



Artificial Intelligence  
Index Report 2023

# CHAPTER 7: Diversity





## CHAPTER 7 PREVIEW:

# Diversity

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# Overview

AI systems are increasingly deployed in the real world. However, there often exists a disparity between the individuals who develop AI and those who use AI. North American AI researchers and practitioners in both industry and academia are predominantly white and male. This lack of diversity can lead to harms, among them the reinforcement of existing societal inequalities and bias.

This chapter highlights data on diversity trends in AI, sourced primarily from academia. It borrows information from organizations such as Women in Machine Learning (WiML), whose mission is to improve the state of diversity in AI, as well as the Computing Research Association (CRA), which tracks the state of diversity in North American academic computer science. Finally, the chapter also makes use of Code.org data on diversity trends in secondary computer science education in the United States.

Note that the data in this subsection is neither comprehensive nor conclusive. Publicly available demographic data on trends in AI diversity is sparse. As a result, this chapter does not cover other areas of diversity, such as sexual orientation. The AI Index hopes that as AI becomes more ubiquitous, the amount of data on diversity in the field will increase such that the topic can be covered more thoroughly in future reports.

# Chapter Highlights

## North American bachelor's, master's, and PhD-level computer science students are becoming more ethnically diverse.

Although white students are still the most represented ethnicity among new resident bachelor's, master's, and PhD-level computer science graduates, students from other ethnic backgrounds (for example, Asian, Hispanic, and Black or African American) are becoming increasingly more represented. For example, in 2011, 71.9% of new resident CS bachelor's graduates were white. In 2021, that number dropped to 46.7%.

## Women make up an increasingly greater share of CS, CE, and information faculty hires.

Since 2017, the proportion of new female CS, CE, and information faculty hires has increased from 24.9% to 30.2%. Still, most CS, CE, and information faculty in North American universities are male (75.9%). As of 2021, only 0.1% of CS, CE, and information faculty identify as nonbinary.

## New AI PhDs are still overwhelmingly male.

In 2021, 78.7% of new AI PhDs were male. Only 21.3% were female, a 3.2 percentage point increase from 2011. There continues to be a gender imbalance in higher-level AI education.

## American K–12 computer science education has become more diverse, in terms of both gender and ethnicity.

The share of AP computer science exams taken by female students increased from 16.8% in 2007 to 30.6% in 2021. Year over year, the share of Asian, Hispanic/Latino/Latina, and Black/African American students taking AP computer science has likewise increased.

# 7.1 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 subsection of the AI Index report presents data from the WiML annual technical workshop, hosted at NeurIPS. Since 2020, WiML has also been hosting the Un-Workshop, which serves to advance research via

collaboration and interaction among participants from diverse backgrounds at the International Conference of Machine Learning (ICML).

### Workshop Participants

Figure 7.1.1 shows the number of participants that have attended the WiML workshop since 2010. In the last decade, there has been a steady increase: 1,157 individuals participated in 2022, 13 times the number in 2010. However, from 2021 to 2022, the number of workshop participants decreased from 1,486 to 1,157.<sup>1</sup>

### Attendance at NeurIPS Women in Machine Learning Workshop, 2010–22

Source: Women in Machine Learning, 2022 | Chart: 2023 AI Index Report

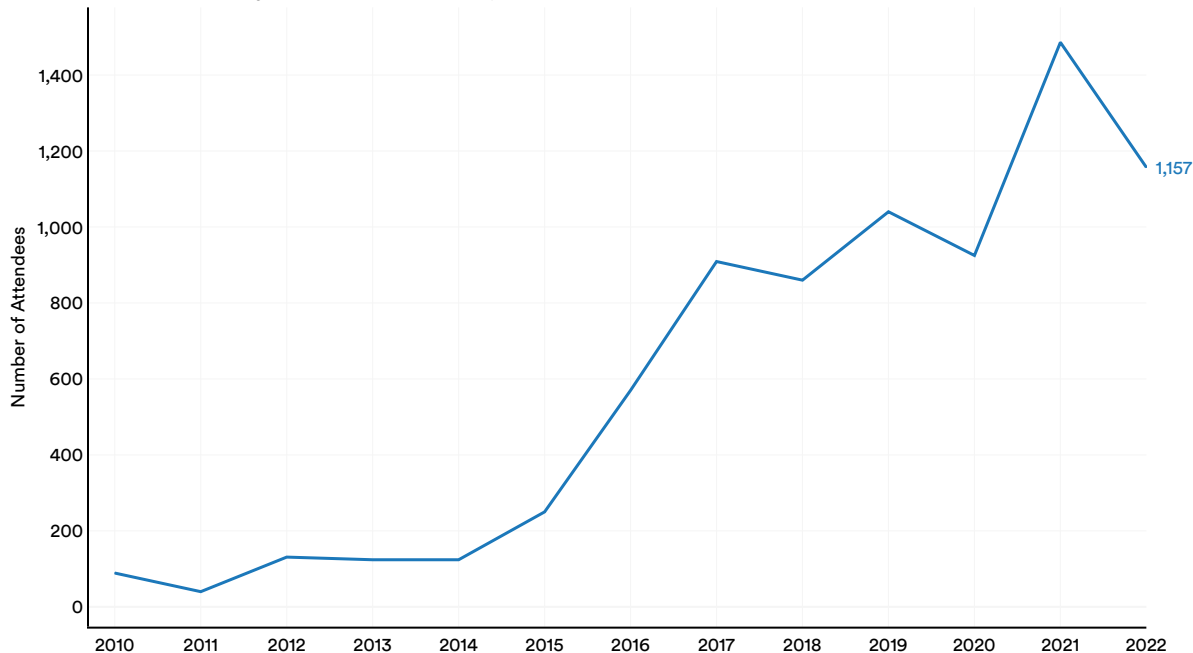


Figure 7.1.1

<sup>1</sup> The recent decrease in WiML workshop attendance may be attributable to the overall recent decrease in NeurIPS attendance. This overall decrease may in turn be a result of NeurIPS moving away from a purely virtual format.

### Demographic Breakdown

Figure 7.1.2 breaks down the continent of residence of the 2022 workshop participants. The data in the following figures comes from a survey completed by participants who consented to having such

information aggregated. Among survey respondents, around 41.5% were from North America, followed by Europe (34.2%), Asia (17.1%), and Africa (3.4%). In 2022, there was greater representation from Europe, Asia, and South America.

#### Continent of Residence of Participants at NeurIPS Women in Machine Learning Workshop, 2022

Source: Women in Machine Learning, 2022 | Chart: 2023 AI Index Report

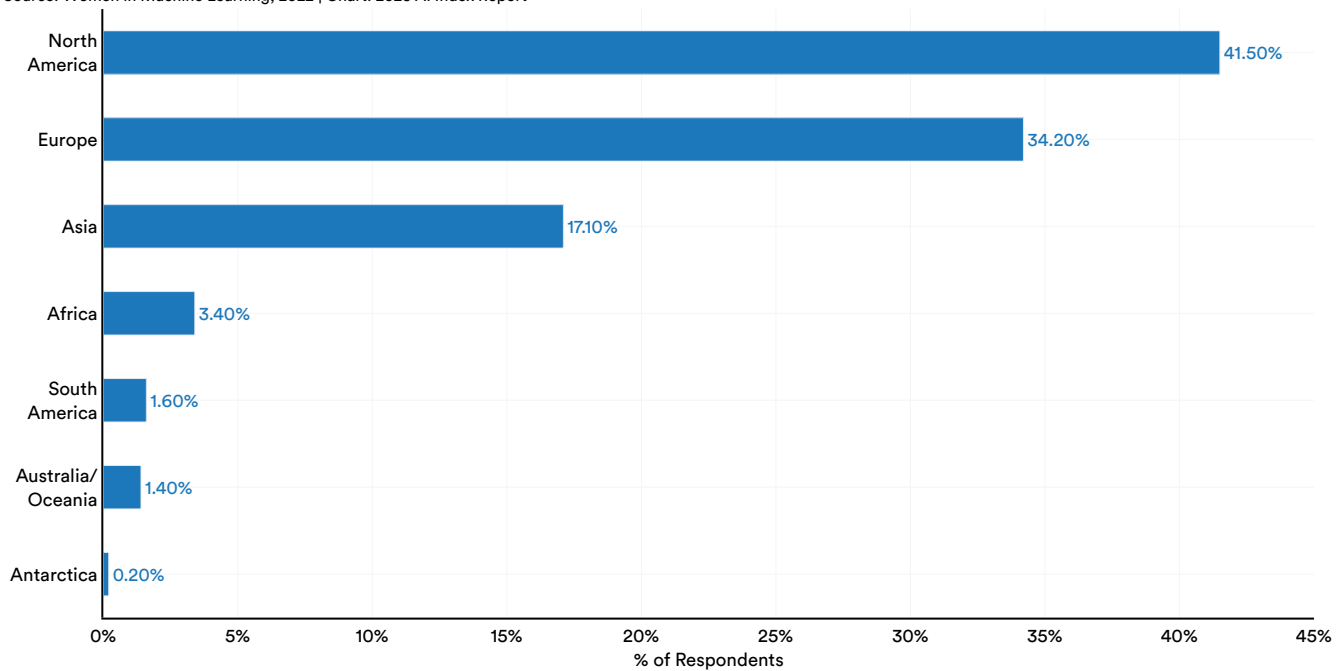


Figure 7.1.2<sup>2</sup>

<sup>2</sup> At the time of the survey, one of the respondents was temporarily residing in Antarctica.

The majority of participants at the 2022 WiML workshop were female-identifying (37.0%), another 25.8% were male-identifying, and 0.5% were nonbinary-identifying (Figure 7.1.3).

### Gender Breakdown of Participants at NeurIPS Women in Machine Learning Workshop, 2022

Source: Women in Machine Learning, 2022 | Chart: 2023 AI Index Report

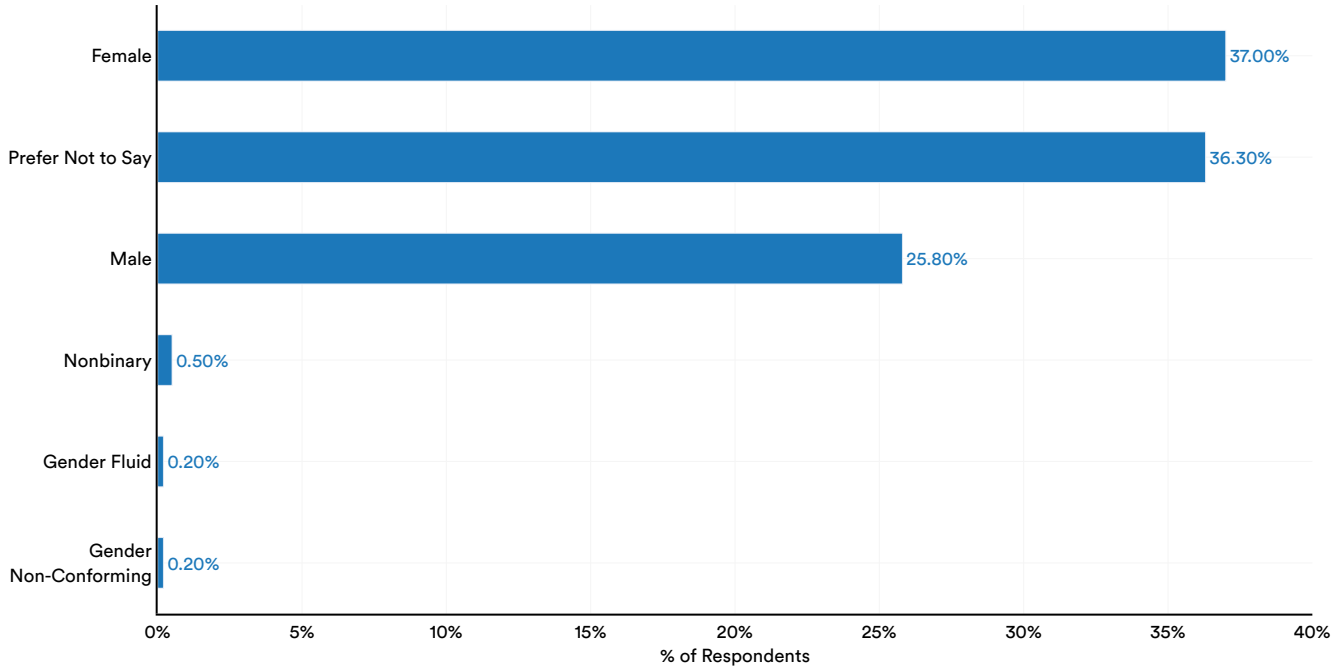


Figure 7.1.3

The most represented professional positions at the workshop were PhD students (49.4%), research scientists/ data scientists (20.8%), software engineers/data engineers (8.4%), and faculty (4.4%) (Figure 7.1.4).

### Professional Positions of Participants at NeurIPS Women in Machine Learning Workshop, 2022

Source: Women in Machine Learning, 2022 | Chart: 2023 AI Index Report

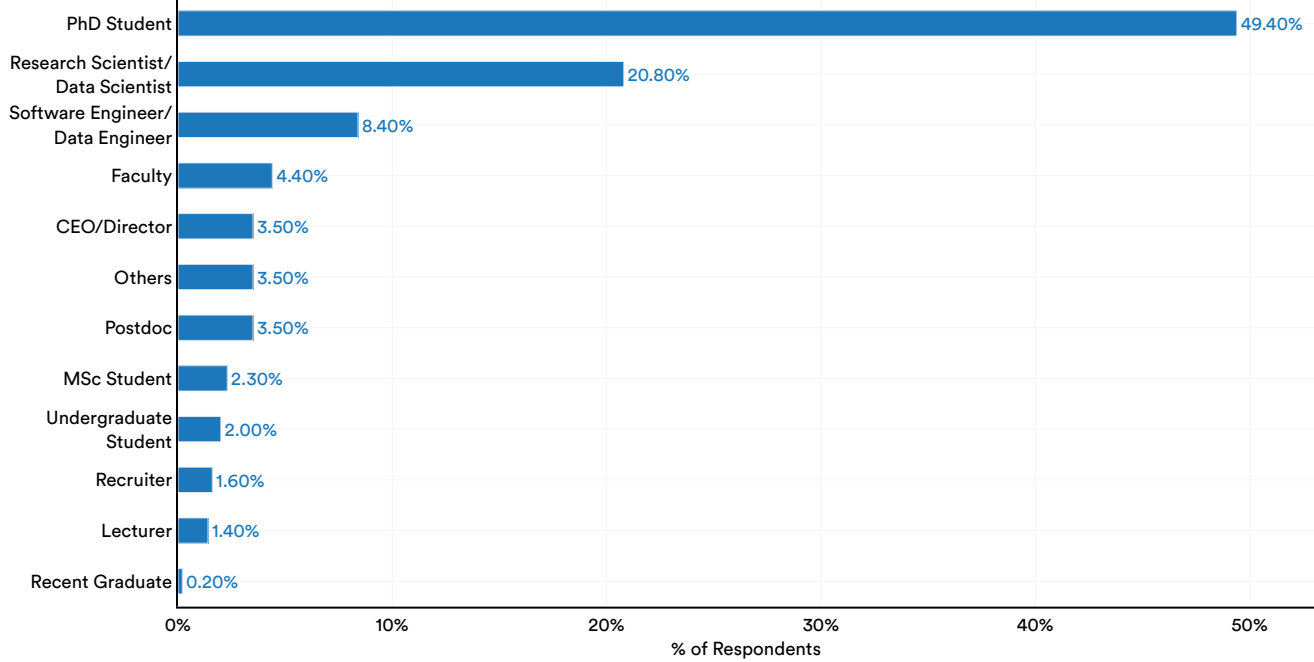


Figure 7.1.4



The WiML workshop participants at NeurIPS submitted papers covering a wide range of subjects (Figure 7.1.5). The most popular submission topics were applications (32.5%), algorithms (23.4%), and deep learning (14.8%).

### Primary Subject Area of Submissions at NeurIPS Women in Machine Learning Workshop, 2022

Source: Women in Machine Learning, 2022 | Chart: 2023 AI Index Report

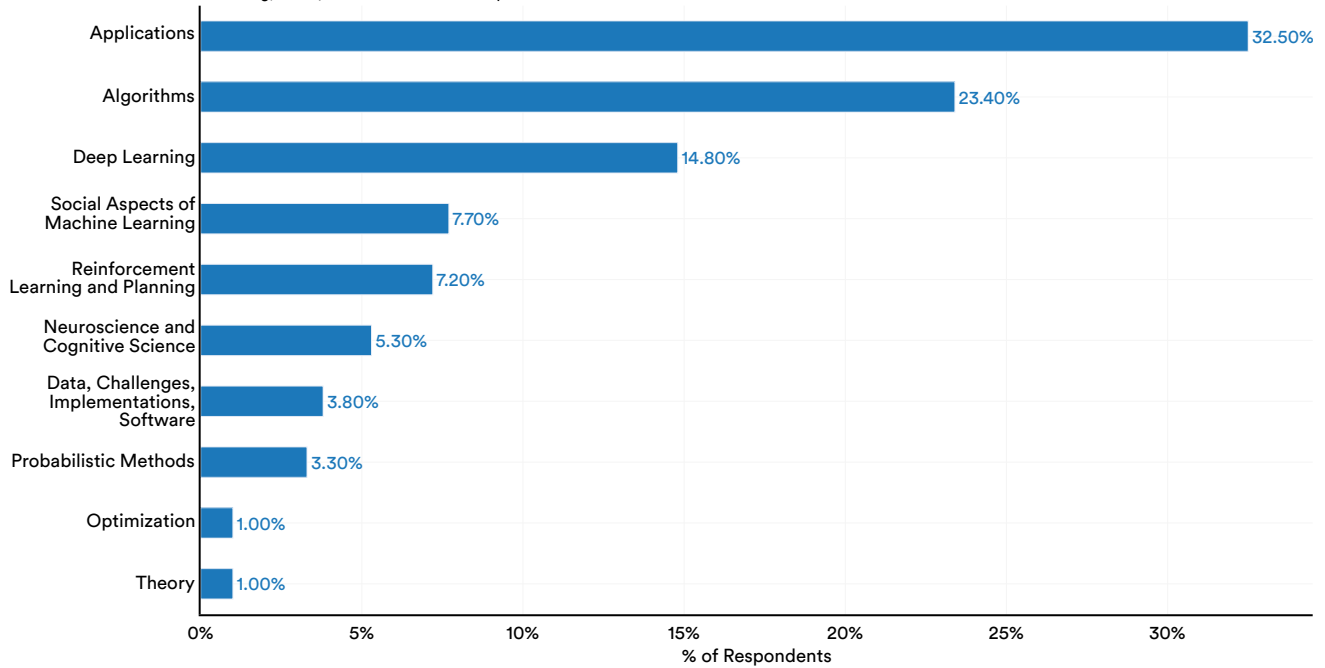


Figure 7.1.5

Another proxy for studying diversity in AI is looking at trends in postsecondary AI education. The following subsection borrows data from the Computing Research Association’s (CRA) annual Taulbee Survey.<sup>3</sup>

## 7.2 AI Postsecondary Education

### CS Bachelor’s Graduates

The number of female CS bachelor’s graduates rose to 22.3% from 2020 to 2021 (Figure 7.2.1). This increase mirrors a broader trend observed in the

last decade whereby an increasingly large number of CS bachelor’s graduates were women. The CRA survey also included a nonbinary gender category: In 2021, the number of nonbinary/other-identifying CS bachelor’s graduates was 0.04%.

**Gender of New CS Bachelor’s Graduates (% of Total) in North America, 2010–21**

Source: CRA Taulbee Survey, 2022 | Chart: 2023 AI Index Report

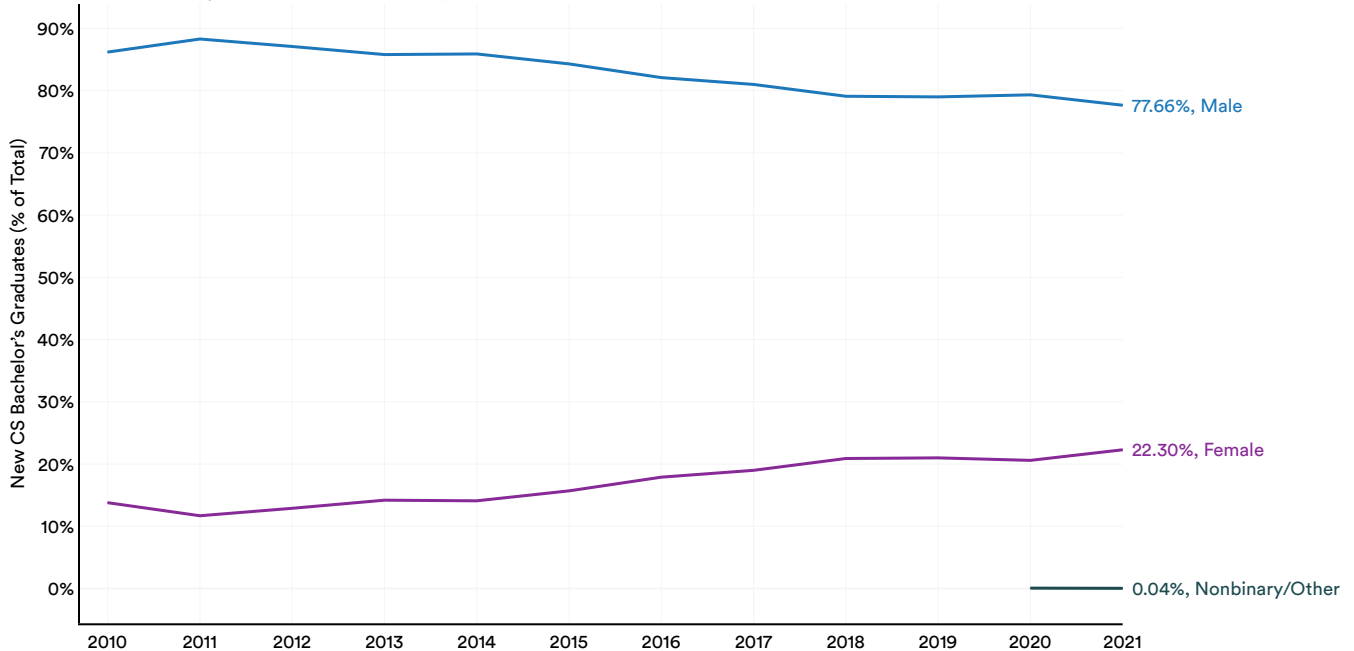


Figure 7.2.1

<sup>3</sup> The charts in this subsection look only at the ethnicity of domestic or native CS students and faculty. Although the CRA reports data on the proportion of nonresident aliens in each educational level (i.e., Bachelor’s, Master’s, PhD, and faculty), data on the ethnicity of nonresident aliens is not included. For the proportion of nonresident aliens in each category, see footnotes.

Figure 7.2.2 breaks down the ethnicity of new CS bachelor’s graduates in North America: The top ethnicity was white (46.7%), followed by Asian (34.0%) and Hispanic (10.9%). In the last decade, the proportion of new CS bachelor’s graduates who were Asian, Hispanic, or multiracial (not Hispanic) steadily increased.<sup>4</sup>

**Ethnicity of New Resident CS Bachelor’s Graduates (% of Total) in North America, 2011–21**

Source: CRA Taulbee Survey, 2022 | Chart: 2023 AI Index Report

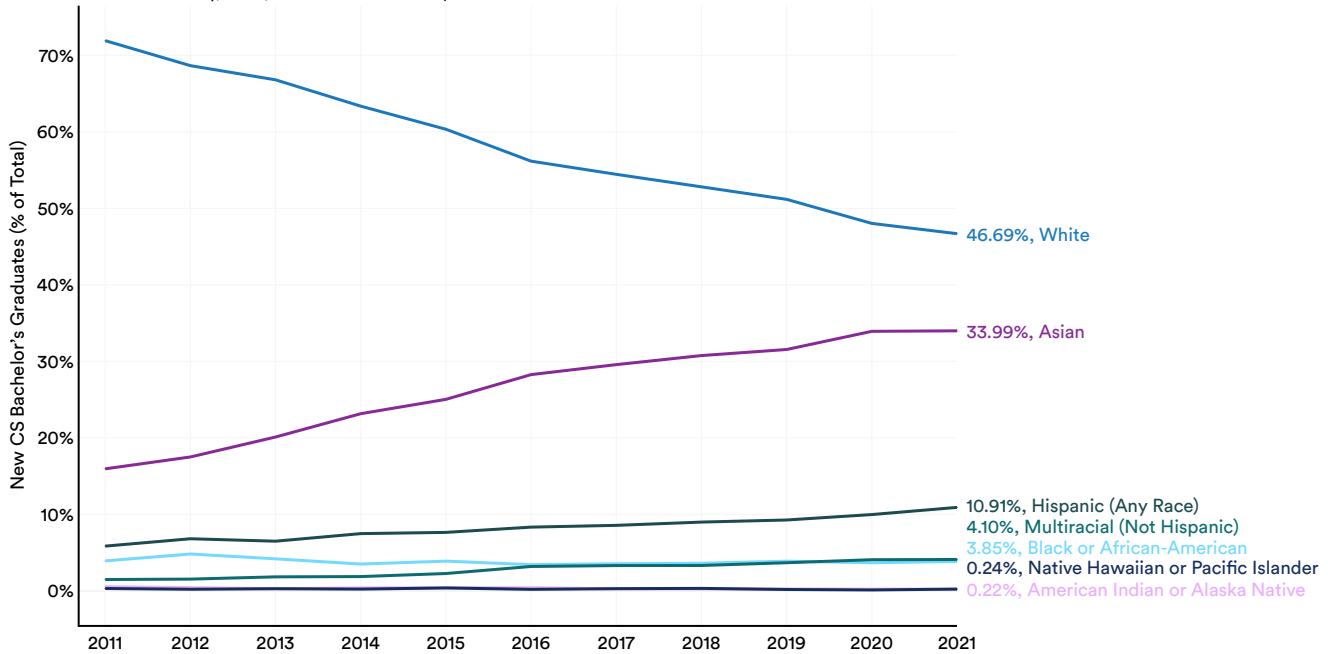


Figure 7.2.2

<sup>4</sup> In 2021, 16.3% of new CS bachelor graduates were nonresident aliens.

## CS Master's Graduates

Figure 7.2.3 shows the gender of CS master's graduates. The proportion of female CS master's graduates has not substantially increased over time,

moving to 27.8% in 2021 from 24.6% in 2011. In 2021, 0.9% of CS master's graduates identified as nonbinary/other.

**Gender of New CS Master's Graduates (% of Total) in North America, 2011–21**

Source: CRA Taubee Survey, 2022 | Chart: 2023 AI Index Report

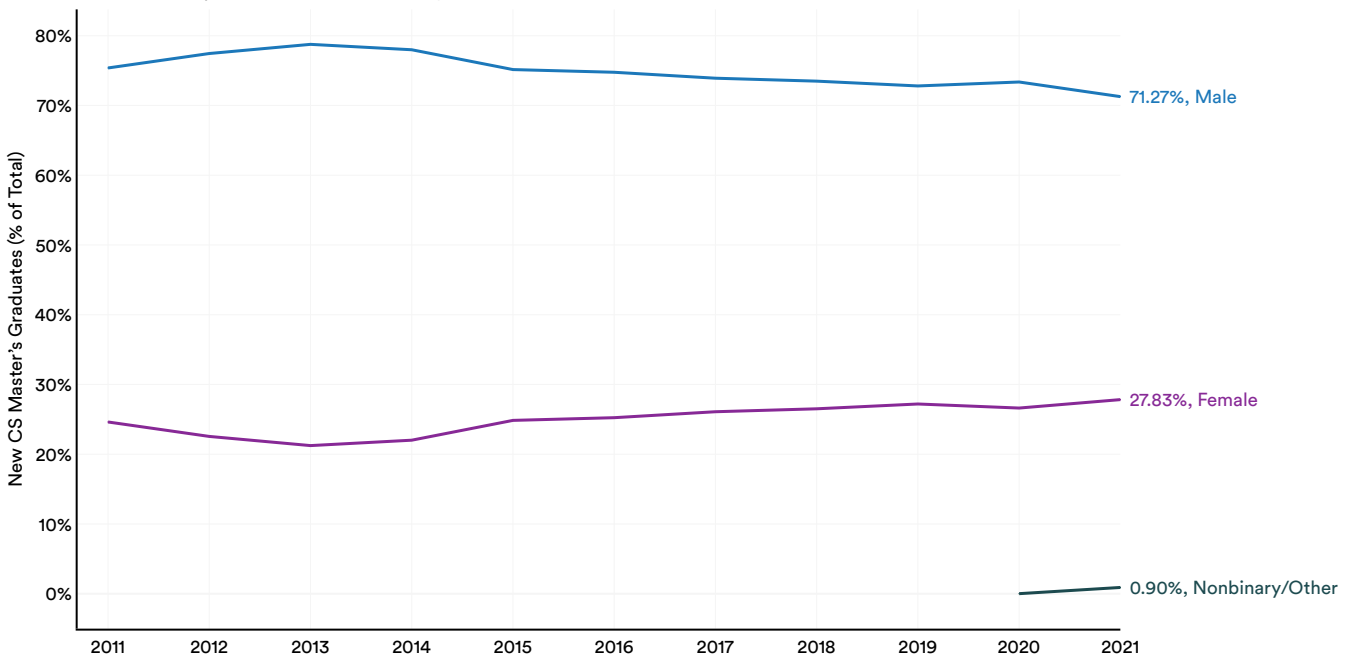


Figure 7.2.3

Of domestic students, the most represented ethnicities are white (50.3%), followed by Asian (34.8%), and Hispanic (7.3%) (Figure 7.2.4). As with CS bachelor’s graduates, in the last decade white students have represented an increasingly smaller proportion of new CS master’s graduates.<sup>5</sup>

### Ethnicity of New Resident CS Master’s Graduates (% of Total) in North America, 2011–21

Source: CRA Taulbee Survey, 2022 | Chart: 2023 AI Index Report

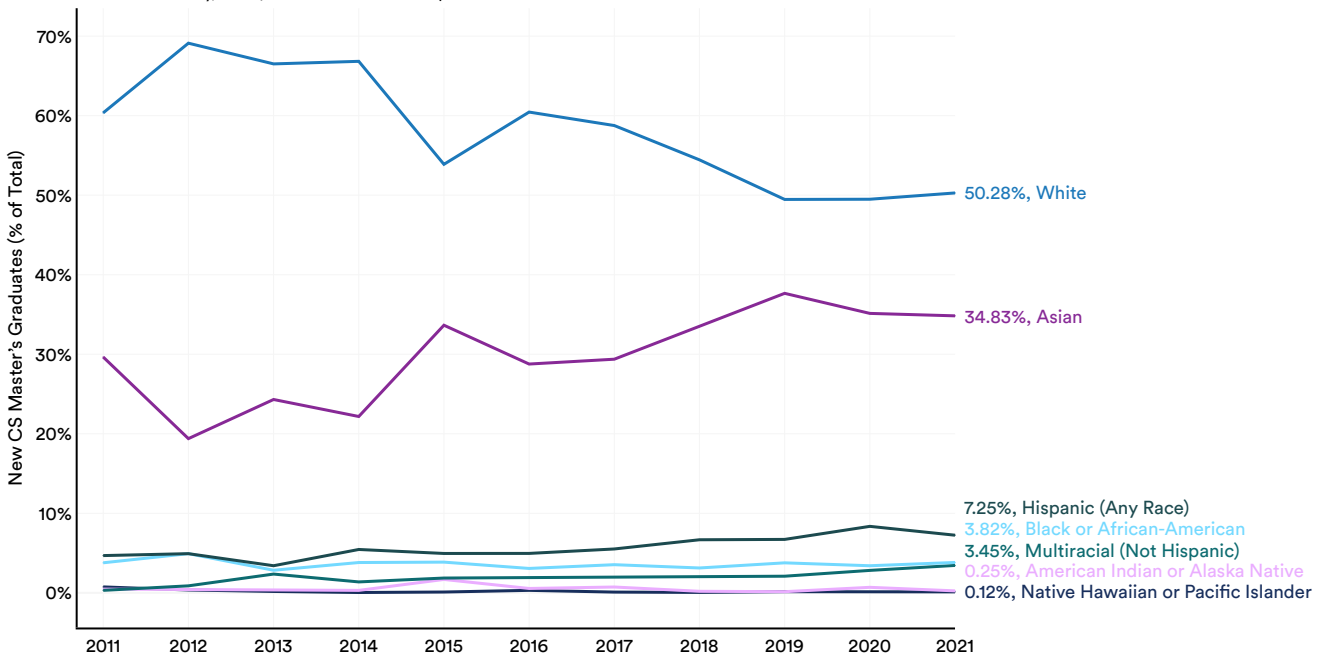


Figure 7.2.4

<sup>5</sup> In 2021, 65.2% of new CS master’s graduates were nonresident aliens.

## CS PhD Graduates

In 2021, the number of new female CS PhD graduates rose to 23.3% from 19.9% (Figure 7.2.5). Despite this rise, most new CS PhD graduates

continue to be male. There remains a large gap between new male and female CS PhDs.

### Gender of New CS PhD Graduates (% of Total) in North America, 2010–21

Source: CRA Taulbee Survey, 2022 | Chart: 2023 AI Index Report

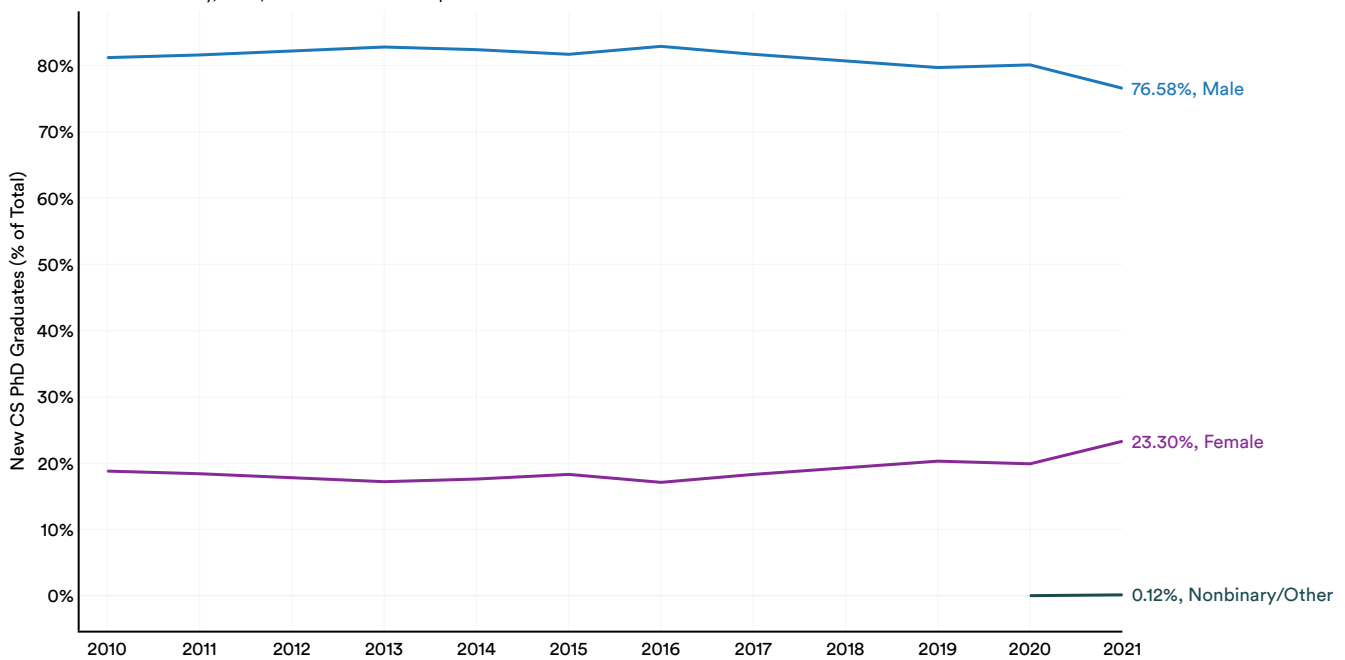


Figure 7.2.5

Between 2011 and 2021, the number of new white resident CS PhD graduates declined by 9.4 percentage points. Asians are the next most represented group (29%), followed by Hispanics (5.1%) and Black or African Americans (4%) (Figure, 7.2.6).<sup>6</sup>

**Ethnicity of New Resident CS PhD Graduates (% of Total) in North America, 2011–21**

Source: CRA Taulbee Survey, 2022 | Chart: 2023 AI Index Report

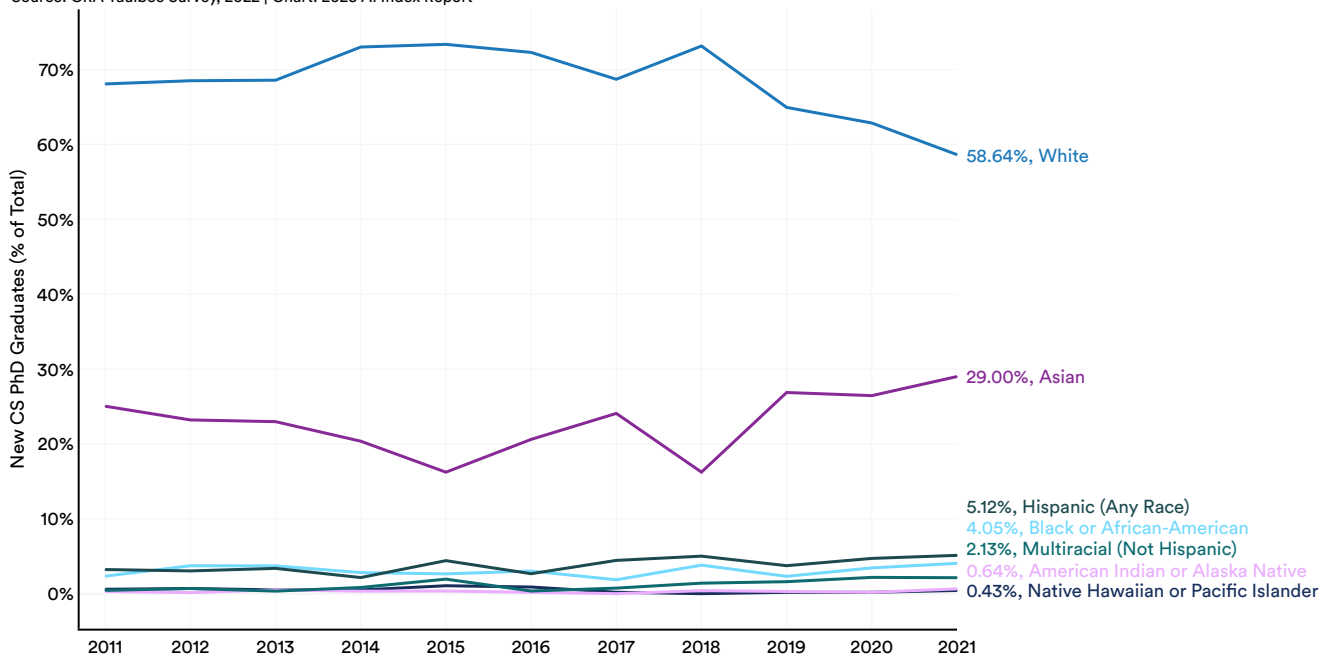


Figure 7.2.6

<sup>6</sup> In 2021, 68.6% of new CS PhD graduates were nonresident aliens.

**Narrative Highlight:**

## Disability Status of CS, CE, and Information Students

The 2021 edition of the CRA Taulbee Survey was the first to gather information about the prevalence of CS, CE, and information students with disabilities. The CRA asked departments to identify the number of students at each degree level who received

disability accommodations in the last year. The number of such students was relatively small. Only 4.0% of bachelor's, 1.0% of PhD students, and 0.8% of master's students reported needing accommodations (Figure 7.2.7).

**CS, CE, and Information Students (% of Total) With Disability Accommodations in North America, 2021**

Source: CRA Taulbee Survey, 2022 | Chart: 2023 AI Index Report

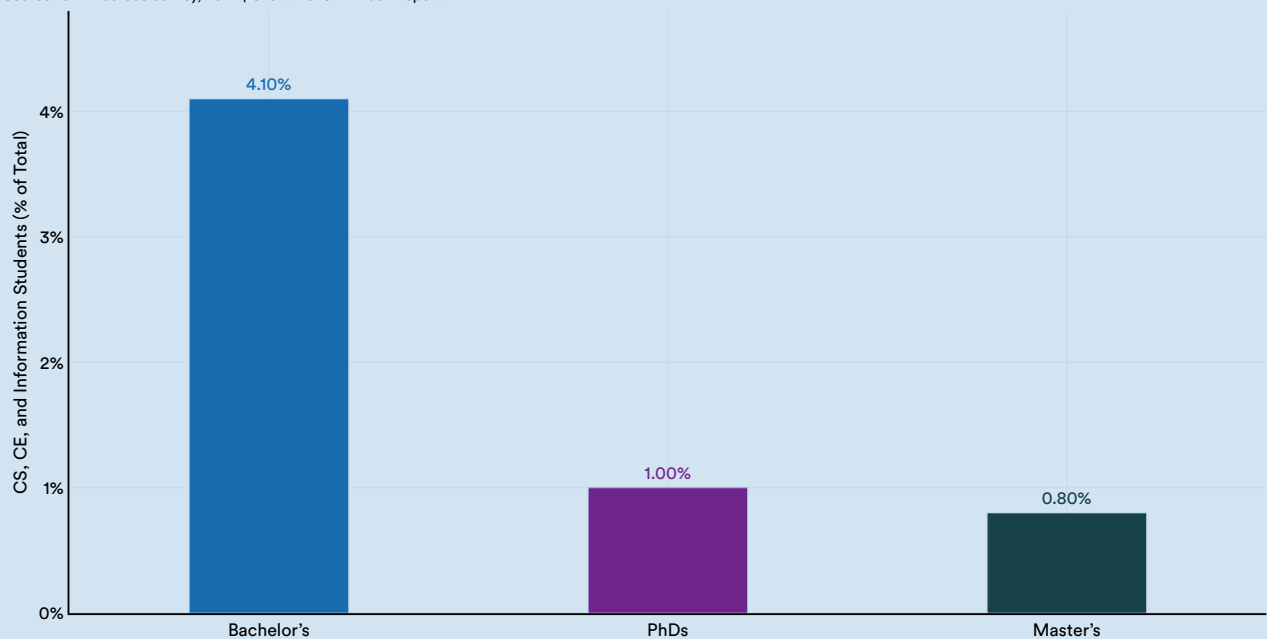


Figure 7.2.7





## New AI PhDs

Figure 7.2.8 looks at demographic trends for new AI PhD graduates who focus on artificial intelligence. In 2021, 78.7% of new AI PhDs were male and 21.3%

were female. While the number of female AI PhDs marginally increased from 2020 to 2021, we find no meaningful trends in the last decade relating to the gender of new AI PhDs.

### Gender of New AI PhD Graduates (% of Total) in North America, 2010–21

Source: CRA Taulbee Survey, 2022 | Chart: 2023 AI Index Report

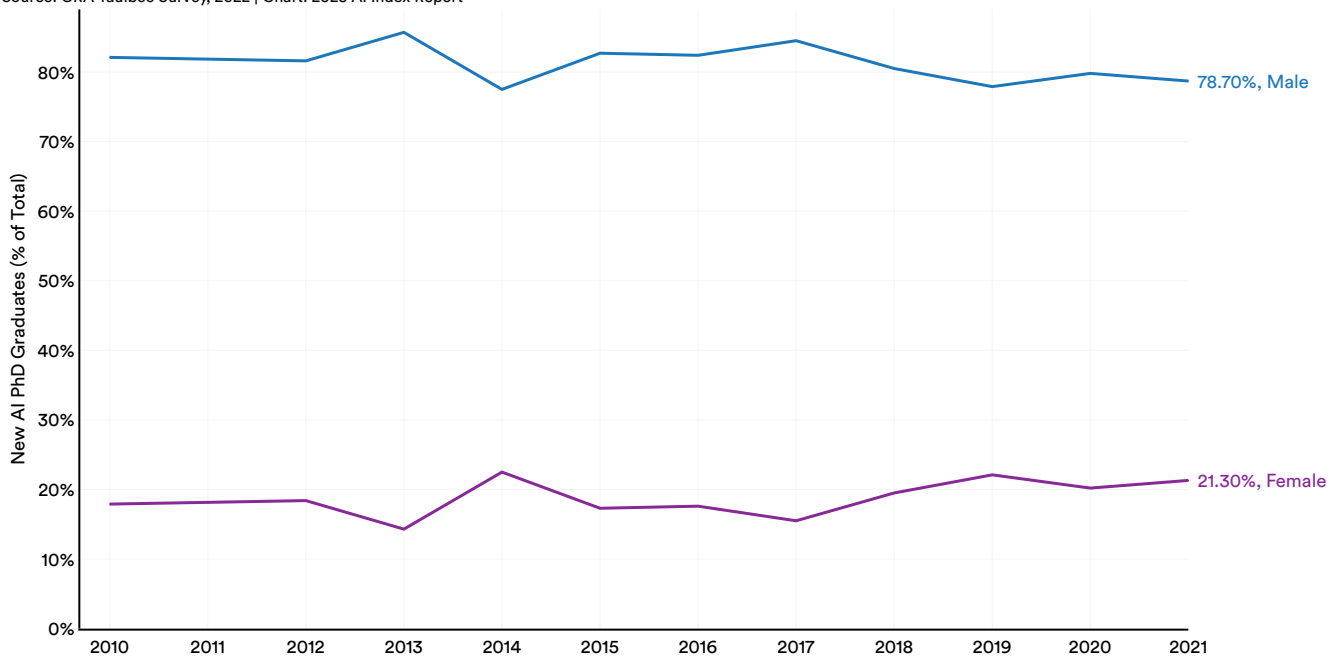


Figure 7.2.8



## CS, CE, and Information Faculty

Data on the ethnicity and gender of CS, CE, and information faculty helps to paint a picture of diversity trends in academic AI and CS. As of 2021, most CS, CE, and information faculty members are

predominantly male (75.9%) (Figure 7.2.9). Women make up 23.9% of CS, CE, and information faculty, and nonbinary individuals make up 0.1%. The share of female CS, CE, and information faculty has slowly increased; since 2011, the number of female faculty members has risen 5 percentage points.

### Gender of CS, CE, and Information Faculty (% of Total) in North America, 2011–21

Source: CRA Taulbee Survey, 2022 | Chart: 2023 AI Index Report

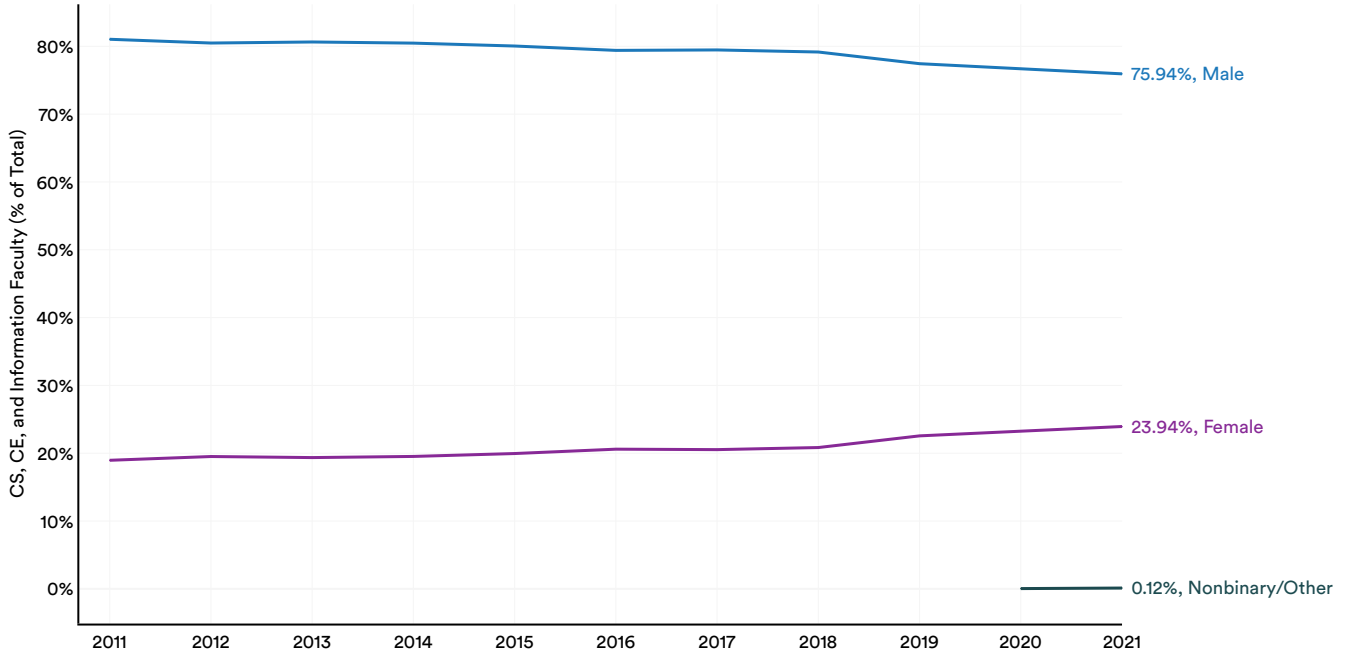


Figure 7.2.9



Although most new CS, CE, and information faculty hires in North American universities are still male, the proportion of women among faculty hires reached 30.2% in 2021, up about 9 percentage points from 2015 (Figure 7.2.10).

### Gender of New CS, CE, and Information Faculty Hires (% of Total) in North America, 2011–21

Source: CRA Taulbee Survey, 2022 | Chart: 2023 AI Index Report

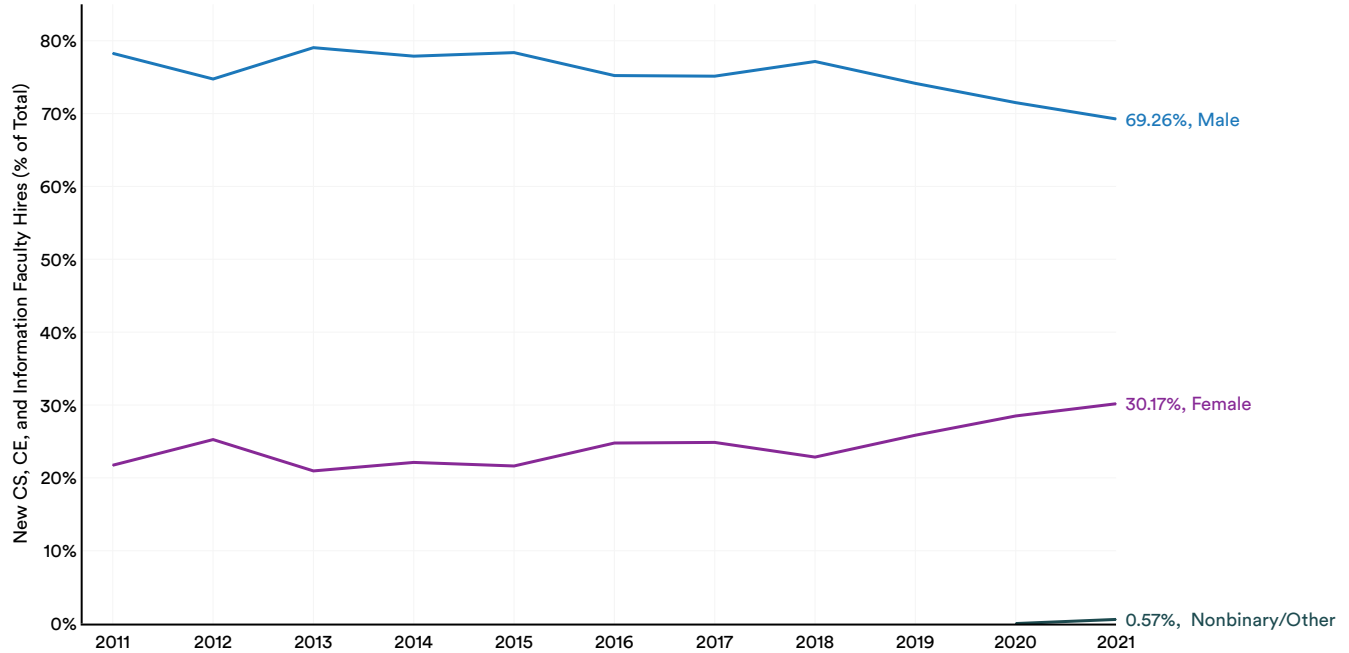


Figure 7.2.10

The majority of resident CS, CE, and information faculty are white as of 2021 (58.1%), followed by Asian (29.7%) (Figure 7.2.11). However, the gap between white CS, CE, and information faculty and faculty of the next nearest ethnicity is slowly narrowing: In 2011, the gap stood at 46.1%, whereas in 2021 it dropped to 28.4%.<sup>7</sup>

### Ethnicity of Resident CS, CE, and Information Faculty (% of Total) in North America, 2010–21

Source: CRA Taulbee Survey, 2022 | Chart: 2023 AI Index Report

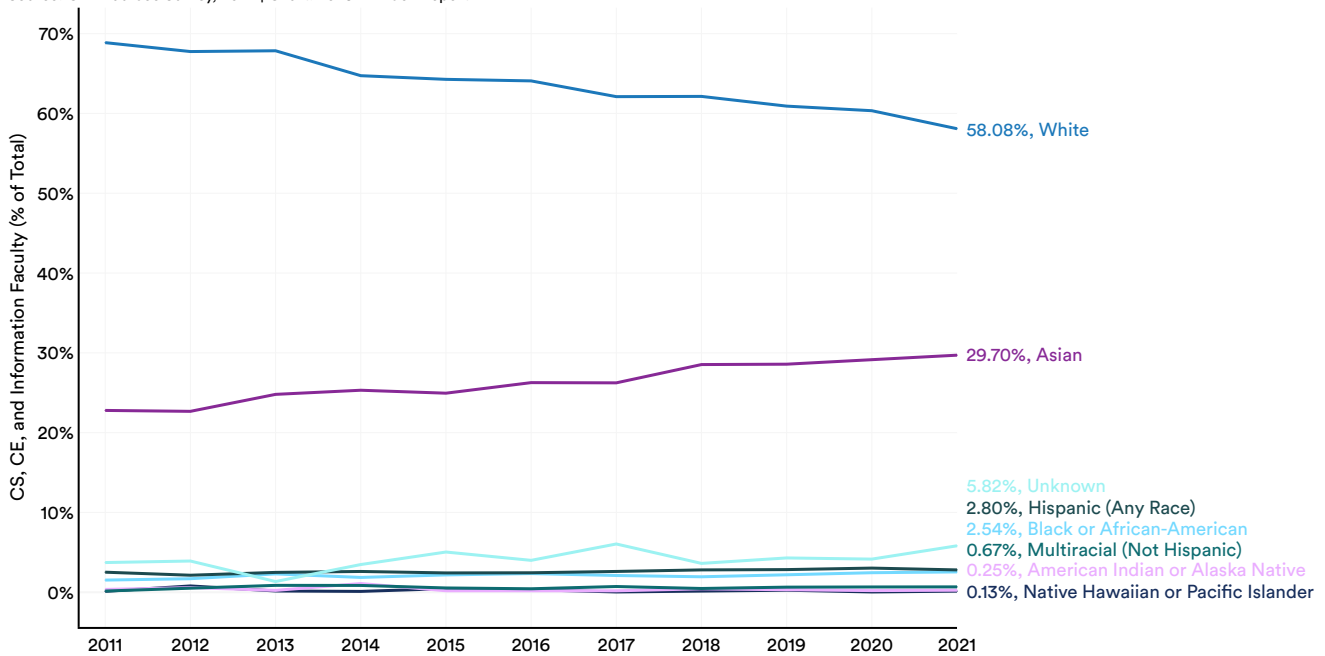


Figure 7.2.11

<sup>7</sup> In 2021, 6.7% of CS, CE, and information faculty in North America were nonresident aliens.



How do trends in AI diversity measure at the K–12 level, prior to students entering university? This subsection borrows data from Code.org, an American nonprofit that aims to promote K–12 computer science education in the United States.

## 7.3 K–12 Education

### AP Computer Science: Gender

In 2021, 69.2% of AP computer science exams were taken by male students, 30.6% by female students, and 0.3% by students who identified as neither male

nor female (Figure 7.3.1). It is still the case that male students take more AP computer science exams than any other gender, but the proportion of female students has almost doubled in the last decade.

#### AP Computer Science Exams Taken (% of Total) by Gender, 2007–21

Source: Code.org, 2022 | Chart: 2023 AI Index Report

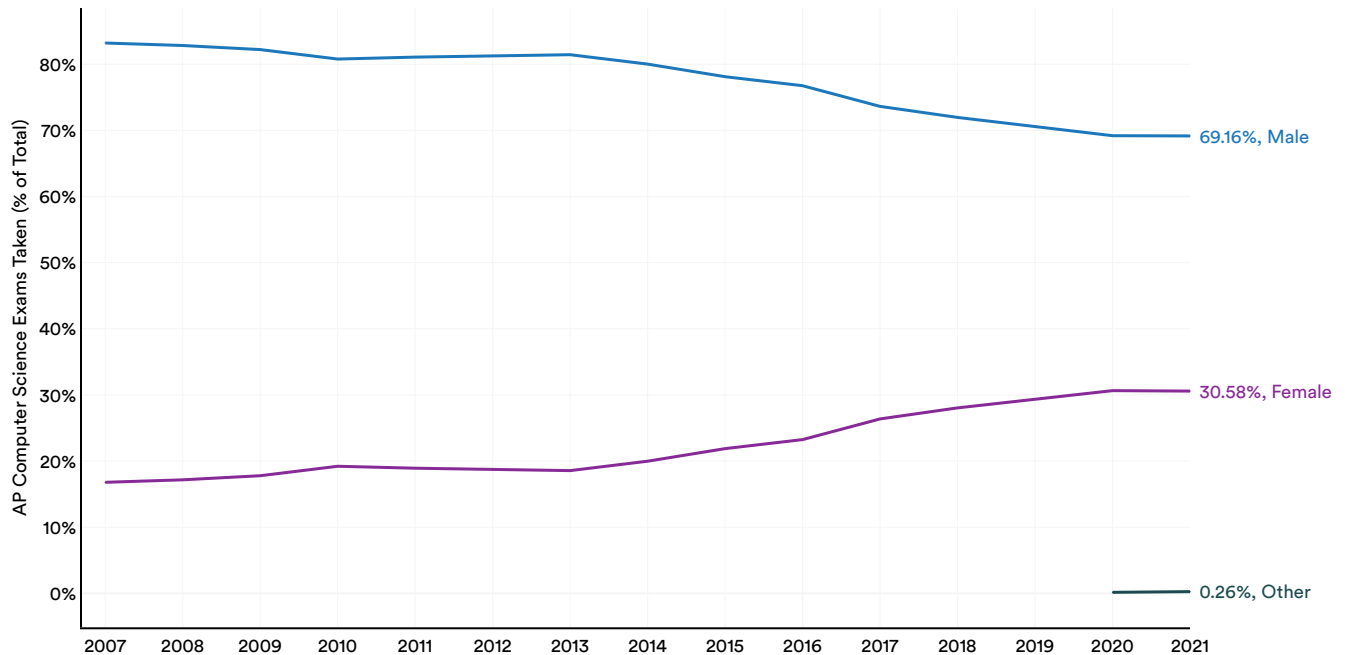


Figure 7.3.1

On a percent basis, the states with the largest number of female AP computer science test-takers were Alabama (36%) and Washington, D.C. (36%), followed by Nevada (35%), Louisiana (35%), Tennessee (35%), Maryland (35%), and New York

(35%) (Figure 7.3.2). Other states with notable CS and AI activity include California, Texas, and Washington, with rates of women taking AP computer science tests at rates hovering around 30 percent.

### AP Computer Science Exams Taken by Female Students (% of Total), 2021

Source: Code.org, 2022 | Chart: 2023 AI Index Report

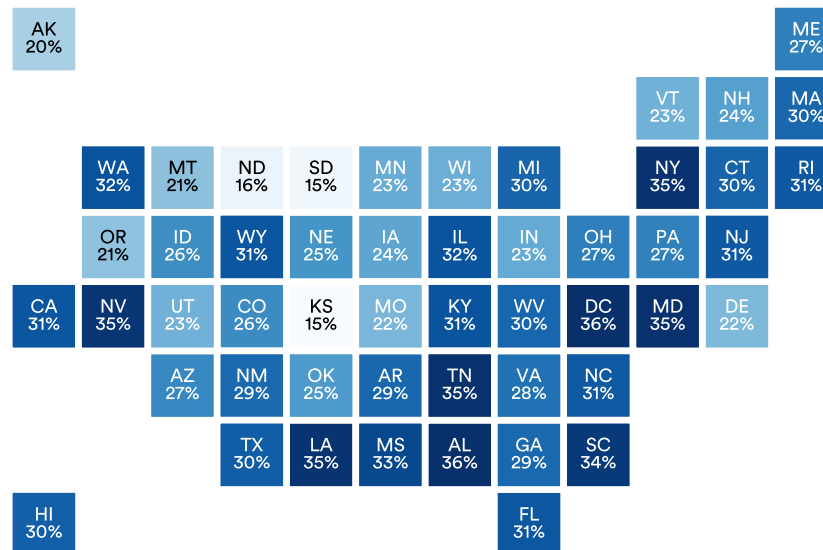


Figure 7.3.2



## AP Computer Science: Ethnicity

Code.org collects data that speaks to trends in the ethnicity of AP computer science test-takers. White students took the greatest proportion of the exams in 2021 (42.7%), followed by Asian (28.8%) and Hispanic/Latino/Latina students (16.5%) (Figure 7.3.3). As with

most postsecondary computer science fields, the pool of AP computer science test-takers is becoming more ethnically diverse over time. White students are still the greatest test-taking group; however, over time, more Asian, Hispanic/Latino/Latina and Black/African American students have taken AP computer science exams.

**AP Computer Science Exams Taken (% of Total Responding Students) by Race/Ethnicity, 2007–21**

Source: Code.org, 2022 | Chart: 2023 AI Index Report

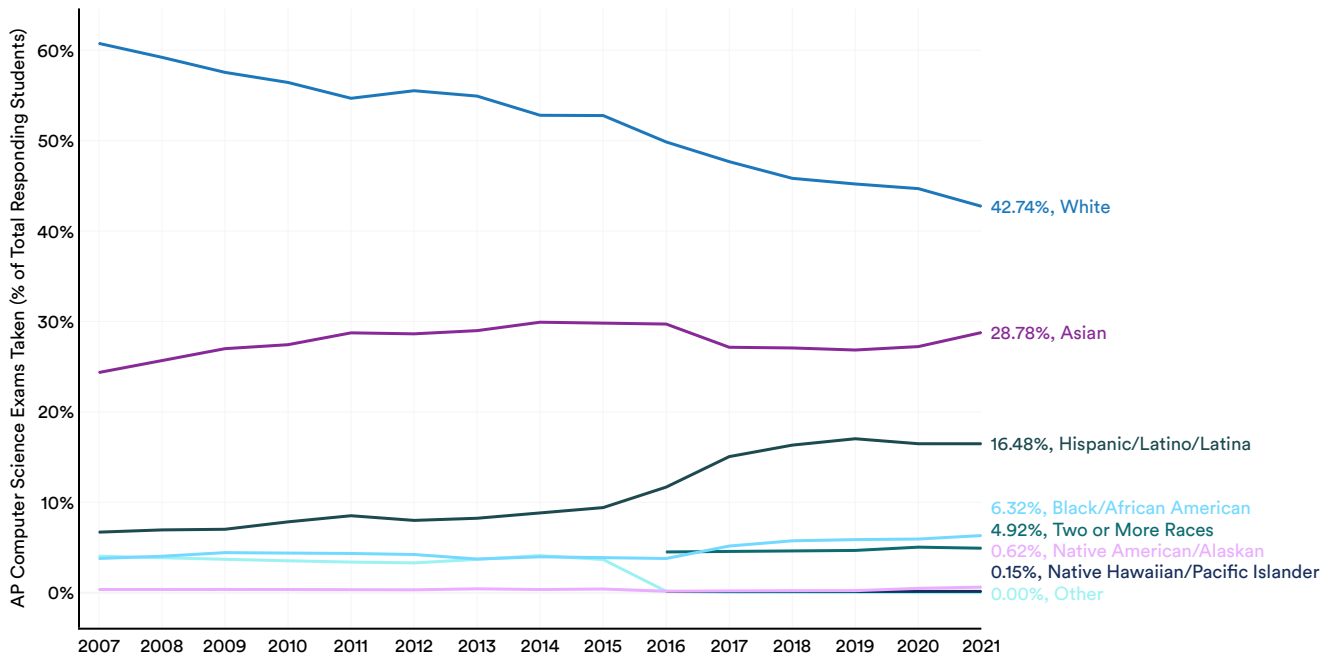


Figure 7.3.3



# 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 5 subsection of the 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 5 subsection of the Appendix.