Computer Science at University 2.0

What the Future Holds and How We Can Shape It

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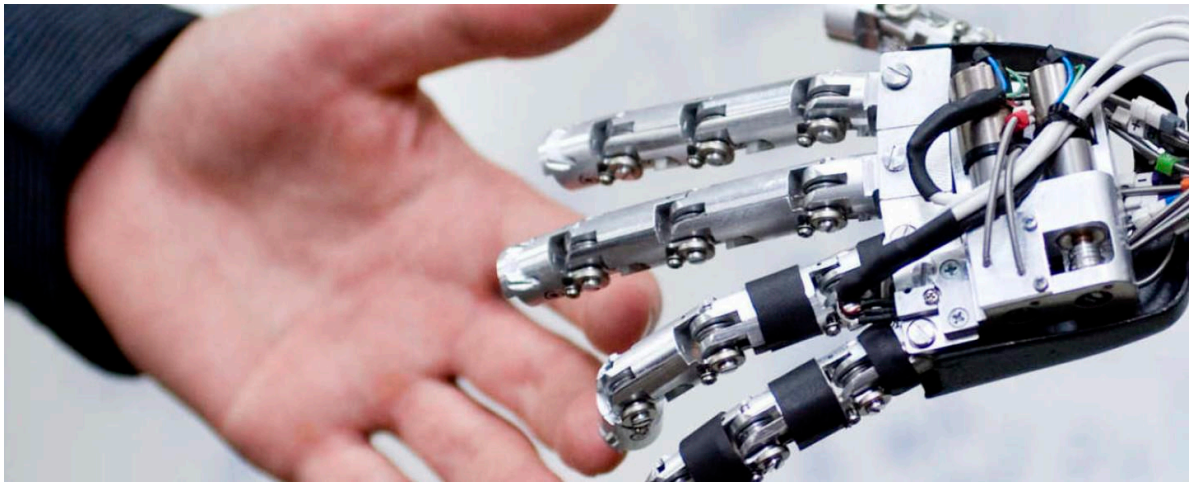

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Any views expressed in this presentation are informed by my experiences in academia and industry; these views are solely my own and not official positions of Imperial College London or xayn.com.

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Computer Science

- Is it a science about "Computing"?
- Computer Science develops theories and algorithms that shape our world, rather than explain it?
- Is Computer Science *owned* by Engineering, Arts & Sciences or other faculties?
- Modern Computer Science makes such ownership claims increasingly weak
- Ditigization shapes the 21th Century:
  - Implications for organizational structure of University 2.0?
  - Embed Computer Science competency in all academic departments/faculties?
  - Implications for Computer Science as academic discipline/department?
- Pace of digital innovation and its impact acellerate:
  - 18 years took the pre-Google world of August 1998 to that of Douyin
  - What does this acelleration mean for how - and in what - we educate?
  - Will this change academic career/progression models or the scientific publication industry?

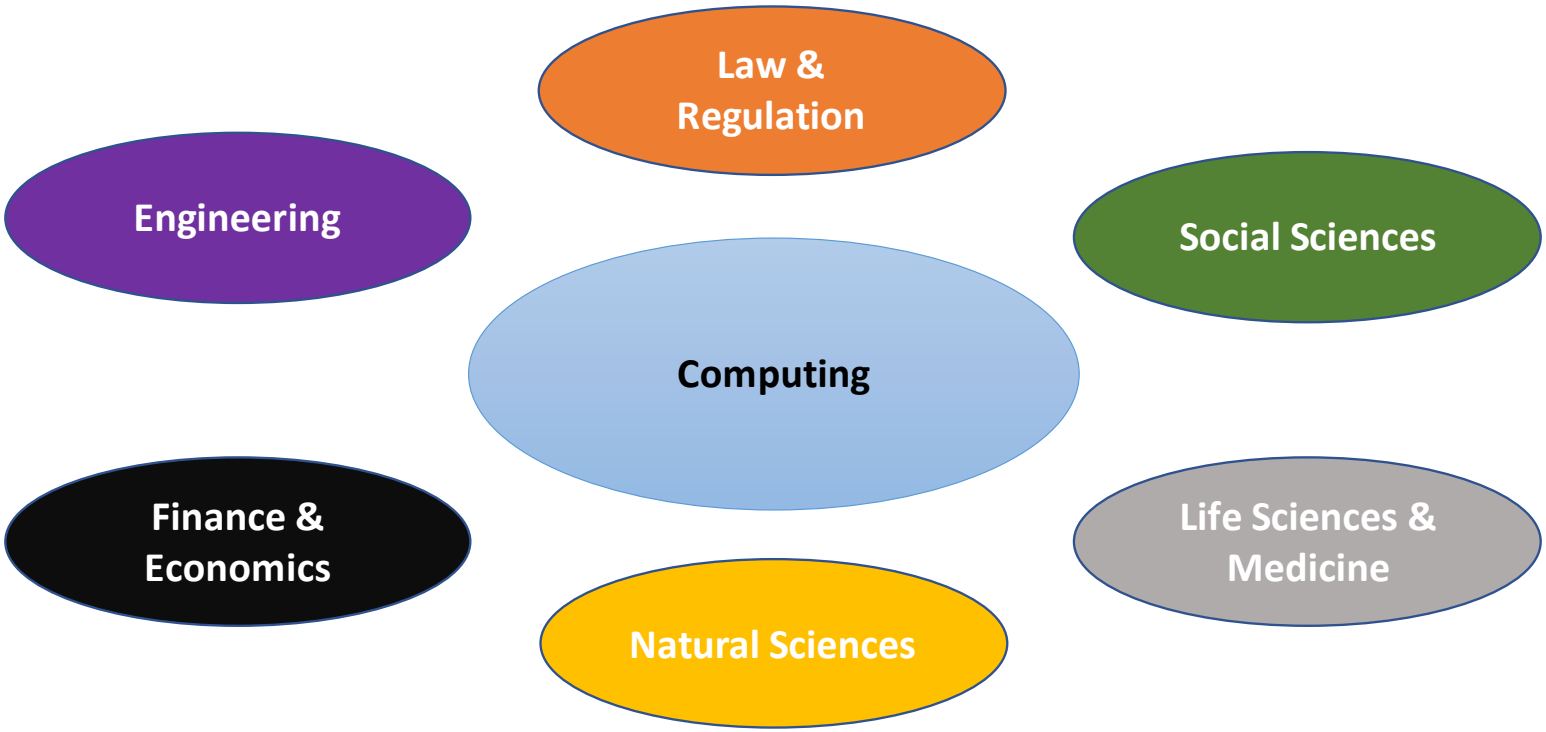
Computing today: key driver in Education

"About 40 percent of MIT undergraduates now major either in computer science alone or in joint programs combining computer science with some other field."

Source: **FAQ on the newly established MIT Stephen A. Schwarzman College of Computing, MIT News Office, Publication Date: October 15, 2018**

- What does this mean for the mission and responsibilities of higher education? For example, social science, history, and language programs are now down-sized in the UK.
- If every student must become Computing literate, then **every** student must become literate about the responsible use of digital technology.
- Sustainability, Ventures, Social Entrepreneurship are examples of what students as future leaders will engage in: *Computing education should give them the tools to make our world better.*

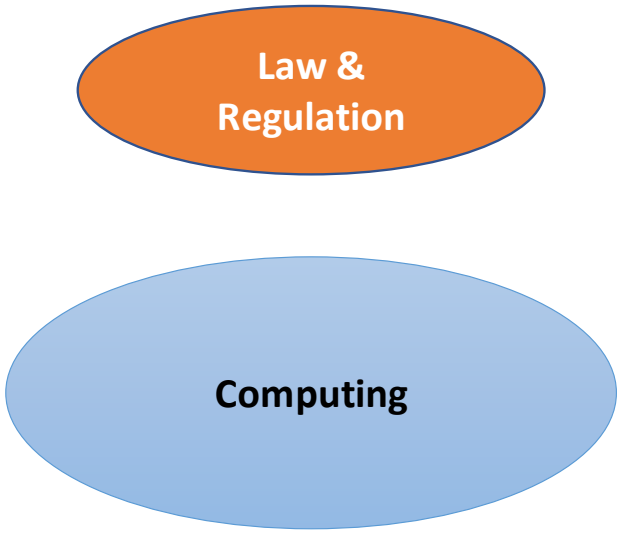
Computing today: at the center - but invisible?



Digital technology, law, and responsibility

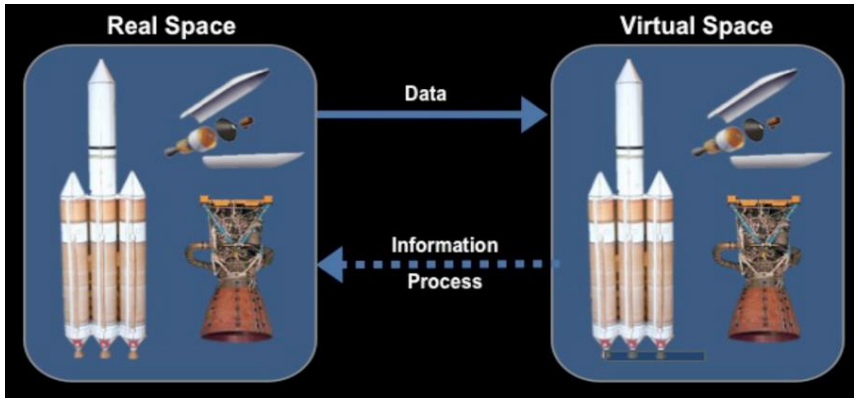
- Personal Information Protection Law in China: in force by 1 November 2021
- GDPR in EU, similar legislation in California, Colorado, Virginia
- Regulation on use of AI, EU law may emerge by 2025
- Decision-support systems, e.g., to assess risk of re-offending
- Computing, e.g., NLP, digitizes some work of courts and law offices
- …

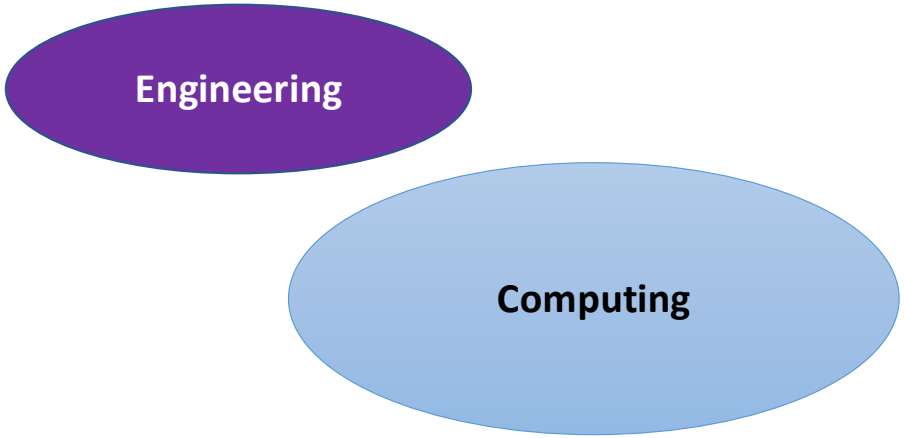
Source: Wikipedia



Engineering 2.0

- Digitization of Engineering disciplines has begun
- Changes Education, e.g., *virtual geological expeditions*
- Changes Innovations, e.g., *AI-supported design of smart materials*
- Digital twins, e.g., in Chemical Process Engineering
- *What is the essential Computing that all engineers should learn at university?*
- …

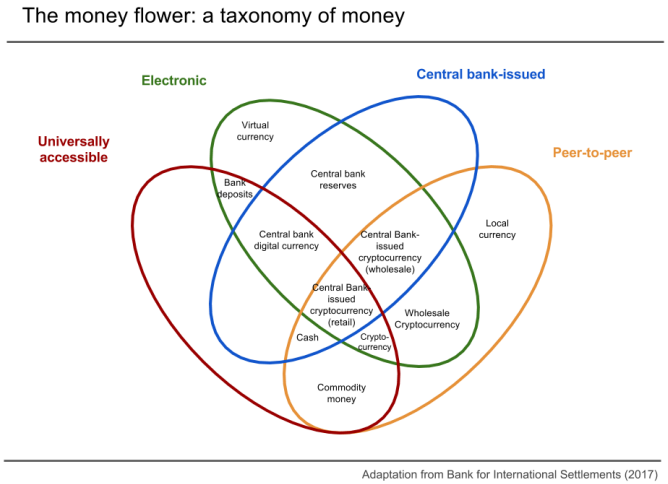




Source: Wikipedia

Optimization/automation - or revolution?

- B2C banking through an app with great user experience
- New ways of constructing and trading assets, e.g., digital yuan
- Google's ad platform: socio-economic-technical system
- Digital platforms such as Amazon and Baidu may become too powerful:
- *China, EU, and US consider balancing economic freedom and public good in regulating such platforms*
- ...



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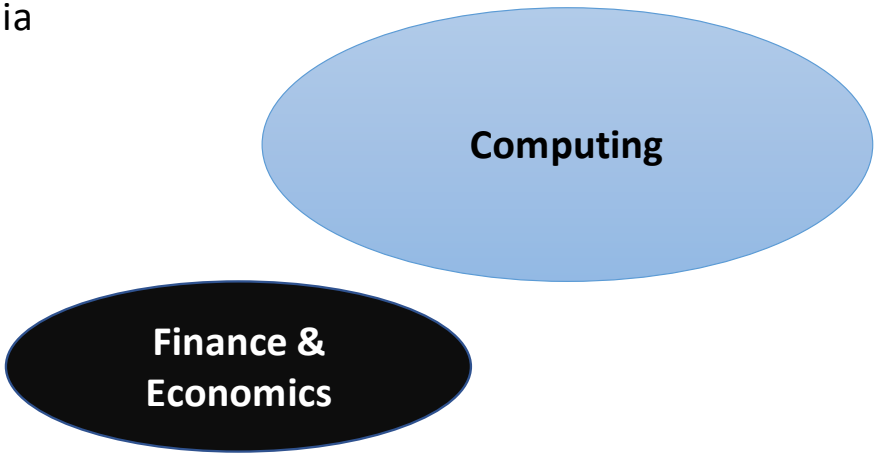
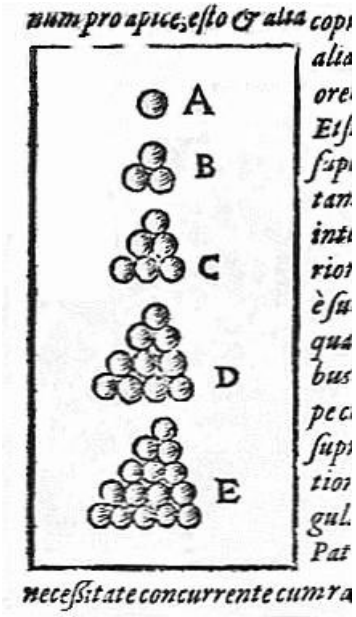


Cross-fertilization of sciences

- What will be the structures/materials that realize future Computing?
- A structure example: *application-specific hardware for Deep Learning*
- What will be the new computational tools for Natural Sciences?
- For example: *Hayles' proof of Kepler's Conjecture and the Flyspeck project*
- ...



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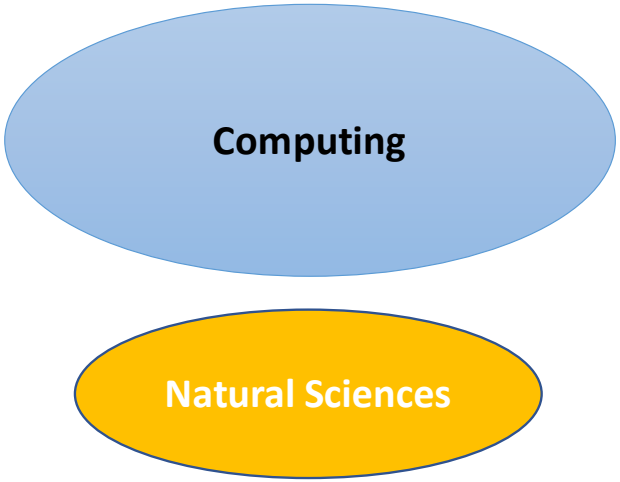
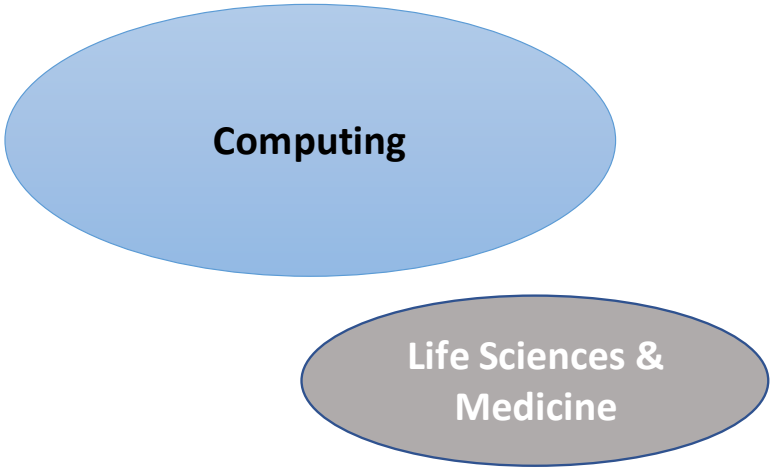


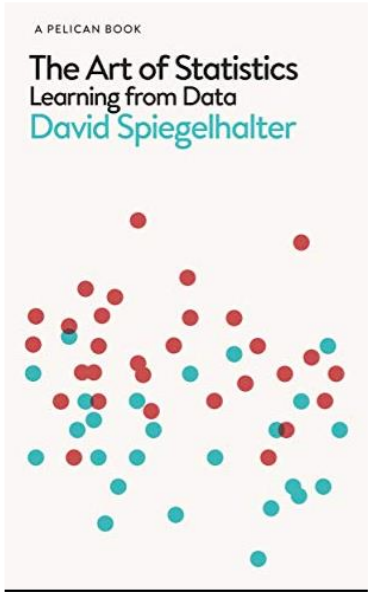
Tremendous impact potential in a highly regulated space

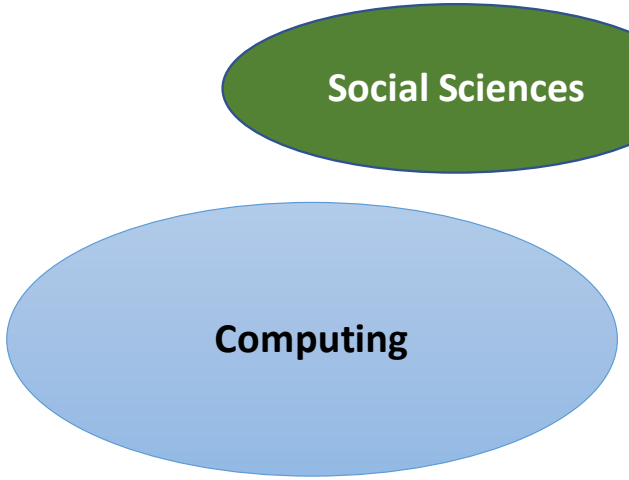
- AI for Health: *better patient experience, better patient outcomes*
- Role of regulation, e.g., *AI for triaging versus AI for patient intervention*
- Medical Imaging: *potential to change workflow/effectiveness of diagnostics*
- ...



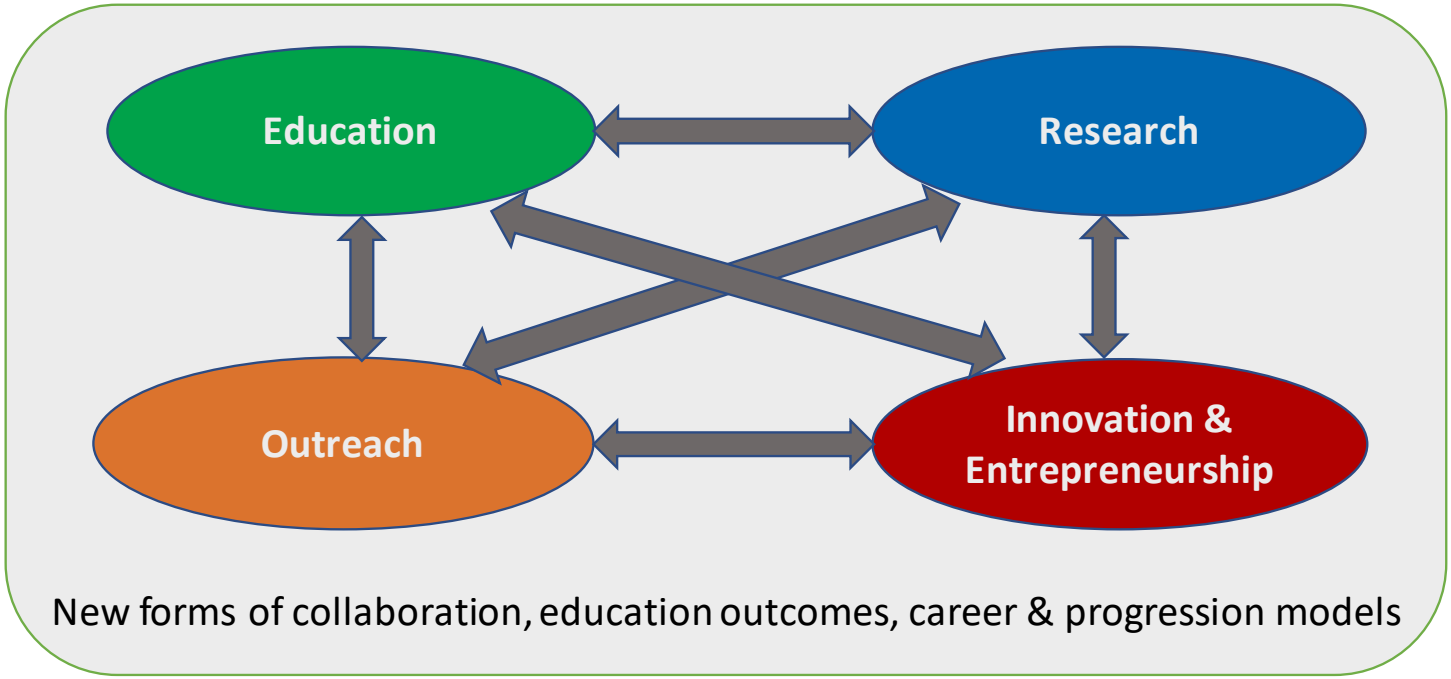
Social Sciences: from the armchair into board rooms?

- Computational Social Science: transforms a discipline
- But data-driven methodologies must be used responsibly
- Education in proper use of methodologies is vital!





University 2.0: shape the future as we forecast/assess it

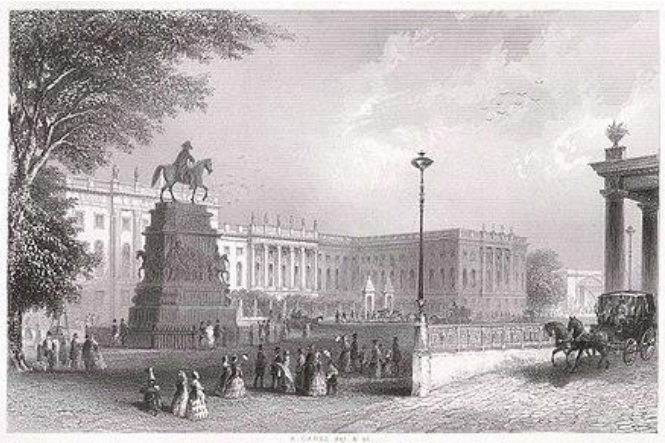


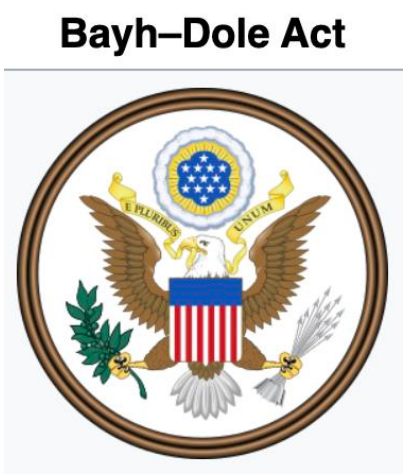
Computer Science 2.0: Education, Research & Innovation

University 2.0 no longer the sole place for higher learning, e.g., Project 42

Wilhelm von Humbold's model from 1810 still valid for the University 2.0?

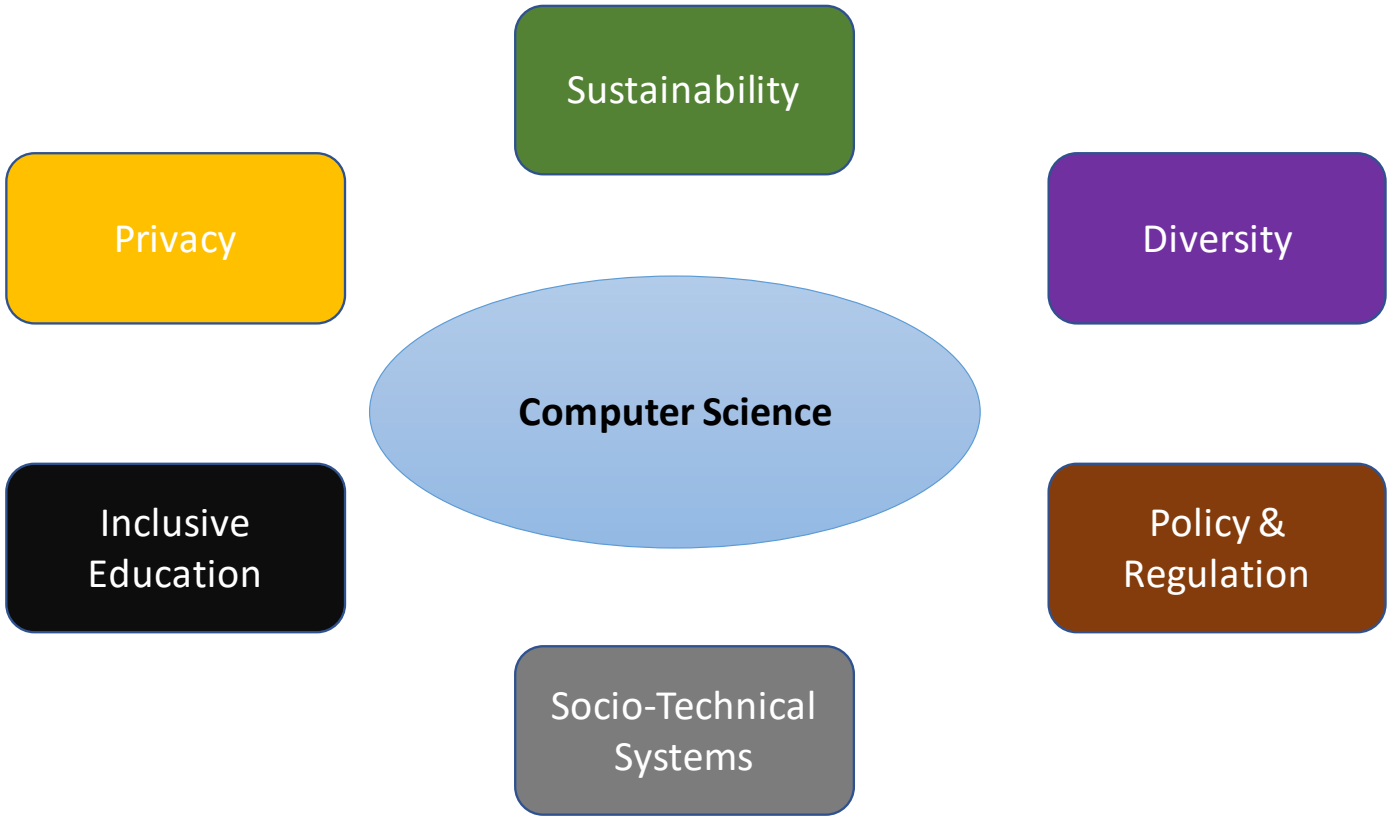
"Unity in teaching and research, the pursuit of higher learning in the philosophy faculty, freedom of study for students and corporate autonomy for universities despite state funding."





Source: https://en.wikipedia.org/wiki/Humboldtian_model_of_higher_education#University_concept

Computer Science 2.0: responsibility at the core



I-X: a strategic initiative at Imperial

Do things differently:

- No silos – working across disciplines in integrated teams, merging of research and education
- Deep and impactful collaboration with industry and digital technology users
- A laboratory for the University of the Future!

Broad focus around everything digital:

- Natural home for research in the "Smart Society" theme of the *Imperial College academic strategy*

Computer Science @ South Kensington campus

I-X @ White City campus

I-X: laboratory for exploring University 2.0

Enables us to tackle major scientific challenges in the digital space (moonshots):

- Building ‘digital twins’ of biological, environmental or industrial systems
- Developing new techniques for virtual-real co-presence and collaboration
- Building AI and Machine Learning systems that understand the real world

I-X: Education 2.0

- Focus on multi-faculty offerings, collaborative programmes with users
- Consolidated, expanded and innovative programmes at MSc level:
  - MSc courses in Executive MBA format
  - Micro-Masters for specific areas
- Doctoral programmes: cohort-driven, Industrial PhD, Doctorate in Innovation
- Engagement with local community

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Thank you.
Any questions?

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I-X and Computing 2.0