CHAPTER 8:
Diversity

Preview

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Overview

The demographics of AI developers often differ from those of users. For instance, a considerable number of prominent AI companies and the underlined datasets utilized for model training originate from Western nations, thereby reflecting Western perspectives. The lack of diversity can perpetuate or even exacerbate societal inequalities and biases.

This chapter delves into diversity trends in AI. The chapter begins by drawing on data from the Computing Research Association (CRA) to provide insights into the state of diversity in American and Canadian computer science (CS) departments. A notable addition to this year's analysis is data sourced from Informatics Europe, which sheds light on diversity trends within European CS education. Next, the chapter examines participation rates at the Women in Machine Learning (WiML) workshop held annually at NeurIPS. Finally, the chapter analyzes data from Code.org, offering insights into the current state of diversity in secondary CS education across the United States.

The AI Index is dedicated to enhancing the coverage of data shared in this chapter. Demographic data regarding AI trends, particularly in areas such as sexual orientation, remains scarce. The AI Index urges other stakeholders in the AI domain to intensify their endeavors to track diversity trends associated with AI and hopes to comprehensively cover such trends in future reports.

Chapter Highlights

1. U.S. and Canadian bachelor's, master's, and PhD CS students continue to grow more ethnically diverse. While white students continue to be the most represented ethnicity among new resident graduates at all three levels, the representation from other ethnic groups, such as Asian, Hispanic, and Black or African American students, continues to grow. For instance, since 2011, the proportion of Asian CS bachelor's degree graduates has increased by 19.8 percentage points, and the proportion of Hispanic CS bachelor's degree graduates has grown by 5.2 percentage points.

2. Substantial gender gaps persist in European informatics, CS, CE, and IT graduates at all educational levels. Every surveyed European country reported more male than female graduates in bachelor's, master's, and PhD programs for informatics, CS, CE, and IT. While the gender gaps have narrowed in most countries over the last decade, the rate of this narrowing has been slow.

3. U.S. K–12 CS education is growing more diverse, reflecting changes in both gender and ethnic representation. The proportion of AP CS exams taken by female students rose from 16.8% in 2007 to 30.5% in 2022. Similarly, the participation of Asian, Hispanic/Latino/Latina, and Black/African American students in AP CS has consistently increased year over year.

This section examines trends in diversity within CS and AI postsecondary education across North America and Europe.

8.1 AI Postsecondary Education

North America

Data on American and Canadian postsecondary CS and AI postsecondary education comes from the Computing Research Association's (CRA) annual Taulbee Survey.[1,2]

CS Bachelor's Graduates

The percentage of female CS bachelor's graduates reached 22.2% in 2022, continuing a decade-long rise (Figure 8.1.1). Nonbinary/other-identifying CS bachelor's graduates accounted for 0.1% in 2022.

Gender of new CS bachelor's graduates (% of total) in the United States and Canada, 2010–22
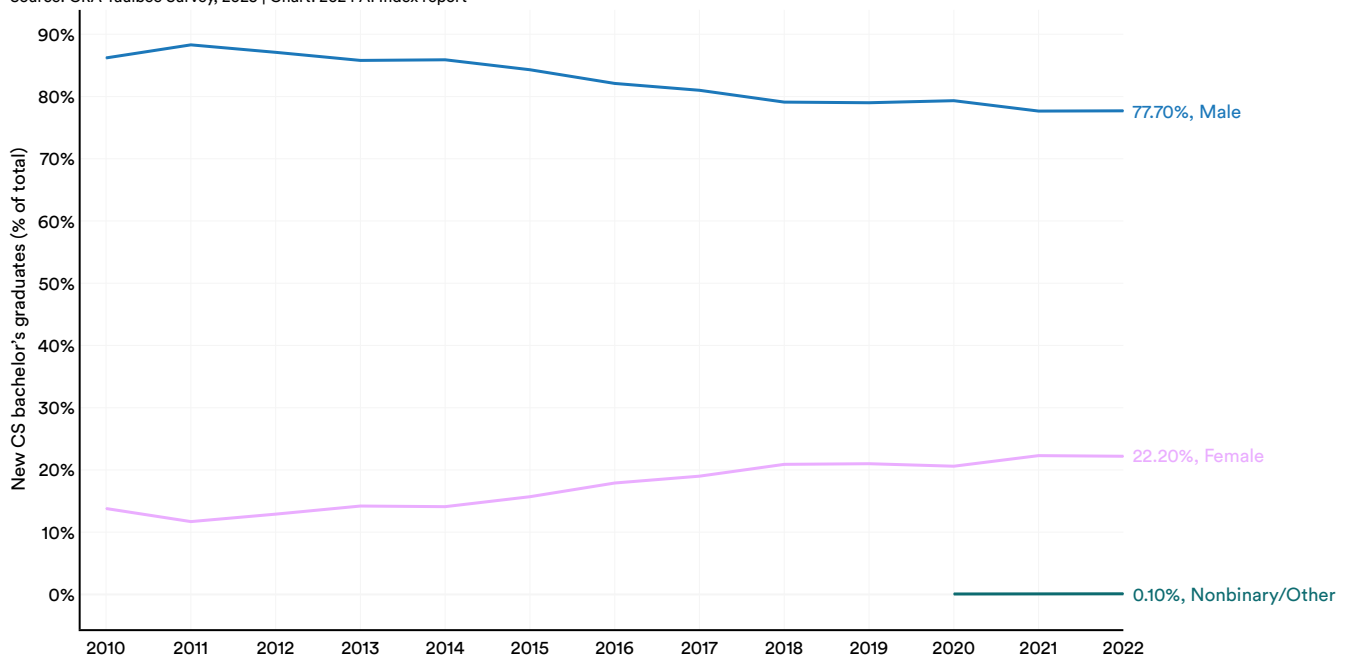Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

Figure 8.1.1

Over the past decade, the number of CS bachelor's graduates of all ethnicities has grown, notably 4.7 times for Hispanics and 2.5 times for African Americans (Figure 8.1.2). As a proportion of ethnicities among all CS bachelor's graduates, Asians have risen the fastest, doubling in the last 10 years (Figure 8.1.3).

1 The charts in this section look only at the ethnicity of domestic or native CS students and faculty. Although the CRA reports data on the proportion of nonresident aliens at each educational level (i.e., bachelor's, master's, PhD, and faculty), data on the ethnicity of nonresident aliens is not included.

2 Not all PhD-granting departments targeted in the survey provided responses. Of the 297 departments targeted, only 182 responded, resulting in an overall response rate of 61%. The AI Index advises against making per capita comparisons between the CRA North American data and the data on European CS graduates detailed in the subsequent sections due to the European data being collected from national statistical offices, which affords it broader coverage.

Ethnicity of new resident CS bachelor's graduates in the United States and Canada, 2011–22
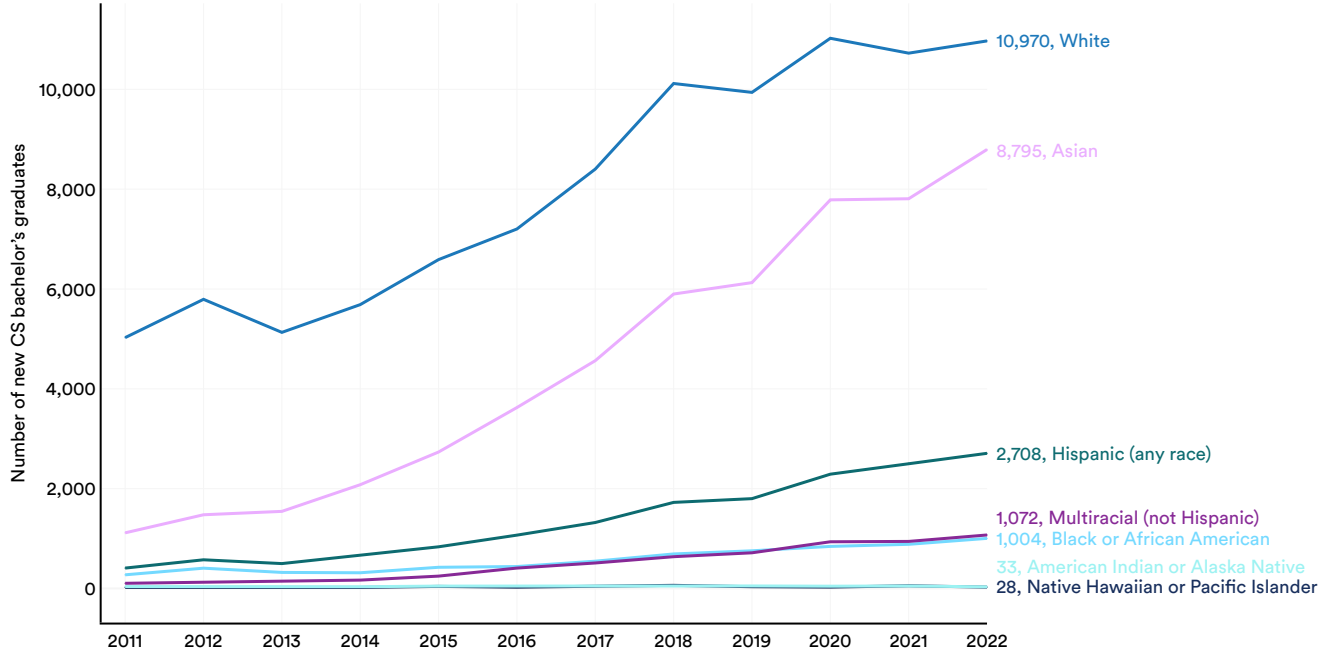Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

10,970, White
8,795, Asian
2,708, Hispanic (any race)
1,072, Multiracial (not Hispanic)
1,004, Black or African American
33, American Indian or Alaska Native
28, Native Hawaiian or Pacific Islander

Figure 8.1.2

Ethnicity of new resident CS bachelor's graduates (% of total) in the United States and Canada, 2011–22
Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

44.58%, White
35.74%, Asian
11.00%, Hispanic (any race)
4.36%, Multiracial (not Hispanic)
4.08%, Black or African American
0.13%, American Indian or Alaska Native
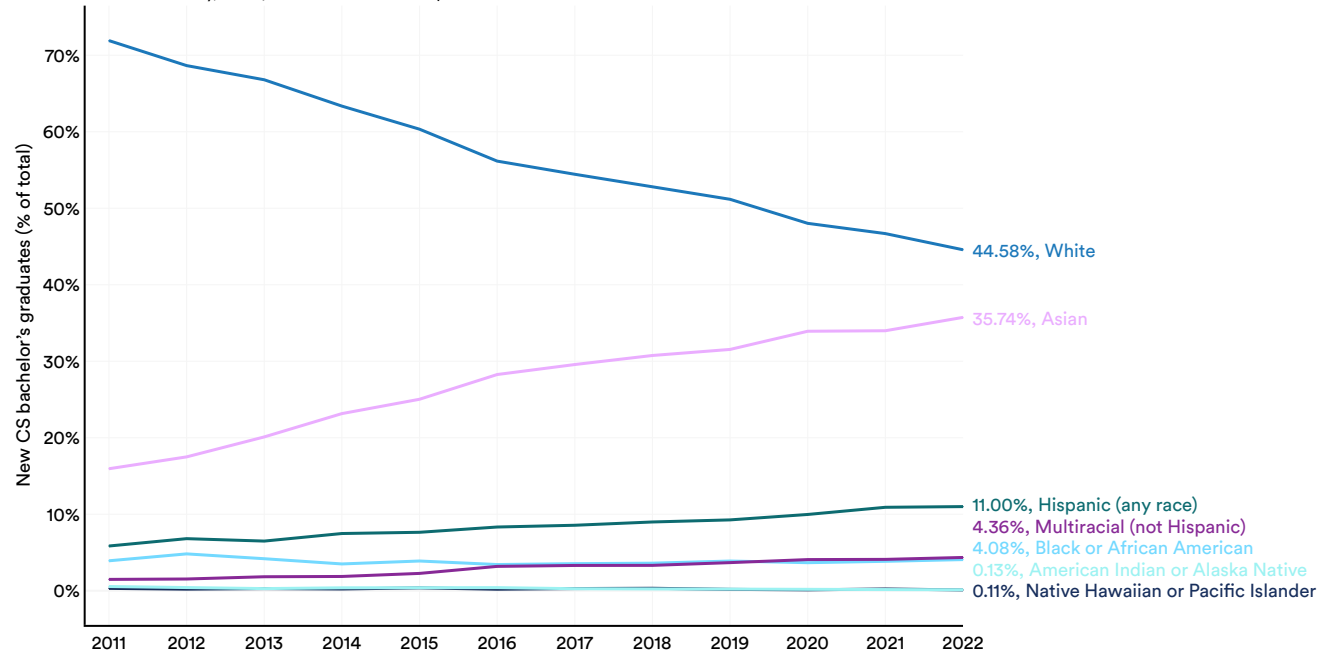0.11%, Native Hawaiian or Pacific Islander

Figure 8.1.3

CS Master's Graduates

The proportion of female CS master's graduates has seen minimal growth in the last decade, increasing to 26.3% in 2022 from 24.6% in 2011. Additionally, in 2022, 0.08% of CS master's graduates identified as nonbinary/other (Figure 8.1.4).

Gender of new CS master's graduates (% of total) in the United States and Canada, 2011–22
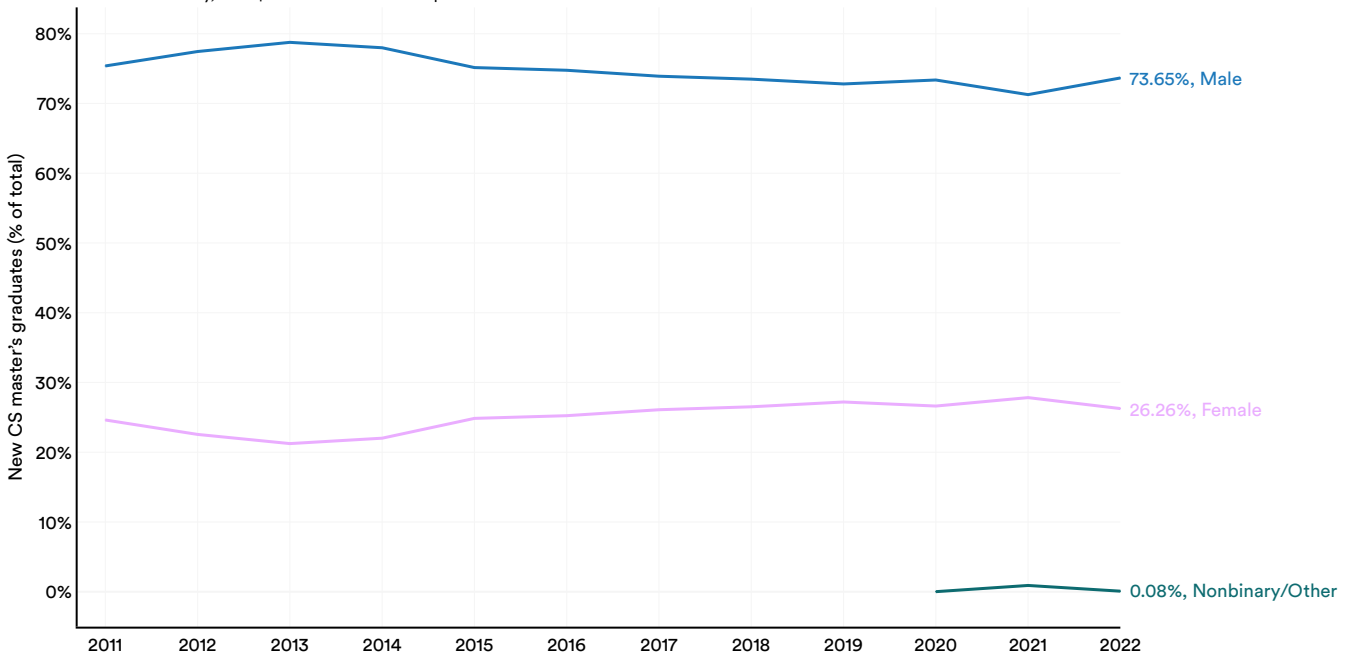Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

Figure 8.1.4

Among North American students, the most represented ethnicities are white (47.9%), Asian (35.8%), and Hispanic (8.2%) (Figure 8.1.5 and Figure 8.1.6). Similar to CS bachelor's graduates, the pool of CS master's graduates has become increasingly ethnically diverse over the last decade.

Ethnicity of new resident CS master's graduates in the United States and Canada, 2011–22
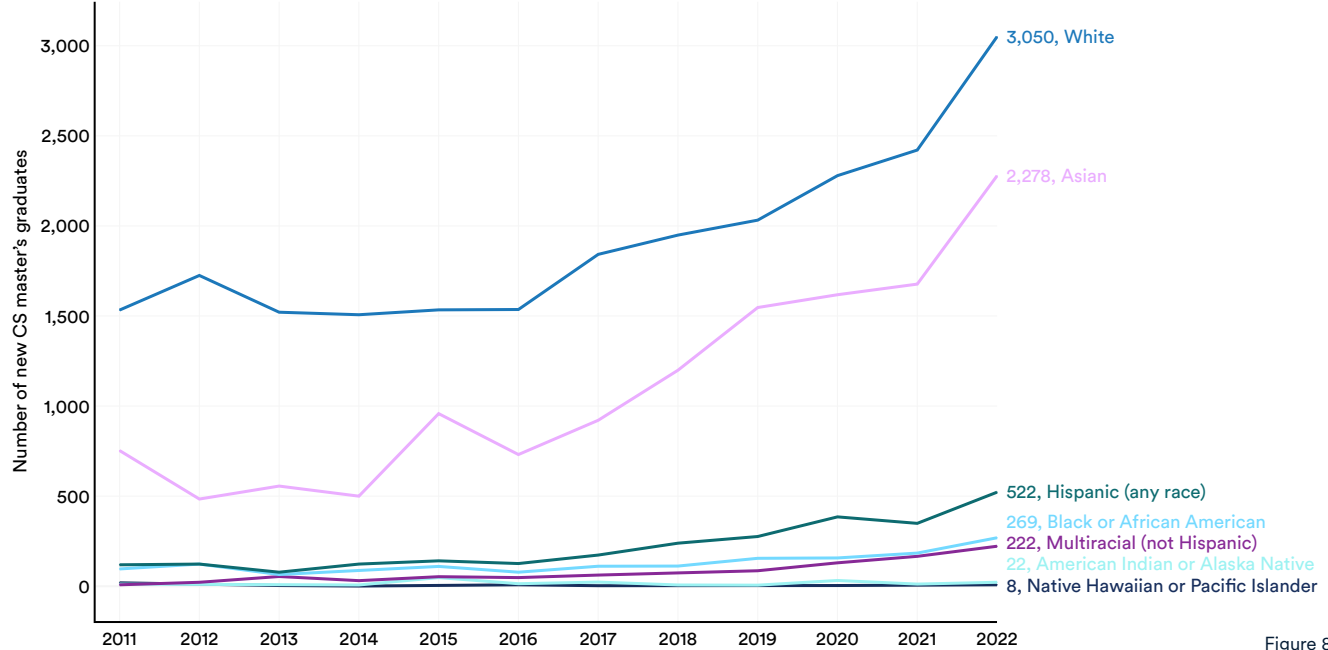Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

Figure 8.1.5

Ethnicity of new resident CS master's graduates (% of total) in the United States and Canada, 2011–22
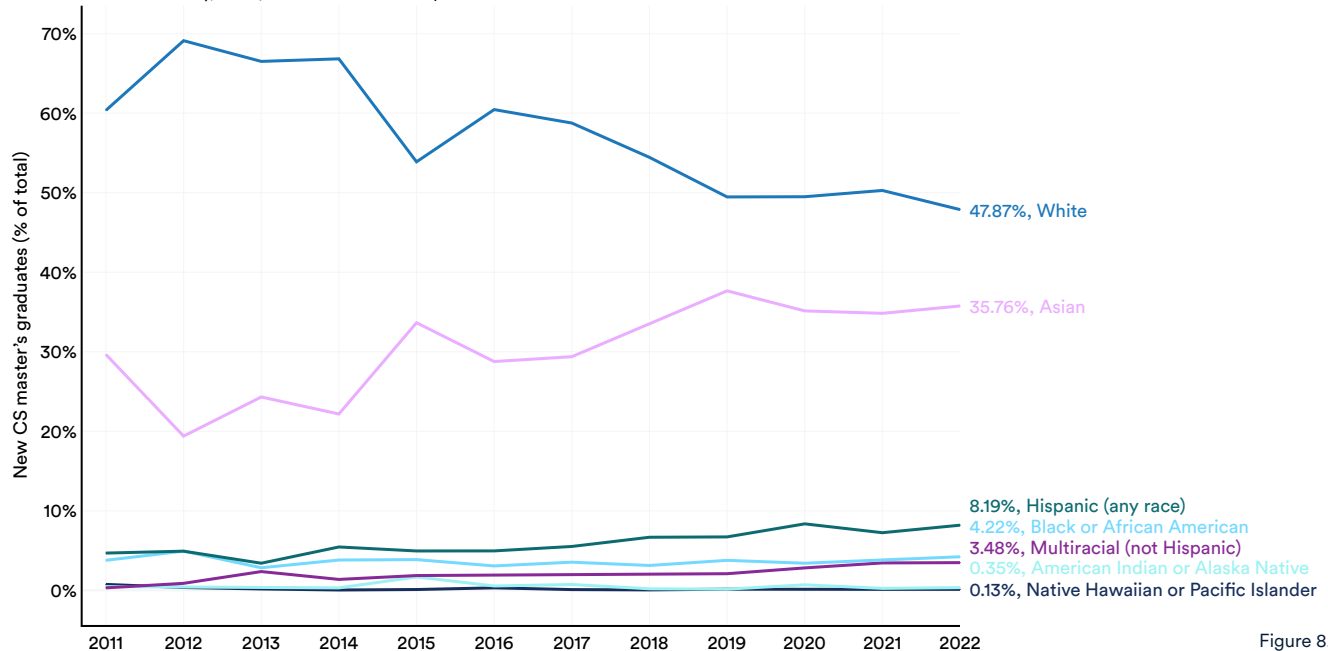Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

Figure 8.1.6

CS PhD Graduates

In 2022, the percentage of female PhD graduates in CS slightly decreased to 22.1% (Figure 8.1.7), but the long-term trend is unchanged.

Gender of new CS PhD graduates (% of total) in the United States and Canada, 2010–22
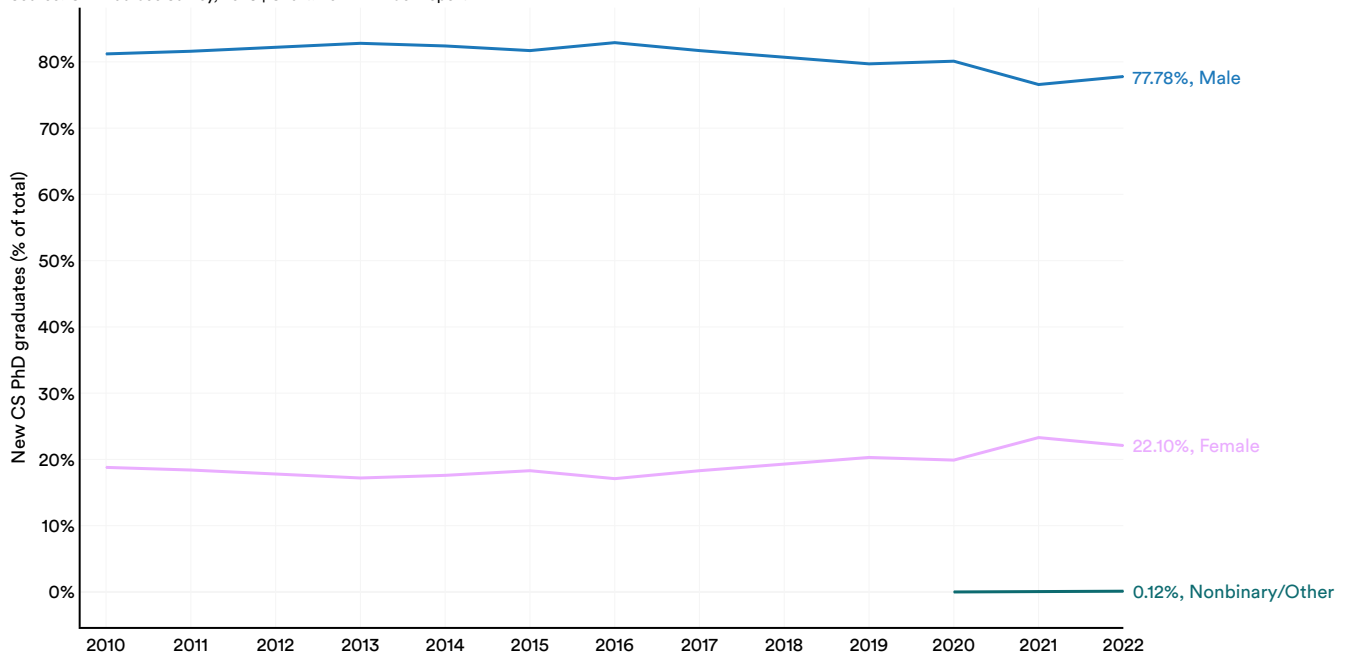Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

Figure 8.1.7

From 2011 to 2022, the diversity among CS PhD graduates significantly increased (Figure 8.1.8 and Figure 8.1.9). In 2022, 41.1% of CS PhD graduates were Asian, Black, Hispanic, multiracial, American Indian, or Native Hawaiian, marking a considerable rise from 2011.

Ethnicity of new resident CS PhD graduates in the United States and Canada, 2011–22
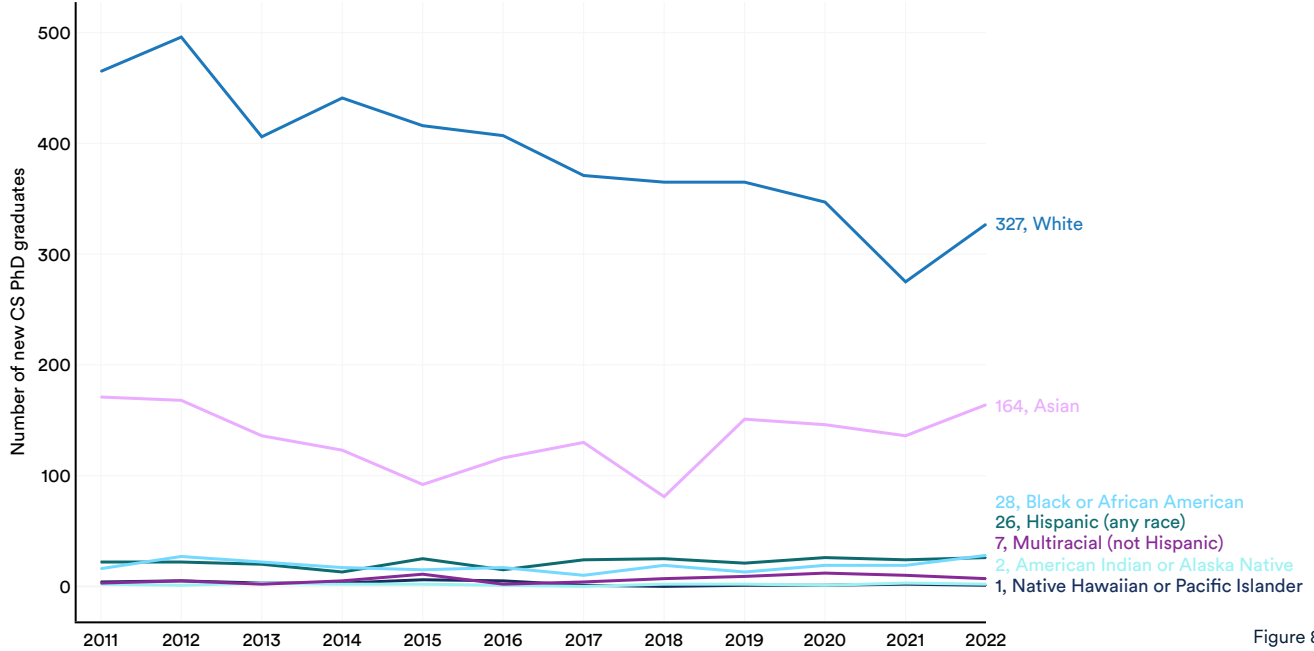Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

327, White
164, Asian
28, Black or African American
26, Hispanic (any race)
7, Multiracial (not Hispanic)
2, American Indian or Alaska Native
1, Native Hawaiian or Pacific Islander

Figure 8.1.8

Ethnicity of new resident CS PhD graduates (% of total) in the United States and Canada, 2011–22
Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

58.92%, White
29.55%, Asian
5.05%, Black or African American
4.68%, Hispanic (any race)
1.26%, Multiracial (not Hispanic)
0.36%, American Indian or Alaska Native
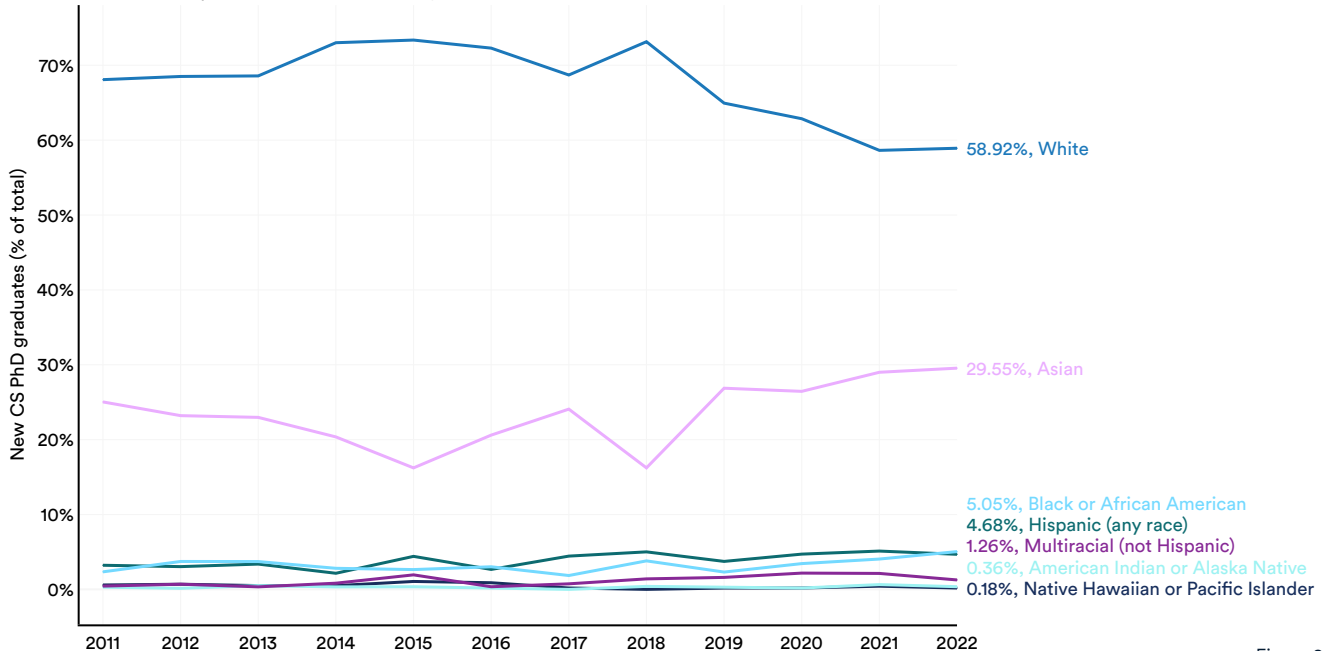0.18%, Native Hawaiian or Pacific Islander

Figure 8.1.9

Disability Status of CS, CE, and Information Students

For the second consecutive year, the CRA requested departments to report the number of students at each degree level who received disability accommodations over the preceding year. The reported numbers were relatively low: 4.1% of bachelor's, 1.5% of master's, and 1.1% of PhD students indicated a need for accommodations (Figure 8.1.10). Year over year, the proportion of students requesting disability accommodations has remained consistent.

CS, CE, and information students (% of total) with disability accomodations in United States and Canada, 2021 vs. 2022
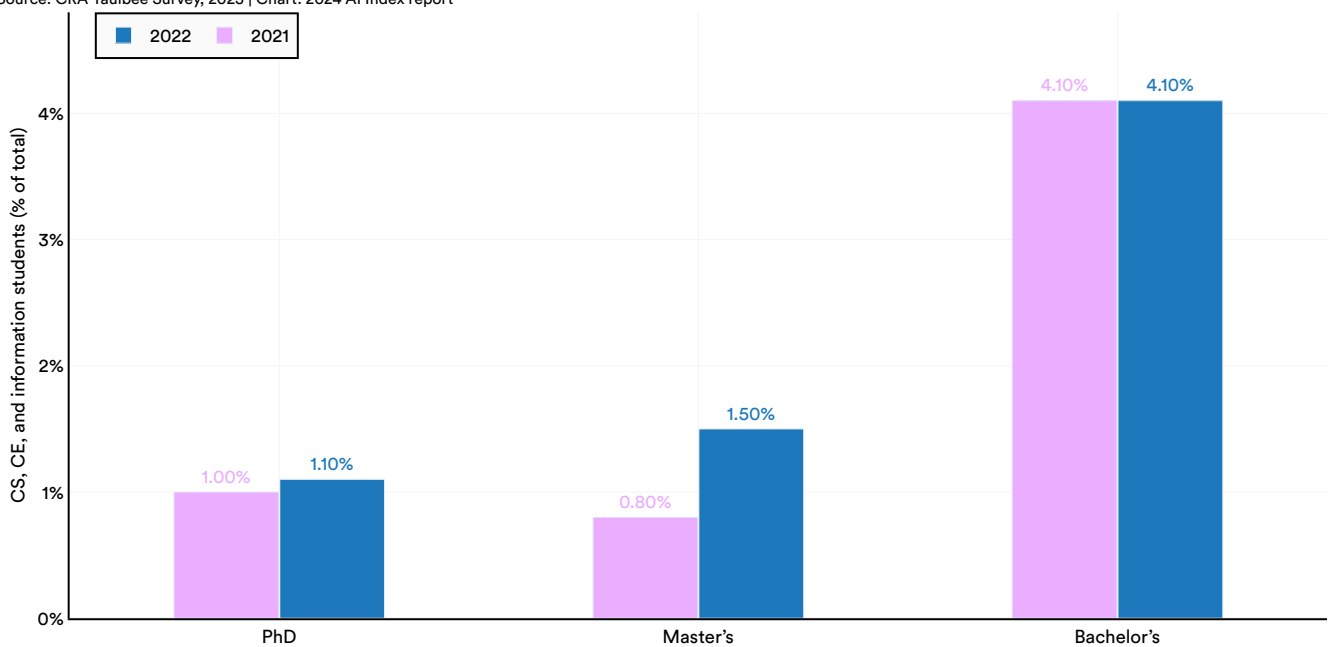Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

Figure 8.1.10

CS, CE, and Information Faculty

Data regarding the ethnicity and gender of faculty in CS, CE, and information fields highlight diversity trends in academic AI and CS. As of 2022, a majority of faculty members in CS, CE, and information are male (75.6%), with women comprising 24.3% and nonbinary individuals accounting for 0.1% (Figure 8.1.11). Although the proportion of female faculty in these fields has risen since 2011, the increase has been small.

Gender of CS, CE, and information faculty (% of total) in the United States and Canada, 2011–22
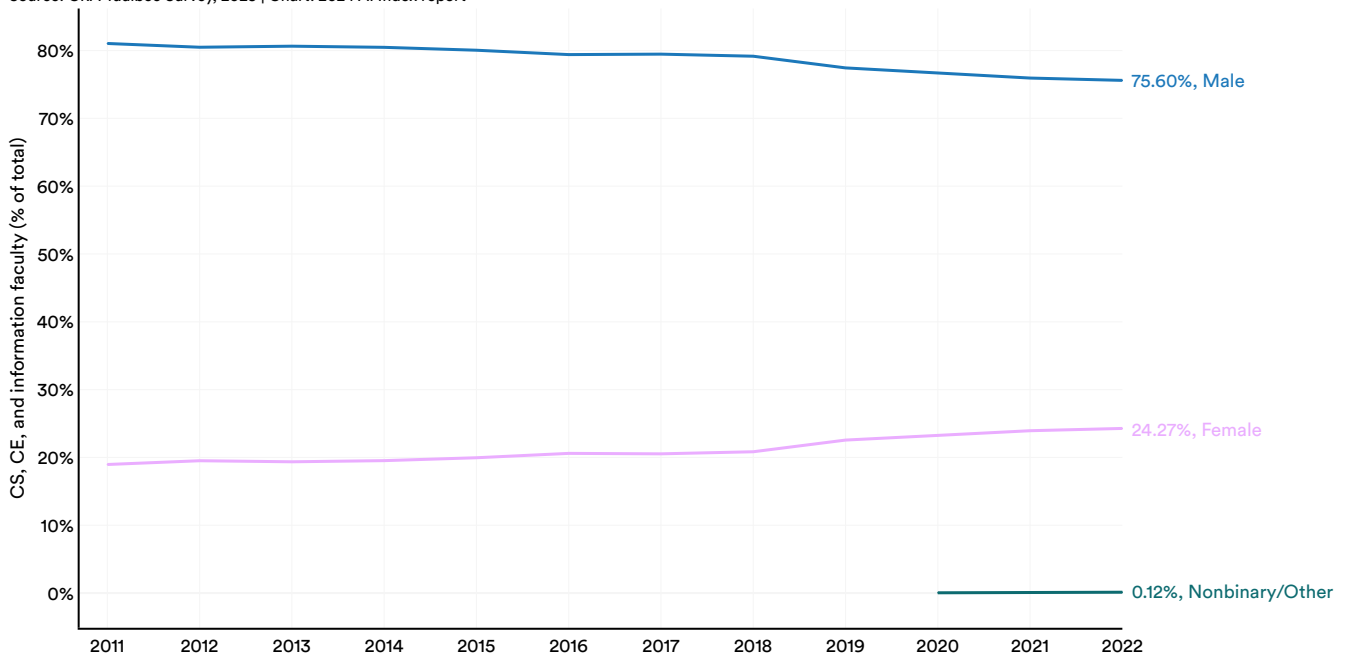Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

Figure 8.1.11

While the majority of new faculty hires in CS, CE, and information at American and Canadian universities remain male (71.7%), the proportion of women reached 28.0% in 2022 (Figure 8.1.12), well above the proportion of new female PhDs.

Gender of new CS, CE, and information faculty hires (% of total) in the United States and Canada, 2011–22
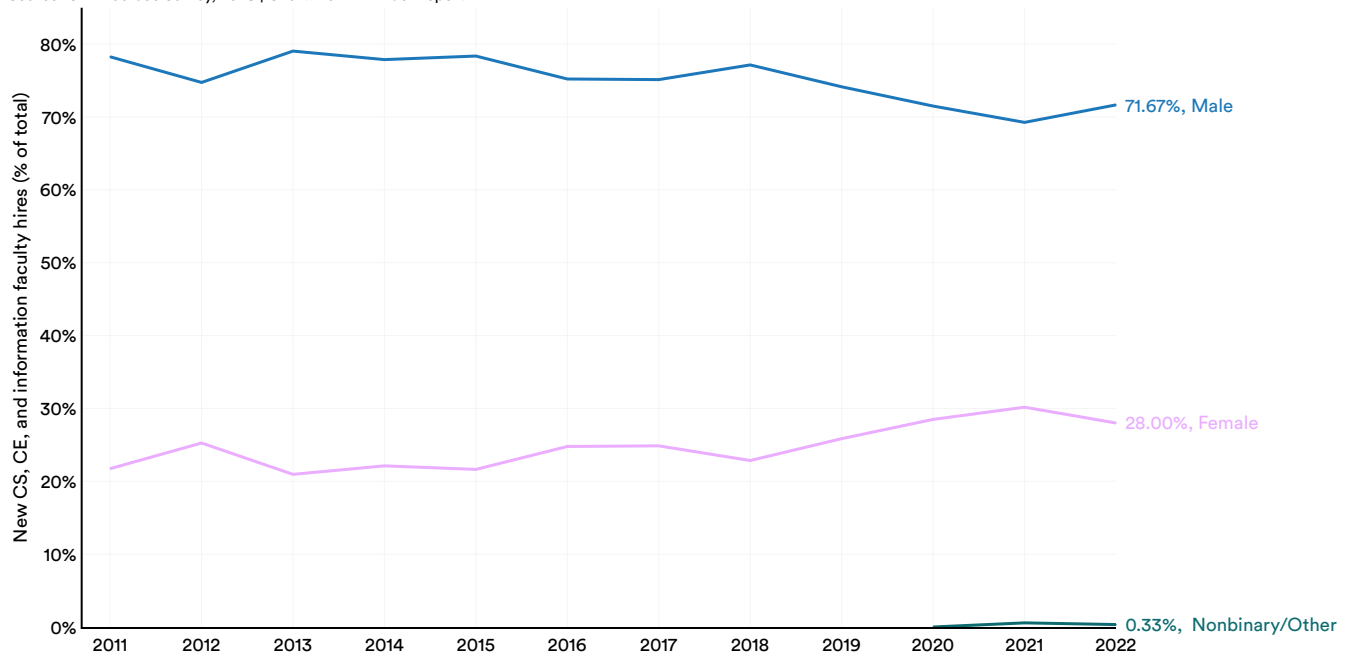Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

Figure 8.1.12

As of 2022, the majority of resident faculty in CS, CE, and information were white (57.3%), with Asian faculty following at 30.1% (Figure 8.2.13 and Figure 8.1.14). The ethnic diversity gap is gradually closing: In 2011, the difference between white faculty and the next largest ethnic group was 46.1%, but by 2021, it had narrowed to 27.2%.

Ethnicity of resident CS, CE, and information faculty in the United States and Canada, 2011–22
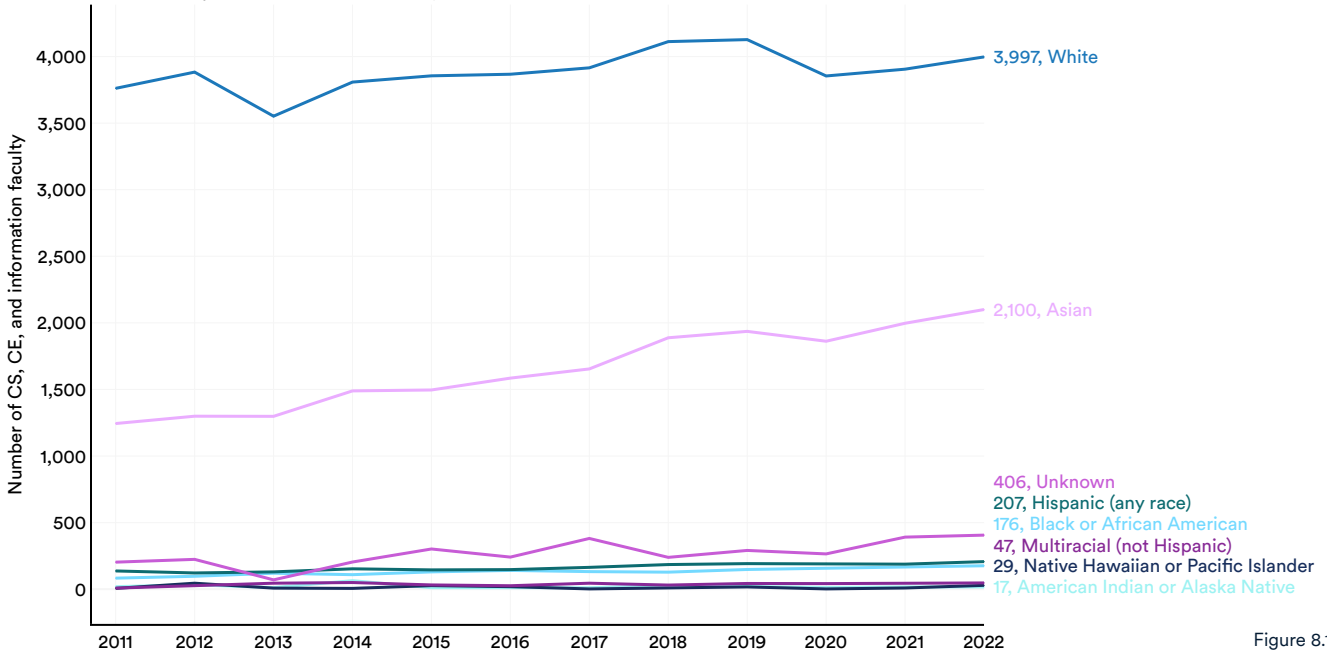Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

Figure 8.1.13

Ethnicity of resident CS, CE, and information faculty (% of total) in the United States and Canada, 2011–22
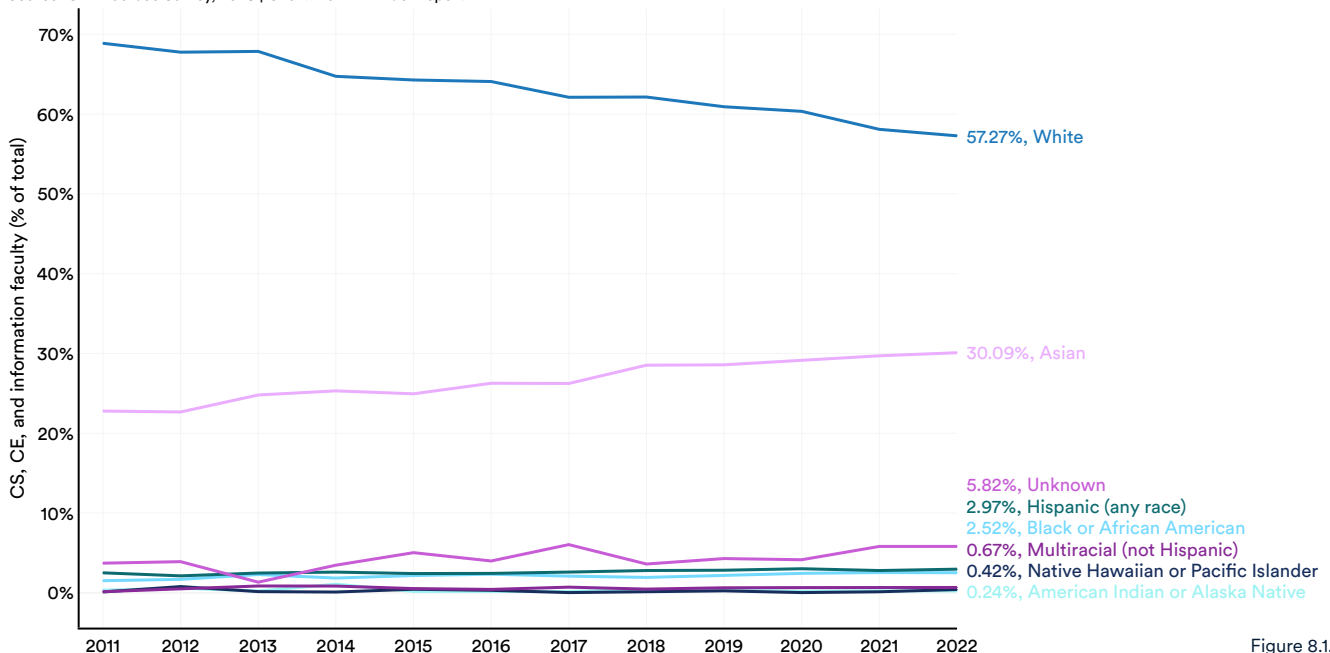Source: CRA Taulbee Survey, 2023 | Chart: 2024 AI Index report

Figure 8.1.14

Europe

Data on diversity trends about European CS graduates comes from Informatics Europe.[3]

Informatics, CS, CE, and IT Bachelor's Graduates

In the majority of surveyed European nations, there is a persistent gender disparity among bachelor's-level graduates in informatics, computer science, computer engineering, and information technology. Despite some narrowing since 2011, men continue to dominate. For example, France (14.8%), the United Kingdom (17.8%), and Germany (21.5%) show relatively low proportions of female graduates in these fields (Figure 8.1.15). Bulgaria stands out among the surveyed countries with the highest proportion of female graduates (35.2%).

Informatics, CS, CE, and IT Master's Graduates

Similar gender disparities are observed among European informatics, CS, CE, and IT master's graduates, with a significantly greater proportion of males than females in most surveyed countries. As of 2022, Estonia (42.0%), Romania (41.9%), and Bulgaria (40.4%) reported the greatest proportion of female master's graduates (Figure 8.1.16). In contrast, Belgium (13.7%), Italy (14.1%), and Switzerland (15.8%) reported the smallest proportion of female master's graduates.

Informatics, CS, CE, and IT PhD Graduates

In all surveyed European countries, informatics, CS, CE, and IT PhD graduates are predominantly male. However, in nations such as the United Kingdom, Germany, and Switzerland, the gender gap has narrowed over the last decade, with women constituting a growing share of PhD graduates (Figure 8.1.17).[4] In contrast, countries like Finland and Spain have seen the gap slightly widen.

3 The year label refers to the year in which an academic year ends. For example, the figures visualizing new graduates for 2022 reflect the number of graduates reported for the 2021/2022 academic year. For the sake of visual simplicity, the Index opts to focus on the year in which students graduated.

4 In countries where the number of PhD graduates is relatively small, trends in gender proportions can be prone to sudden year-over-year changes. For example, in 2022 Bulgaria produced 24 total PhDs, Latvia 12, and Estonia 26.

Gender of new informatics, CS, CE, and IT bachelor's graduates (% of total) in Europe, 2011–22
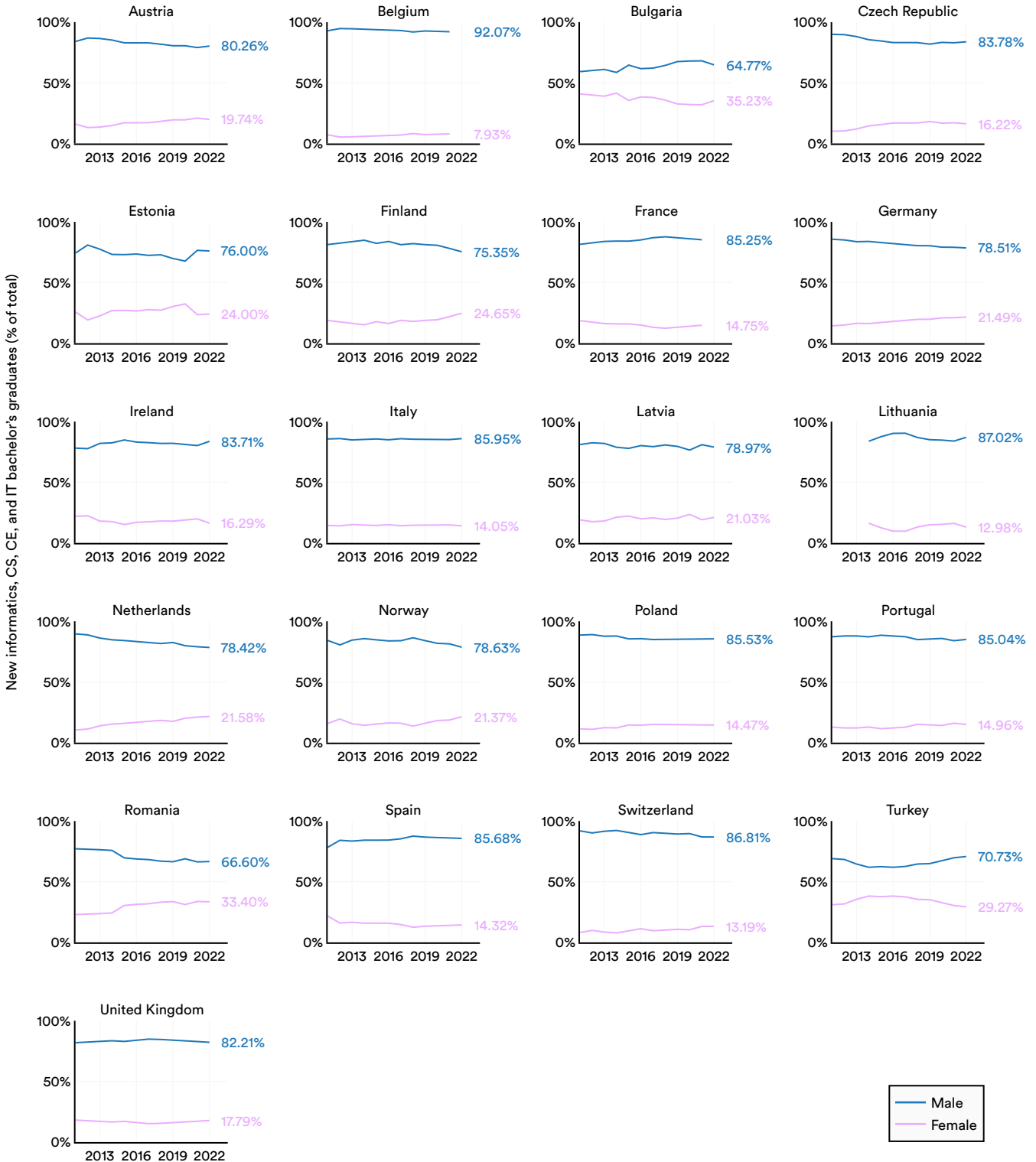Source: Informatics Europe, 2023 | Chart: 2024 AI Index report

Figure 8.1.15

Gender of new informatics, CS, CE, and IT master's graduates (% of total) in Europe, 2011–22
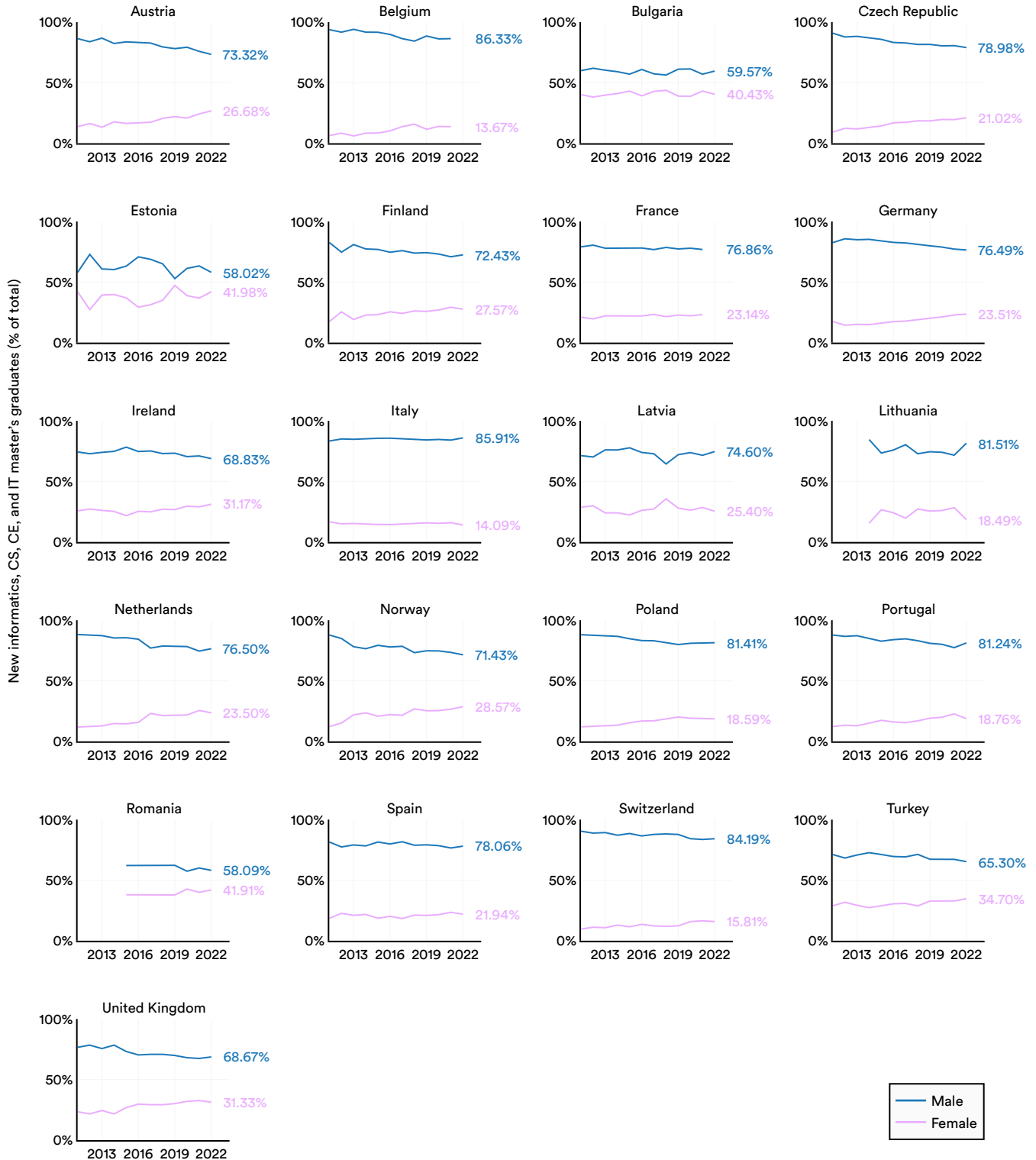Source: Informatics Europe, 2023 | Chart: 2024 AI Index report

Figure 8.1.16

Gender of new informatics, CS, CE, and IT PhD graduates (% of total) in Europe, 2011–22
Source: Informatics Europe, 2023 | Chart: 2024 AI Index report

Figure 8.1.17

8.2 AI Conferences

Women in Machine Learning (WiML) NeurIPS Workshop

Women in Machine Learning (WiML), founded in 2006, is an organization dedicated to supporting and increasing the impact of women in machine learning. This section of the AI Index presents data from the WiML annual technical workshop, hosted at NeurIPS.

Workshop Participants

Despite a decline in participation over the last two years, the 2023 NeurIPS WiML workshop attendance of 714 was nearly eight times higher than the attendance of 89 in 2010 (Figure 8.2.1). The recent drop in WiML workshop attendance may be linked to the overall decrease in NeurIPS attendance, which could be attributed to the shift away from a purely virtual format.[5] As a share of total conference attendance, the 2023 WiML workshop represented 4.4% of attendees (Figure 8.2.2).

Attendance at NeurIPS Women in Machine Learning workshop, 2010–23
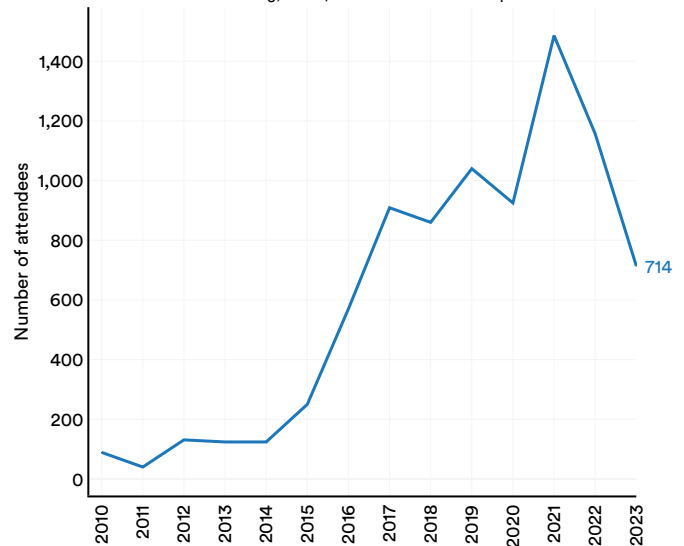Source: Women in Machine Learning, 2023 | Chart: 2024 AI Index report

Figure 8.2.1

Attendance at NeurIPS Women in Machine Learning workshop (% of total), 2010–23
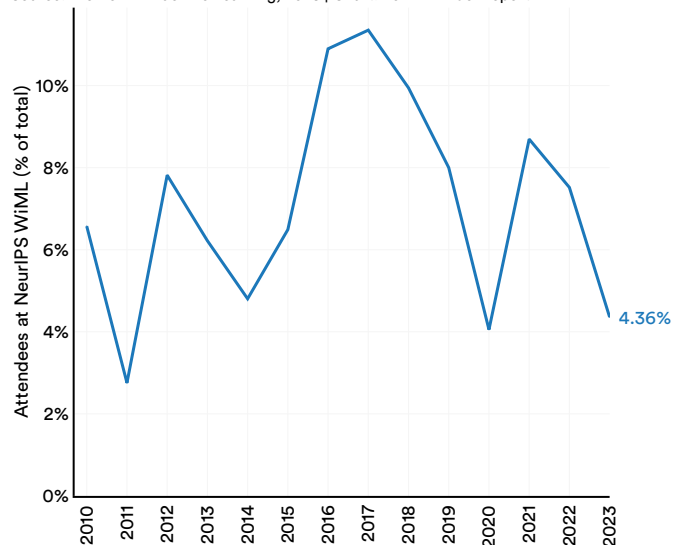Source: Women in Machine Learning, 2023 | Chart: 2024 AI Index report

Figure 8.2.2

5 Figure 8.1.1 accounts for total attendance, which in some conference years comprised both in-person and virtual attendance.

Demographic Breakdown

The data in the subsequent figures is derived from a survey completed by participants who agreed to aggregate their information. One component of the WiML survey asked attendees at the WiML workshop where they live. Among respondents, 56.4% hailed from North America, followed by Europe (21.8%), Asia (11.4%), and Africa (8.9%) (Figure 8.2.3). At this year's workshop, there was a greater proportion of North American attendees than in 2022.

Continent of residence of participants at NeurIPS Women in Machine Learning workshop, 2022 vs. 2023
Source: Women in Machine Learning, 2023 | Chart: 2024 AI Index report
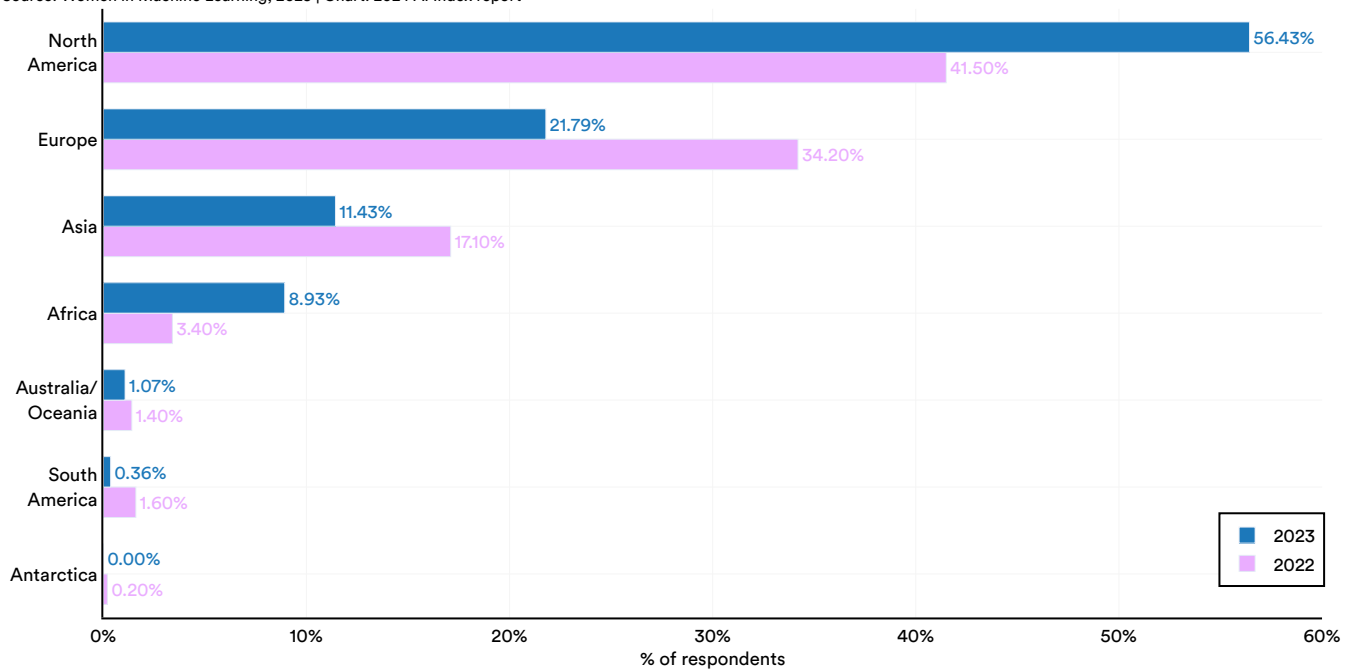

Figure 8.2.3

The majority of participants at the 2022 WiML workshop were female-identifying (84.2%), another 10.0% were male-identifying, and 3.2% were nonbinary-identifying (Figure 8.2.4).

Gender breakdown of participants at NeurIPS Women in Machine Learning workshop, 2022 vs. 2023
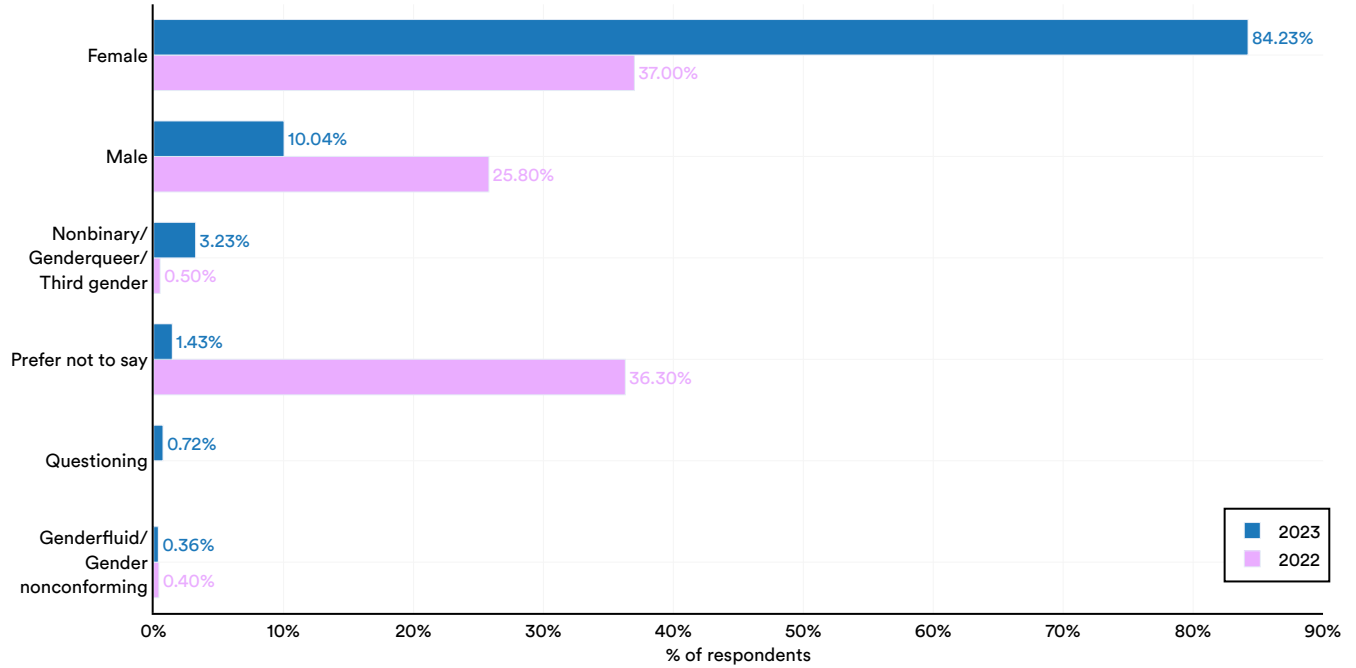Source: Women in Machine Learning, 2023 | Chart: 2024 AI Index report

Figure 8.2.4

This section uses data from Code.org, a U.S. nonprofit dedicated to advancing CS education in K–12 schools across the country, to paint a picture of how AI diversity trends are reflected at the K–12 level.

8.3 K–12 Education

AP Computer Science: Gender

In 2022, male students accounted for 68.9% of AP CS exam-takers, female students 30.5%, and students identifying as neither male nor female 0.7% (Figure 8.3.1).[6] While male students continue to dominate AP CS exam participation, the proportion of female students has nearly doubled over the past decade.

AP computer science exams taken (% of total) by gender, 2007–22
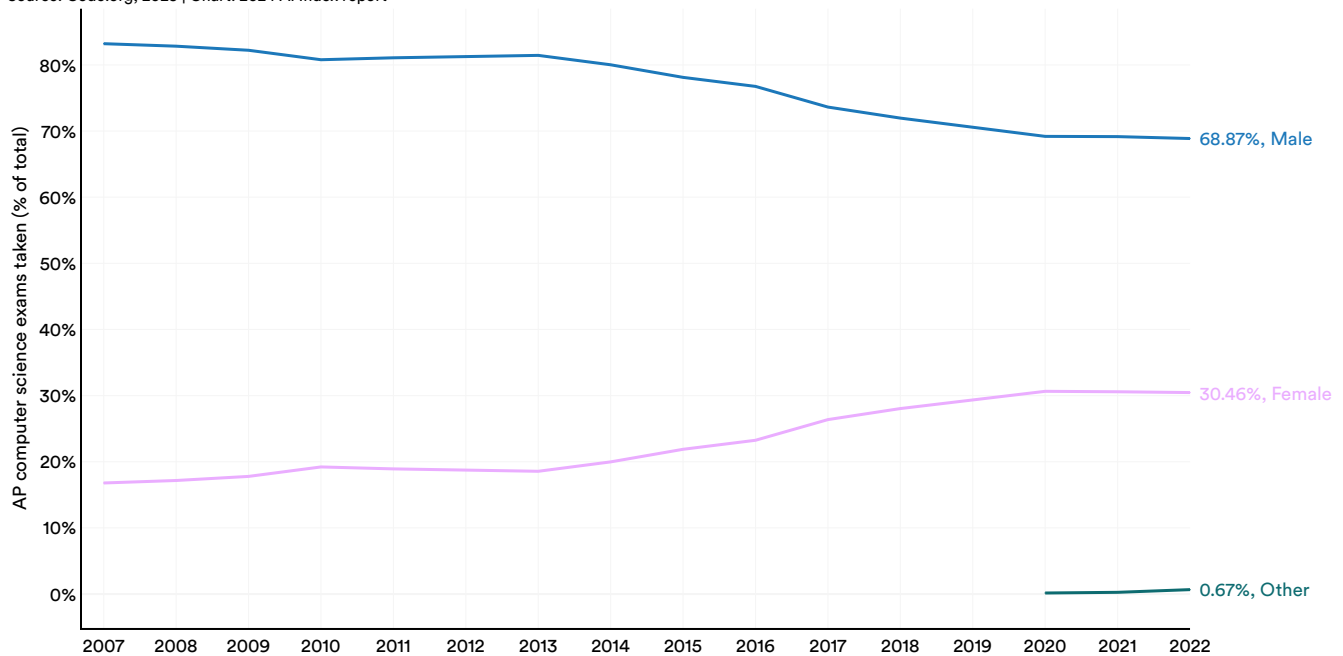Source: Code.org, 2023 | Chart: 2024 AI Index report

Figure 8.3.1

6 There are two types of AP CS exams: Computer Science A and Computer Science Principles. Data on computer science exams taken includes both exams. AP CS Principles was initially offered in 2017.

On a percentage basis, the states with the highest number of female AP CS test-takers in 2022 were Mississippi (41%), Alabama (37%), and Washington, D.C. (37%) (Figure 8.3.2). California, Texas, and Washington, states known for significant CS and AI activity, also saw notable participation, with approximately 30% of AP CS exam-takers being female.

AP computer science exams taken by female students (% of total), 2022
Source: Code.org, 2023 | Chart: 2024 AI Index report

Figure 8.3.2

AP Computer Science: Ethnicity

Code.org's data highlights the evolving ethnic diversity among AP CS test-takers. Similar to trends in postsecondary CS, the ethnic diversity of AP CS test-takers is increasing. While white students remain the largest group, the participation of Asian, Hispanic/Latino/Latina, and Black/African American students in AP CS exams has grown over time (Figure 8.3.3). In 2022, white students constituted the largest share of exam-takers (38.2%), followed by Asian (27.8%) and Hispanic/Latino/Latina students (17.6%) (Figure 8.3.3 and Figure 8.3.4).

AP computer science exams taken by race/ethnicity, 2007–22
Source: Code.org, 2023 | Chart: 2024 AI Index report
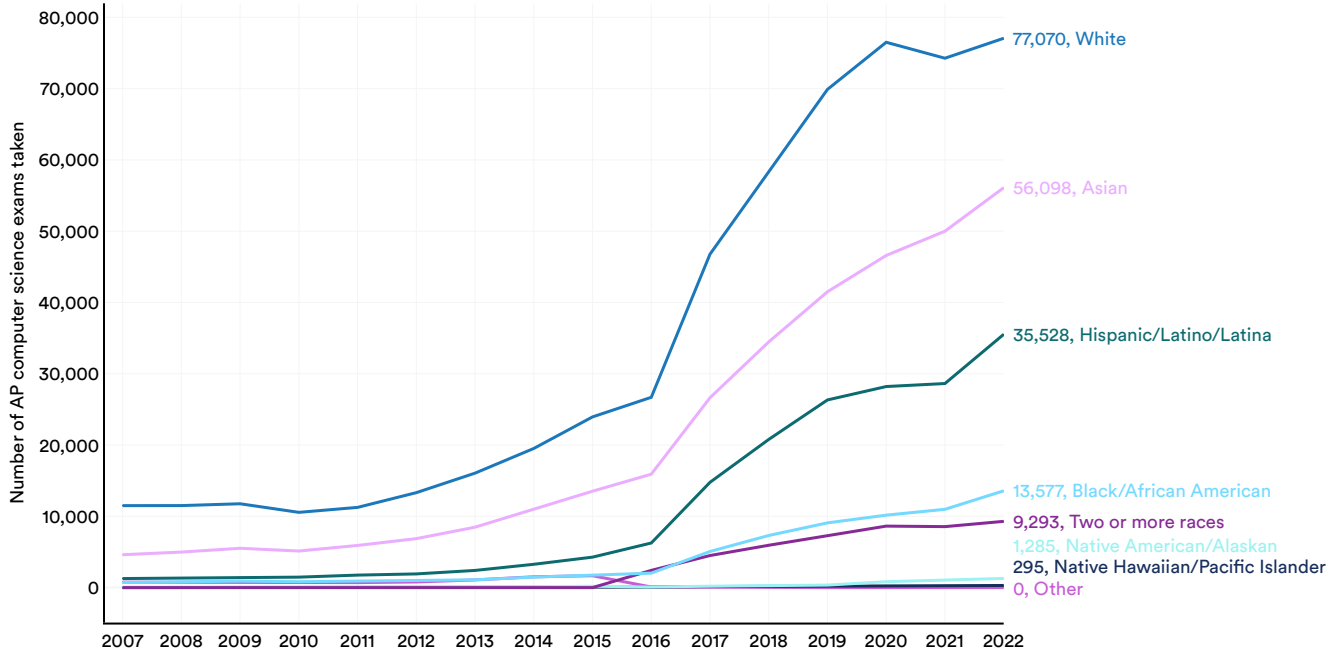

Figure 8.3.3

AP computer science exams taken (% of total responding students) by race/ethnicity, 2007–22
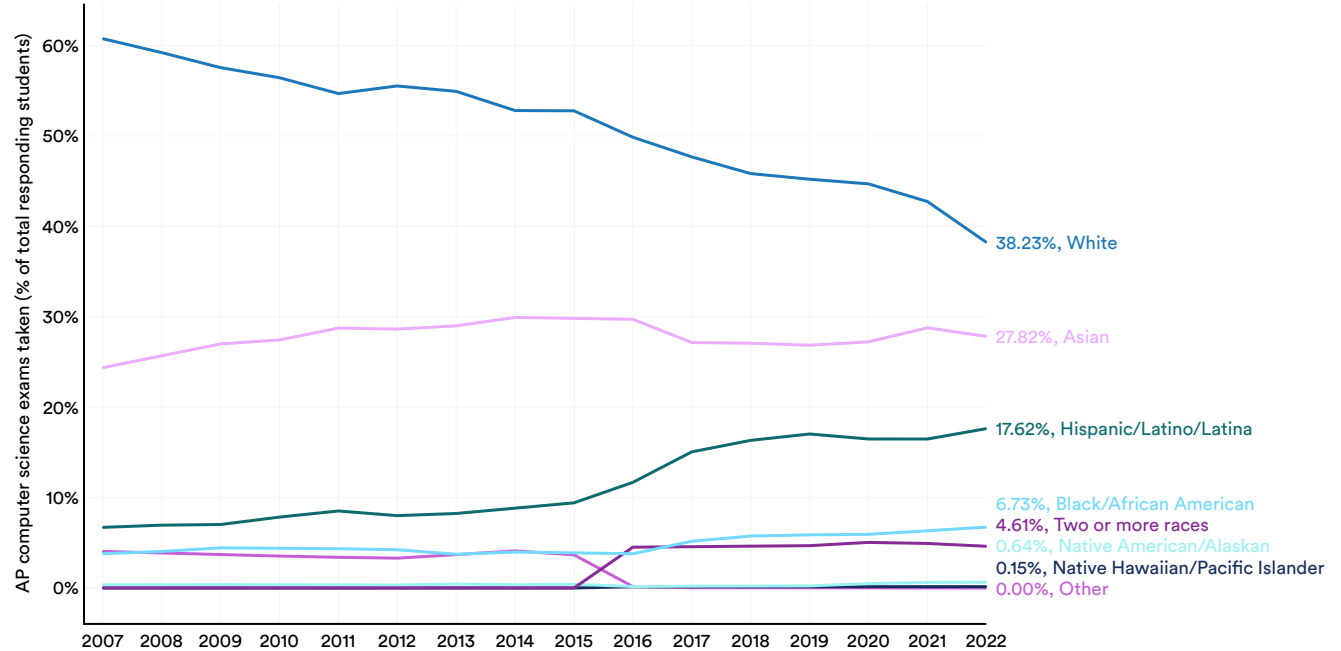Source: Code.org, 2023 | Chart: 2024 AI Index report

Figure 8.3.4

Appendix

Code.org

To learn more about the diversity data from Code.org, please read the methodological note on Code.org's data included in the Chapter 6 subsection of the Appendix.

Computing Research Association (CRA Taulbee Survey)

To learn more about the diversity data from the CRA, please read the methodological note on the CRA's data included in the Chapter 6 subsection of the Appendix.

Informatics Europe

To learn more about the diversity data from Informatics Europe, please read the methodological note on Informatics Europe's data included in the Chapter 6 subsection of the Appendix.