

# Social Impact and Diversity

# Impact as a Computer Scientist

- A computer scientists primary job is to write code
  - All code is based on mathematics, physics, algorithms, etc.
- However, computer scientists are human being, and human being make mistakes
- Inevitably there will be incorrect code written; when this happens, it is called a “bug” or “error”
- How much do bugs/errors really affect others?

# Impact as a Computer Scientist

- Non-Critical System
  - A system that is “non-essential”; usually one that does not have significant impact on the entity and end users it services if it were to be lost/interrupted
- Critical System
  - A system that is “essential”; usually one that has significant impact (medical, financial, safety, etc.) on the entity and end users it services if it were to be lost/interrupted
- Sometimes “critical” and “non-critical” is a matter of perspective/user
- The greatest impact bugs can have is usually in critical systems
  - Bugs in non-critical systems can, of course, also have significant impact; however it is usually not as immediate or far-reaching as critical systems

# Impact as a Computer Scientist

- Even seemingly small bugs can have major consequences, especially in critical systems:
  - Destruction of The Mars Climate Orbiter
    - [https://en.wikipedia.org/wiki/Mars\\_Climate\\_Orbiter](https://en.wikipedia.org/wiki/Mars_Climate_Orbiter)
    - Major Bug: a difference in units of measure (metric vs imperial units) which caused an orbit entry error where the unmanned craft exploded
    - Total Loss: \$327.6 million and about 4 years of research and development
  - The Patriot Missile Defence Failure
    - <https://www-users.cse.umn.edu/~arnold/disasters/patriot.html>
    - Major Bug: improper rounding/conversion of time units which allowed a missile to be undetected before hitting a military barracks
    - Total Loss: 28 lives
  - Incorrect Update of Medical Records at St. Mary's Mercy
    - <https://apnews.com/article/6870c9bd785360007b5981f0d5443b19>
    - Major Bug: incorrect mapping error that dropped a single digit from a software update causing 8500 people to be reported as deceased, even though they were alive
    - Total Loss: the records, time, and money of 8500 people

# Bias in Computer Science and Technology

- Can a computer (a non-thinking, not-alive, purely logical, and instruction-following machine) be biased?
  - The short answer: “Yes”
- Bias in data:
  - Facial recognition failures:
    - <http://proceedings.mlr.press/v81/buolamwini18a/buolamwini18a.pdf>
    - Facial recognition success in 2012:
      - White middle-aged men: 94.5 percent success
      - Women: 89.5 percent
      - Black: 88.7 percent
      - Young: 91.7 percent

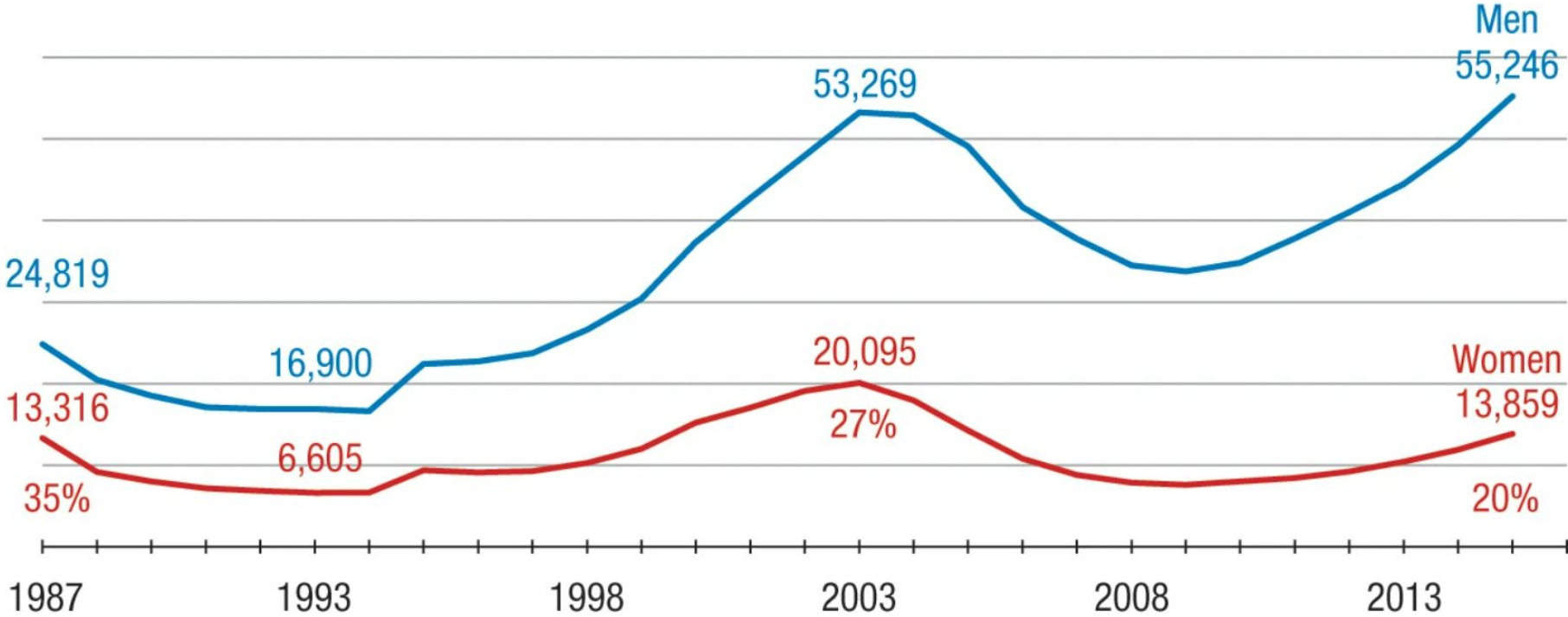
# Bias in Computer Science and Technology

- Can a computer (a non-thinking, not-alive, purely logical, and instruction-following machine) be biased?
  - The short answer: “Yes”
- Bias in data:
  - When data used to perform error checking and software testing does not capture the entire scope of the software’s intended use (primarily due to missing race, ethnicity, gender, etc. data)
  - This is especially bad in Artificial Intelligence
  - Facial recognition failures:
    - Software used to detect facial features to identify, track, etc. a person based on those features
    - <http://proceedings.mlr.press/v81/buolamwini18a/buolamwini18a.pdf>
    - Facial recognition success in 2012:
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# Bias in Computer Science and Technology

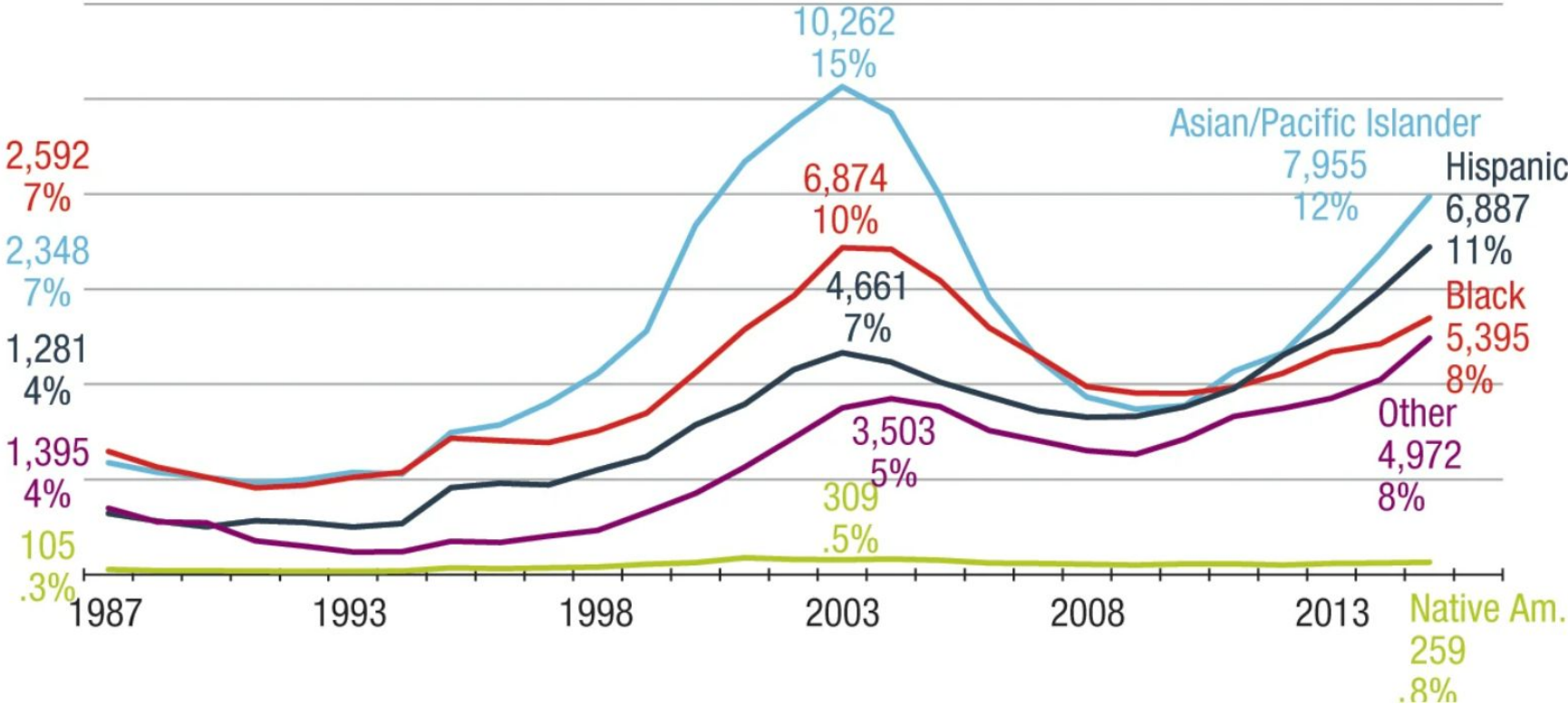
- Bias in assumptions:
  - When a programmer writes code with incorrect assumptions and/or without accounting for all possible options (primarily due to race, ethnicity, gender, etc. assumptions)
  - Real Name Detection Systems:
    - Software used to determine if a “real” name has been entered
    - Many problems arose in these systems in the early 2010s:
      - Some racial groups had names that the system deemed “not real” (e.g., Shane Creepingbear, someone of Native American heritage)
      - Transgendered individuals were flagged as having “mismatches” between their gender and legal names
      - Individuals who feared using their legal/real name on public systems (e.g., abuse survivors being exposed to their abusers, immigrants who fled due to violence and danger in their country of origin being exposed, etc.)

# Diversity in CS Industry and Research





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# Diversity in CS Industry and Research

- The Importance of Diversity
  - Diversity allows for a much greater breadth of different ideas and thoughts
  - Diversity allows for better and more efficient problem-solving and implementation of ideas
  - Diversity combats unconscious/implicit bias