Intern  
at NVIDIA AI Technology Center  
Hong Kong

## Research Intern at NVIDIA

### Internship Project:

- Using deep learning to build models on stocks, and derivative pricing and optimization
- Math requirement: Optimization and Machine Learning, Information Theory, Scientific Computing, Financial Calculus and Numerical Analysis

Google Cloud Hero  
Hong Kong 2019



## Data Scientist at HK Jockey Club

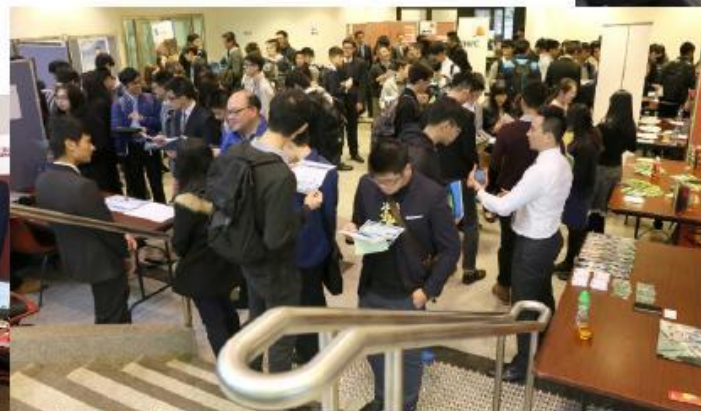
- To compare several sport analytics companies and select the optimal data provider in terms of data coverage and data quality
- To simulate the match and apply the automation process on various betting products

Yeung Wong, 2019 BSc(Decision Analytics), 2020 Master of Data Science (Part-time)  
[Aug 2019] The Champion Award – Taiwan 2019 Blockchain in InsurTech Hackathon  
[Jan 2019] 1st Prize & Wisers AI Innovation Award – Data and Media Hack 2019  
[Nov 2018] Grand Prize & Ontology Task Winner – TechCrunch Shenzhen Hackathon 2018

# Career Advising Programme (CAP)



- Professional Preparation Programme (PPP)
- Individual consultation on cover letter, CV and interview skills
- Corporate Mentorship Programme (CMP)
- Market information workshop
- Firm visits and alumni sharing
- SAAS Career Fair





# Scholarships

On top of numerous scholarships established by the University HKU and by the Faculty of Science, a few dedicated scholarships are being specially created for the BAsC AppliedAI programme:

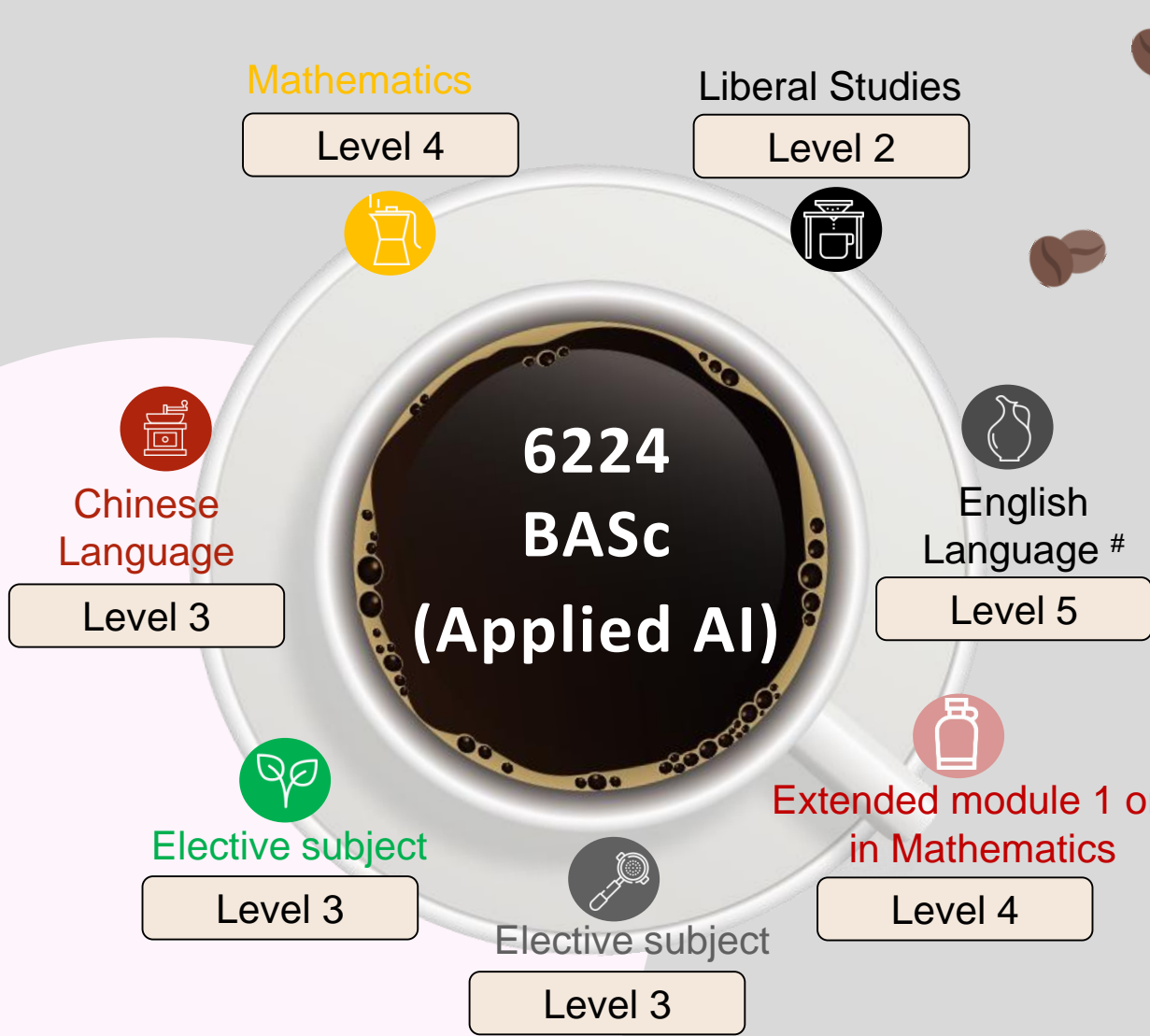


## Winnie S M Tang Scholarship in Applied Artificial Intelligence

- ❖ HK\$20,000 awarded to a year 3 student on the basis of their academic achievements during in their year 1 and year 2 studies.
- ❖ HK\$20,000 awarded to a year 4 student on the basis of their academic achievements during in their year 2 and year 3 studies.



Dr. Winnie Tang  
Founder and Chairman at Esri China  
(Hong Kong) Limited



**2020 Admission Quota**  
**15-20**

# Candidates with level 4 in English Language and good results in other HKDSE subjects will be considered on a case by case basis.



6224

# Admissions Formula for 6224 BAsc(AppliedAI)


JUPAS



English

$f_x$

Mathematics



Extended module 1 or 2 in Mathematics



The **BEST 3** of remaining Category A subjects

## DSE Subjects



- English language
- Mathematics
- Extended module 1 or 2 in Mathematics



Science subject (Biology, Chemistry, Physics, Combined Science or Integrated Science)



Other Category A subjects

## Weighting

× 2

× 1.5

× 1

Non-JUPAS

## Expected lower boundary score

IB Diploma: 37

GCE A-Level: 2A\*, 1A

SAT: 1350





# 2019 Admission Statistics



## Admitted 19 students

- ❖ 12 DSE local students
- ❖ 5 international students
- ❖ 2 Mainland students



## Best 6 DSE Scores:

- ❖ Maximum 43.5
- ❖ Average 37.1
- ❖ Lower quantile 34.5



Level 1 - 4	Level 5	Level 5*	Level 5**
1 - 4	5.5	7	8.5



# Further Information



BASc(Applied AI) website:

<https://saasweb.hku.hk/programme/ai.php>

(or Google with “hku applied ai”)

Q & A