Undergraduate University AI Education: A Survey
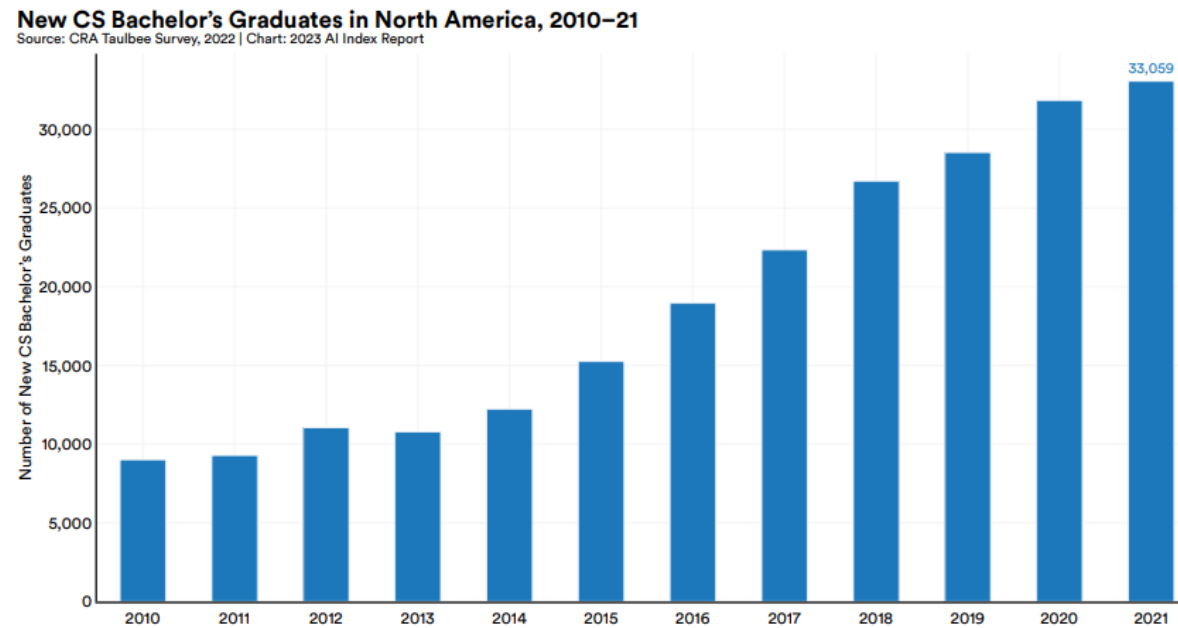
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Introduction

- AI has emerged as one of the defining technologies of the 21st century.

- The importance of imparting AI knowledge in university education has been widely acknowledged.

- The robust AI job market boosted a substantial demand for CS graduates with AI expertise.

Introduction

- For example, the number CS Bachelor's in 2021 is more than 3 times that of 2010 in N. America.

New CS Bachelor's Graduates in North America, 2010–21
Source: CRA Taulbee Survey, 2022 | Chart: 2023 AI Index Report

Fig. 1: Total number of new North American CS bachelor's graduates 2010-21

Introduction

- In the past, AI was a specialization of CS and/or ECE studies, at the MSc or PhD level.

- A new trend is the establishment of AI Departments and/or AI BSc programs that are independent from CS or ECE.

Introduction

- Our aim is to present a comprehensive survey of **undergraduate AI** programs in Universities worldwide, by:
  - Offering a comprehensive view of the state of undergraduate AI education.
  - Reviewing the curricular content of AI bachelor programs.
  - Identify the challenges confronting institutions, in establishing AI as a standalone discipline.

- In our opinion, **AI Science and Engineering** has become a **separate** discipline rather than a CS/ECE **specialization.**
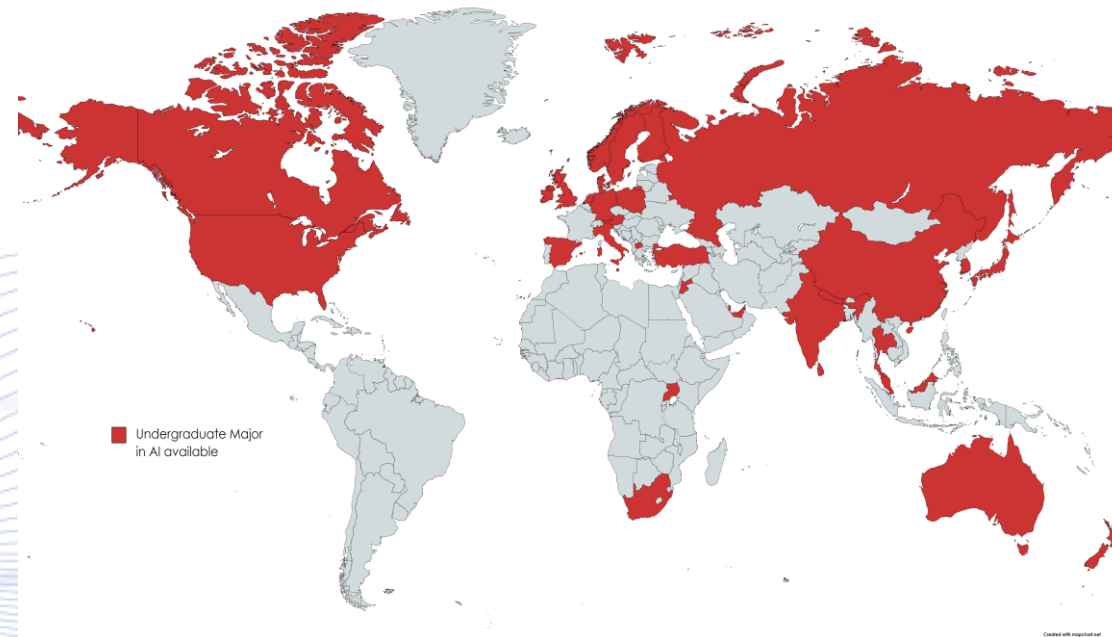
Evolution of AI Education

- **Early Developments** (1950s-1980s)

- **Global AI Expansion** (1980s - 2010s)

- **AI Revolution** (2010s - 2022)

- **Generative AI** era (2022 onwards)

Survey of Undergraduate AI Programs

- Most **undergraduate AI programs** are concentrated in developed countries (**Global North**).

Fig 2: Countries that offer AI as an undergraduate major.

Survey of Undergraduate AI Programs

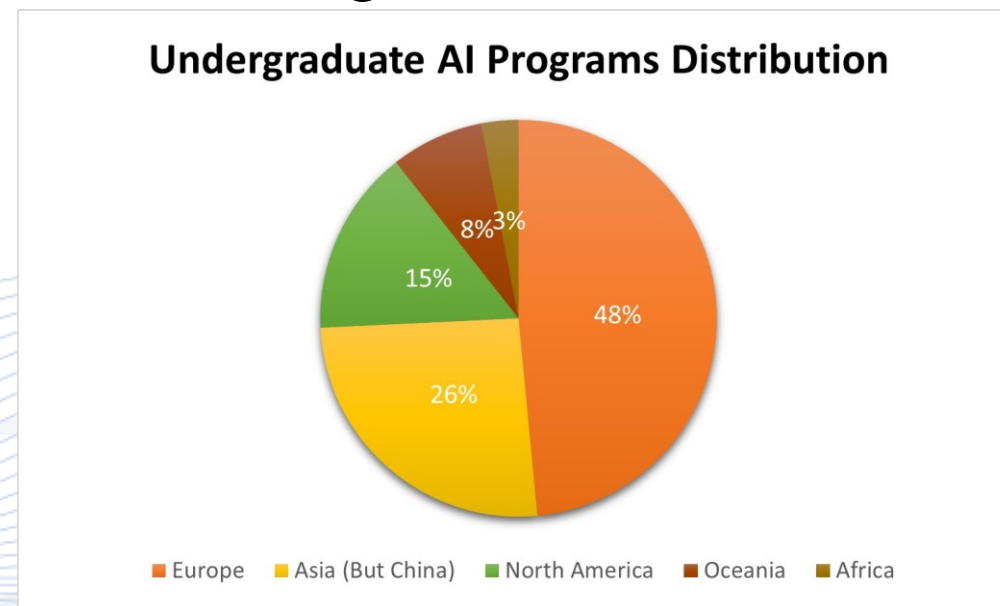- Worldwide, **64** universities offer undergraduate-level AI studies, not including China.

Fig. 3: Global Undergraduate AI Programs Distribution (but China)

Survey of Undergraduate AI Programs: China

- China has emerged as a global leader in AI education.

- By **2022**, the Chinese Ministry of Education has approved **440 undergraduate AI university programs**.

- The Chinese State Council's AI Development Plan, aims for the Chinese AI industry to:
  - Have a **400 billion yuan** turnover by 2025.
  - Boost related industries and financial sectors by **5 trillion yuan**.

Survey of Undergraduate AI Programs: Europe

- Excluding China, Europe makes up **48% of the global offerings** in undergraduate AI education.
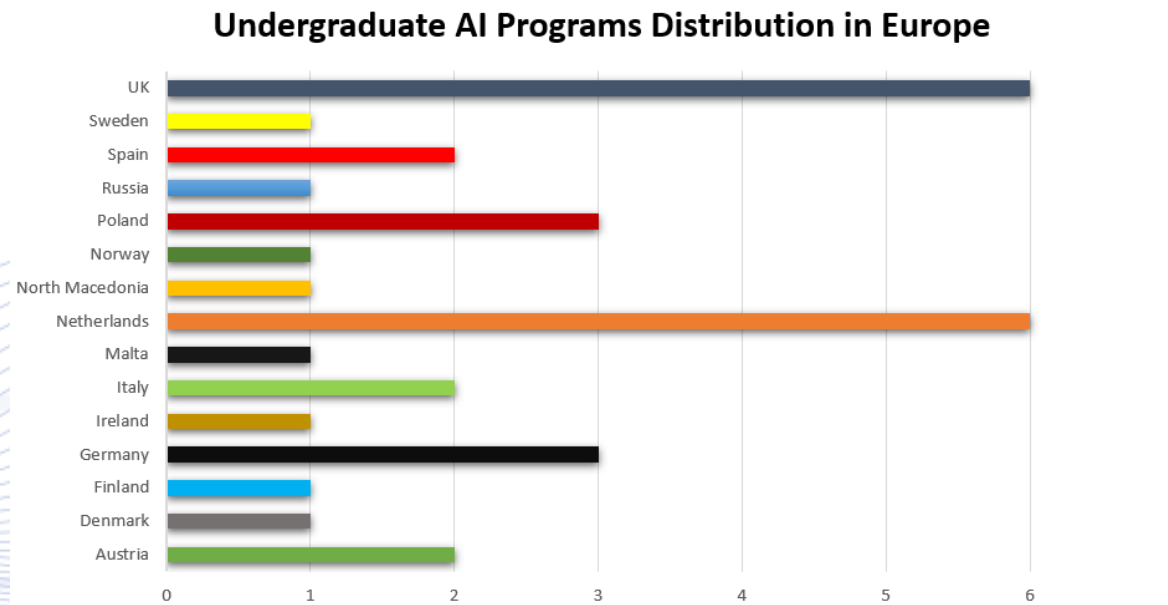

Fig. 4: Undergraduate AI Programs Distribution in Europe

Survey of Undergraduate AI Programs: Asia

- Asia, with the exclusion of China, accounts for **26% of the offerings** in undergraduate AI studies.

- A **diverse array of countries** are investing in undergraduate AI education:
  - Tech giants like **Japan**.
  - Rich countries like **Singapore** and the **UAE**.
  - Middle income countries like **India**, **Turkey** and **Malaysia**.

Survey of Undergraduate AI Programs: North America

- The **USA** and **Canada** have some of the **best AI university education** worldwide.

- However, such programs remain as a **MSc or PhD specialization**.

- As such the region **only makes up 15%** of the offered undergraduate AI programs.

Survey of Undergraduate AI Programs: Oceania

- **Australia** has emerged as a strong contender in the field of undergraduate AI education.
  - **UTS** has been ranked as one of the **best universities** for AI in the world.

- **New Zealand**'s Media Design School offers a **BSc degree** in Software Engineering and AI.

- Together, they are taking up **8% of the global offerings**.

Survey of Undergraduate AI Programs: Africa

- **Africa contributes 3%** of the total undergraduate AI education offerings.

- BSc programs have been introduced in both:
    - Regional technological centers, like **South Africa**.
    - Less economically advanced countries, like **Uganda**.

AI Science and Engineering Discipline

- Like Physics in previous centuries, CS has started spawning new disciplines.
  - AI, Network Science, Data Science, etc.

- The IT and AI knowledge is huge to be accommodated in a single CS or ECE program of studies.

- Thus, it is important that **AI Science and Engineering** begin to be considered its own separate discipline.

AI Science and Engineering Discipline

- Schools of *Information Science and Engineering* can be created to maximize the **synergy** between **AI studies** and **related disciplines**.

- Such schools will be made of **departments** like:
  - Computer Science or Informatics
  - Mathematics
  - Computer Engineering
  - Artificial Intelligence Science and Engineering
  - Internet/Web Science

AI Curriculum

- Based on the **AIDA AI PhD Curriculum** for advanced AI studies, a comprehensive **AI Curriculum** was created, made up of:
  - **AI Prerequisites**, various courses from Mathematics, CS and Cognitive Science.
  - **AI Core Courses**, 8 subjects that make the core of the curriculum.
  - **AI Elective courses**, specializing on various AI related topics.
  - **AI Application Courses,** application-oriented courses covering several disciplines.
  - **AI Support Courses**, which cover subjects that are increasingly demanded by a modern workplace.

Impact of AI on other University disciplines

- AI is changing a plethora of scientific disciplines, even those not directly related with Computer Science.

- For example:
  - In **Journalism**, it can help automate news editing and analyzing new stories.
  - In **Medicine**, it changes how doctors diagnose illnesses and manage healthcare.

Impact of AI on other University disciplines

- The rise of AI can be addressed either by:
  - Offering **AI** as a **minor degree**, so students following a major in a different discipline can learn about AI.
  - Through **special AI Departments** (e.g., Mind and Social Science and Engineering, Bio-Science and Engineering)

- It is important for AI studies to provide:
  - Courses that address the ethical and legal side of its use.
  - In-depth courses on Mathematics and Computer Science fundamentals.

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Conclusion

- The landscape of undergraduate AI education is a constantly evolving canvas, reflecting the global recognition of AI.

- Establishing a standalone AI major comes with its set of challenges and considerations.

- The adoption of AI education by institutions plays a pivotal role in shaping a future where AI is effectively utilized.

Q & A

Thank you very much for your attention!

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