Precision education

A new challenge for AI in education

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Agenda

- Precision education: A new challenge for AI in education

- 以人為本: Human-center AI

Important research issues for AI in education

- AI-enabled learning & teaching strategy (enabler, inhibitor)
- Ethics, norms, rules, privacy, de-identification
- Intelligent tutoring systems, Robot, Chabot

- Big data, data mining, machine learning, deep learning
- AR/VR, Cloud, AIoT, BlockChain
- Data analytics (text, voice, image, video)

*New Challenges for AI in education

- From General-purpose to Transferring intelligence
- From Computation to Cognition
- From Customized to Adaptation
- From Knowing to Unknown
- From Technology to Humanity
- From One-size-fits-all to Precision

*Stephen J.H. Yang @ Kyoto University, March 23, 2019

General-purpose to Transferring intelligence

- General-purpose intelligence
  - Knowledge apply for all
  - Common sense

- Transferring intelligence
  - Knowledge transfer
  - Transferring from one domain to another

From Computation to Cognition

- Computation
  - Web, Mobile, Cloud
  - Computational thinking

- Cognition
  - Perception, emotion, phychology
  - Cognitive thinking

From Customized to Adaptation

- Customized for different students
  - Beforehand

- Adaptation to fit individual needs
  - Real-time

From Knowing to Unknown

- Knowing of unknown
  - Reasons, Insights

- Unknown of unknown
  - Hidden values, Unknown results

From Technology to Humanity

- Technology
  - Cloud, Big data, IOT, Blockchain, AR/VR, game, Robot
  - Augment human production with technology

- Humanity
  - Human impact, human context, human condition
  - Augment human intelligence with machine intelligence

From One-size-fits-all to Precision

- One-size-fits-all
  - One kind of
  - Average

- Precision
  - One of a kind
  - Precision, specific

From One-size-fits-all to Precision education

*Precision education

- Precision education is a new challenge of applying artificial intelligence, machine learning, and learning analytics for improving teachers' teaching quality and students' learning outcome.

- The goal of Precision education is to identify at-risk students as early as possible and provide timely intervention based on learning analytics.

*Yang, S.J.H. (2019). Precision education: new challenges for AI in education. *The 27th International Conference on Computers in Education (ICCE 2019)*, Keynote speech, https://youtu.be/VKmUE1Hnaro

Lu, O.H.T, Huang, A.Y.Q, Huang, J.C.H., Lin A.J.Q., Ogata, H., Yang, S.J.H.*, (2018). Applying Learning Analytics for the Early Prediction of Students' Academic Performance in Blended Learning, *Educational Technology & Society, 21*(2), 220-232.

We were inspired by Precision medicine

- The Precision Medicine Initiative
  - https://obamawhitehouse.archives.gov/precision-medicine

- Obama, 2015 State of the Union address
  - "President Obama announced that he's launching the Precision Medicine Initiative — a bold new research effort to revolutionize how we improve health and treat disease."

Precision medicine

- "Most medical treatments have been designed for the "average patient." As a result of this "one-size-fits-all-approach," treatments…"

- "…takes into account individual differences in people's genes, environments, and lifestyles."

- "To improve the Diagnosis, Prediction, Treatment, and Prevention for disease."

Comparison of Medicine & Education

Disease	At-risk students
Genes	IQ
Living behavior	Learning behavior
Living environment	Learning environment
Living philosophy	Learning strategy

Research issues for Precision education

- Precision education for smart learning and teaching

- Agenda
  - Research goal & steps
  - Governance and policy
  - Technology & practice

Precision education - research goal & steps

- Research goal
  - Identify at-risk students as early as possible and provide timely intervention through Diagnosis, Prediction, Treatment, and Prevention

- Research steps
  - Diagnosis of students' engagement, learning patterns and behavior
  - Prediction of students' learning performance and the improvement of predictive models
  - Treatment and prevention with teachers' timely intervention, learning strategy and activities

Precision education - governance and policy

- Topics
  - Ethical, norms, rules, and other concerns relating to precision education
  - The impact of precision education to emerging pedagogical environments such as MOOCs, eBook, coding, AR/VR, robotics, games, et al.
  - Exploring the critical factors affecting students' learning performance based on precision education
  - Exploring the influence of teachers' intervention on students' learning performance based on precision education

Precision education - technology & practice

- Topics
  - The design of pedagogical models and tools for precision education
  - The design of learning strategy and learning activity for precision education
  - The design of evaluation and assessment methods for precision education
  - Data analytics for precision education, such as text analytics, audio analytics, image analytics, video analytics
  - Data visualization for precision education, such as dashboard, simulation

Agenda

- Precision education: A new challenge for AI in education
- 以人為本: Human-center AI

Inspiration: 人工智慧何以「人本」

- 2019.04.18 @史丹佛大學，Harari 與李飛飛的對談

- Yuval Noah Harari in Conversation with Fei-Fei Li, Moderated by Nicholas Thompson.
  - https://www.youtube.com/watch?v=b9TfkgH0Xzw
  - Stanford, Apr. 18, 2019

Inspiration: AI時代的人文省思

- 2020.09.30 @ 中大哲學所 - 人文與AI對話論壇 - AI時代的人文省思

- 主講者: 楊祖漢 (中央大學中文系特聘教授)
- 主持人: 陸敬忠 (中央大學哲學研究所所長、特聘教授)
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AI時代的人文省思 - Reflection & Inspiration

- 我自己的人文省思
  - 何以為人
  - 演算法的偏見 (biases)
  - AI 的風險
  - AI 對人類社會的益處
  - 培育下一代工程師/科學家的人文省思 & 自我規範
  - 以人為本
  - 還有什麼是AI 無法取代的?

何以為人 - 自由意志，能為自己做決定

- 人類獨有的特質—「我們之所以是人而不是機器是因為我們有自由意志，能自己為自己做決定」也就是人類獨有自由意志 (free will)

- 當人工智慧在越來越多層面傾向於為人類做決策及判斷，機器的自主性及人類的自主性就更值得探討

- 如何保有自我認知，更應該認識自己並進而自我決策

反思：人類有自由意志嗎?

- 人類問機器人：你能證明你是有自由意志的嗎？
- 機器人問人類：這是個很難回答的題目，那你能嗎？

- 人類的情感有時包含不合理的衝突
  - 人類有時就是會不理智
    - 認同一個人，卻不認同他/她所做的事

- 人類可以同時存在兩種非常矛盾的心理
- 機器沒辦法，機器只能按著邏輯走

演算法的偏見 (biases)

- 當人工智慧的演算法越來越強大，能夠幫助人類判斷及做決策的能力越趨於完美，在這種情況下反而更容易形成演算法的偏見，進而引導甚至擴大錯誤的偏見，特別是在族群及性別方面

- 當機器的演算法趨於最佳化以及追求完美解決方案，同時代表的就是絕對的偏見

AI 的風險

- 當人工智慧越來越強大，只有大國及大公司才有能力財力發展，進而演變成大國或是大公司之間的競爭
- 這個世界先天上已經不公平了，而人工智慧正在擴大這個不公平
- 如果這些科技落入了獨裁的政權，或是商業利益掛帥的公司，就跟現在的毀滅性武器或是沉迷式商品一樣，對人類的未來都會是很大的危害

AI對人類社會的益處

- AI 對人類的影響越是巨大，我們就越要了解AI，如果我們要談AI的風險，我們同時也必須考慮其對人類社會的益處

- 現在人工智慧的科學家們正在進行可解釋的AI (Explainable AI)，希望在做複雜決策時，人工智慧能夠逐項解釋為何達到該項決策的理由，增加人類對人工智慧的信任

- 但同時也會因為人工智慧得到人類更多的信任，而產生信任偏頗或是另一種偏見。總之新的解決方案也會帶來新的問題

培育下一代工程師/科學家的人文省思 & 自我規範

- 當人工智慧能比我們做出更好的決策或是比我們更了解自己的時候，我們人類究竟還可以做些什麼呢?

- 人工智慧在運算及決策方面的確已經遠遠超過了人類的能力，但是人類有一些特質是人工智慧目前無法追上的，這些特質就是我們的感知(perception)、情感(emotion)、心理(psychology)、及認知(cognition)

- 或許人類的最後防線應該是在哲學思想與倫理道德，唯有透過思想精神層面的人文省思 & 自我規範才能超越物質的束縛

以人為本 (human-centered)

- 人工智慧的興起與發展並非突然而是必然
- 隨著對AI風險、AI 自我監督、AI可解釋性議題，AI不僅能被研發得越來越被信任，更是需要朝向「以人為本」的方向前進
- 或許「以人為本」指的就是人類自始至終總會對潛在的危險具備意識、適時修正、適時踩煞車，而非如同機器一直向著利益最大化而前進吧

反思：人工智慧－人與機器間的「模仿遊戲」

- 一台機器畢竟不同於一個人，因此他們思考的方式亦不同。
- 就因為某樣東西思考的方式得跟你不一樣，就代表它沒在思考嗎？
- 有時，是那些意想不到的人，成就了意想不到的事。

From technology to humanity

Augment human production with technology

Augment human intelligence with machine intelligence

Research issues for Human-centered AI

- Augment human intelligence with machine intelligence

- Agenda
  - Challenges
  - Governance and policy
  - Technology & practice

Human-centered AI – challenges

- Topics
  - Biases in AI Algorithms
  - Use and misuse of AI
  - AI on social impact

  - AI risk management
  - AI accountability
  - AI self-surveillance

Human-centered AI – governance and policy

- Topics
  - AI in governance
  - AI governance

  - AI in administration
  - Infrastructure and virtual facilitators for smart learning and teaching environment
  - Intelligent admission decision and course scheduling

Human-centered AI – technology & practice

- Topics (in general)
  - Explainable AI
  - Interpretable ML
  - Flexibility and contextual understanding by humans
  - Explanation and comprehensible by humans

  - Intelligent agent (assistants)
  - Automated conversational robot (Chabot)
  - AI-enabled personalization

Human-centered AI – technology & practice

- Topics (for teaching & learning)
  - Intelligent tutoring systems
  - Student and teacher modeling for smart learning and teaching
  - Smart content, learning pathway, and recommendation
  - Differentiated and individualized learning

  - Intelligent assessment and evaluation
  - Automated question generation
  - Automated grading
  - Plagiarism detection

反思: 還有什麼是AI 無法取代的?

- 人文美感
- 愛與期待

AI 或許是現在的趨勢

人文美感 才是 永恆

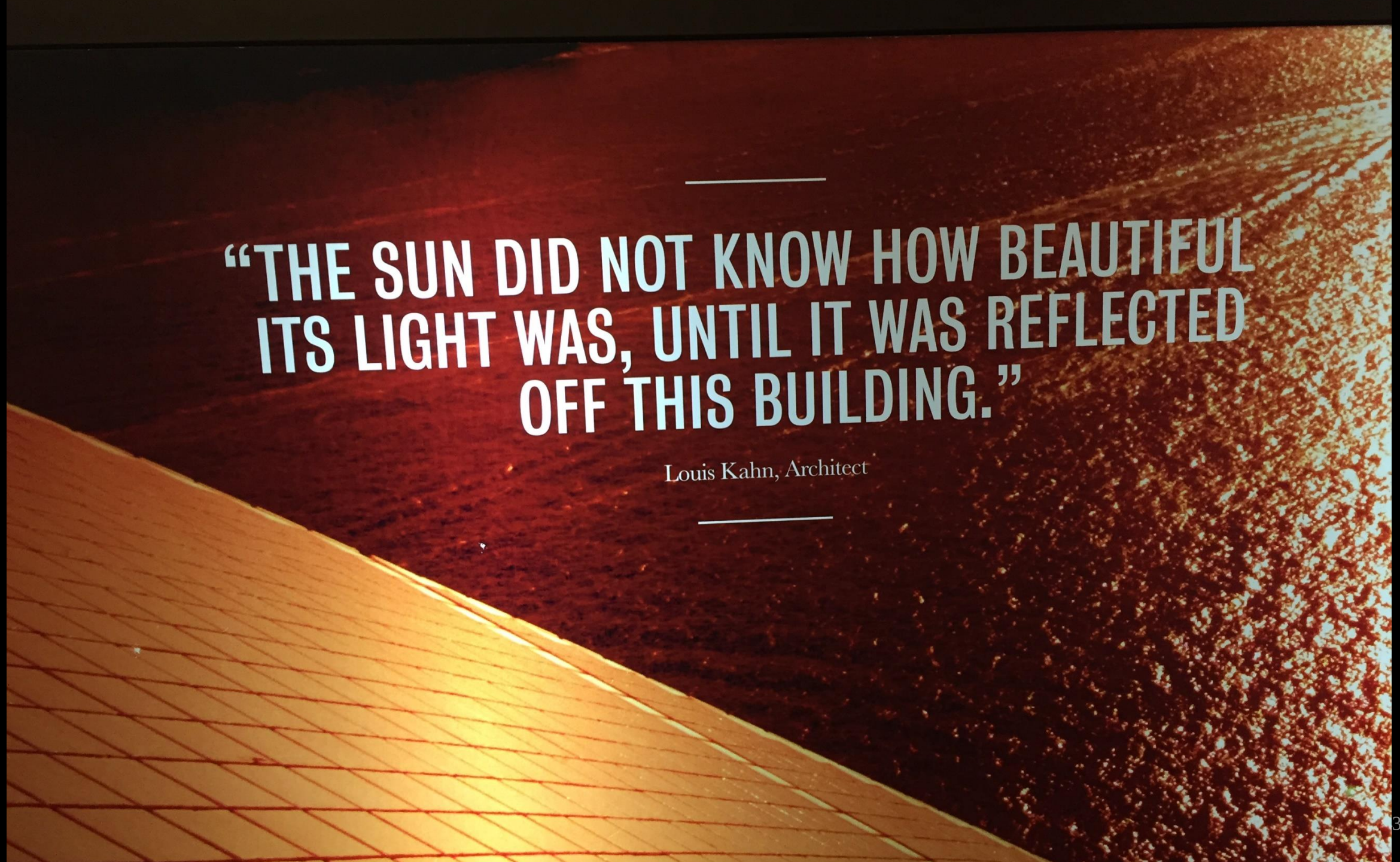
蔣勳：過得像個人，才能看到美

工作忙碌之餘，你還是一個人

你看到了 美

才會覺得這個世界是值得活下去的


OPERA BAR


“THE SUN DID NOT KNOW HOW BEAUTIFUL
ITS LIGHT WAS, UNTIL IT WAS REFLECTED
OFF THIS BUILDING.”
Louis Kahn, Architect

“The sun did not know how beautiful its light was,
until it was reflected off you”

“太陽不知道它的光有多美，
直到光線從妳的臉龐反射出來!"

愛與期待

千年古都
校園自由

保守、叛逆
衝突的美感

Thanks very much

Stephen J.H. Yang

楊鎮華