ARTIFICIAL INTELLIGENCE

Bias in AI: What it is, Types & Examples of Bias & Tools to fix it

UPDATED ON OCTOBER 8, 2021 | PUBLISHED ON SEPTEMBER 12, 2020 | 7 MINUTE READ

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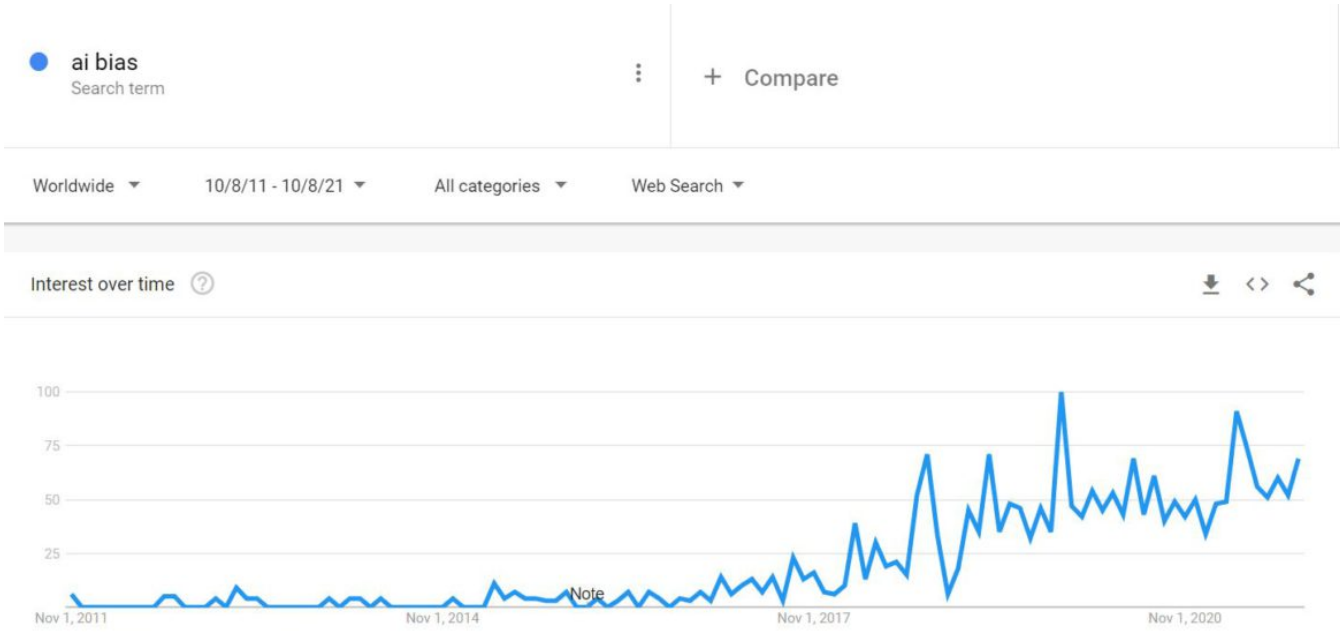


Interest in Artificial Intelligence (AI) is increasing as more individuals and businesses witness its benefits in various use cases. However, there are also some valid concerns surrounding AI technology:

- Will AI be a threat to humanity? For that AI first needs to surpass human intelligence. Experts do not expect that to happen in the next 30-40 years.
- Will AI be a threat to our jobs? Yes, 44% of low education workers will be at risk of technological unemployment by 2030.
- Can we trust the judgment of AI systems? Not yet, AI technology may inherit human biases due to biases in training data

In this article, we focus on AI bias and will answer all important questions regarding biases in artificial intelligence algorithms from types and examples of AI biases to removing those biases from AI algorithms.

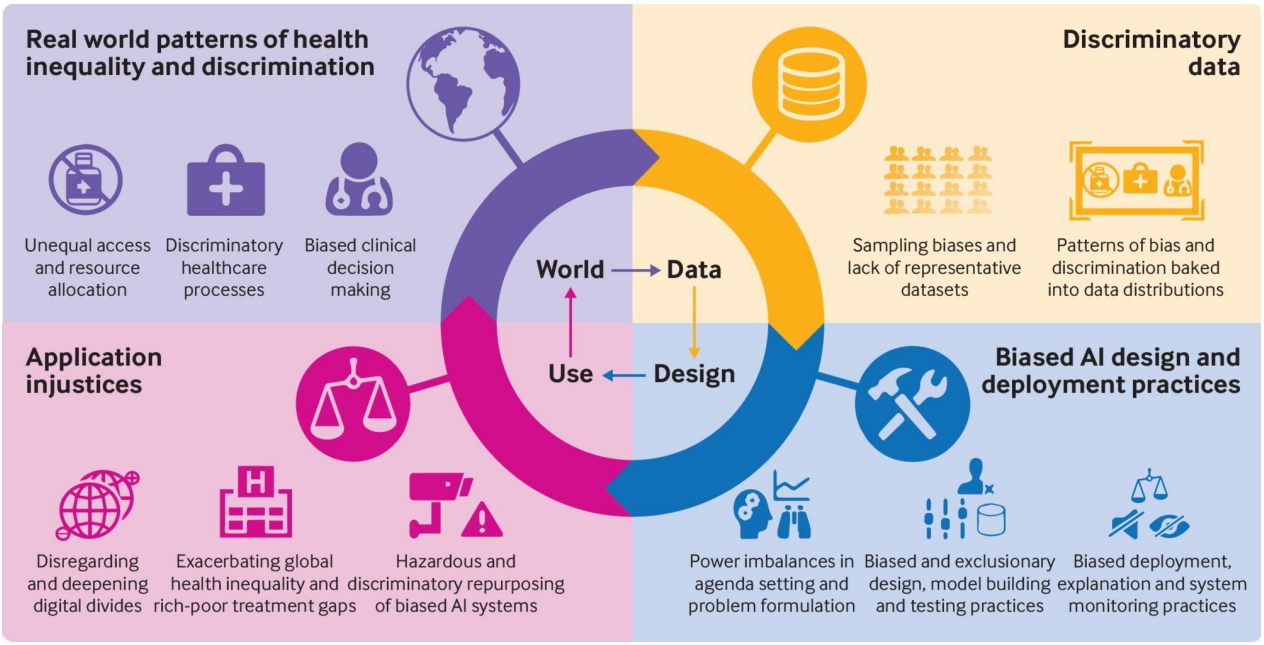
What is AI bias?

AI bias is an anomaly in the output of machine learning algorithms. These could be due to the prejudiced assumptions made during the algorithm development process or prejudices in the training data.

What are the types of AI bias?

AI systems contain biases due to two reasons:

- **Cognitive biases:** These are effective feelings towards a person or a group based on their perceived group membership. More than 180 human biases have been defined and classified by psychologists, and each can affect individuals we make decisions. These biases could seep into machine learning algorithms via either
  - designers unknowingly introducing them to the model
  - a training data set which includes those biases
- **Lack of complete data:** If data is not complete, it may not be representative and therefore it may include bias. For example, most psychology research studies include results from undergraduate students which are a specific group and do not represent the whole population.



Source: British Medical Journal

What are examples of AI bias?

Amazon's biased recruiting tool

With the dream of automating the recruiting process, Amazon started an AI project in 2014. Their project was solely based on reviewing job applicants' resumes and rating applicants by using AI-powered algorithms so that recruiters don't spend time on manual resume screen tasks. However, by 2015, Amazon realized that their new AI recruiting system was not rating candidates fairly and it showed bias against women.

Amazon had used historical data from the last 10-years to train their AI model. Historical data contained biases against women since there was a male dominance across the tech industry and men were forming 60% of Amazon's employees. Therefore Amazon's recruiting system incorrectly learnt that male candidates were preferable. It penalized resumes that included the word "women's," as in "women's chess club captain." Therefore, Amazon stopped using the algorithm for recruiting purposes.

Racial bias in healthcare risk algorithm

A health care risk-prediction algorithm that is used on more than 200 million U.S. citizens, demonstrated racial bias because it relied on a faulty metric for determining the need.

The algorithm was designed to predict which patients would likely need extra medical care, however, then it is revealed that the algorithm was producing faulty results that favor white patients over black patients.

The algorithm's designers used previous patients' healthcare spending as a proxy for medical needs. This was a bad interpretation of historical data because income and race are highly correlated metrics and making assumptions based on only one variable of correlated metrics led the algorithm to provide inaccurate results.

Bias in Facebook ads

There are numerous examples of human bias and we see that happening in tech platforms. Since data on tech platforms is later used to train machine learning models, these biases lead to biased machine learning models.

In 2019, Facebook was allowing its advertisers to intentionally target adverts according to gender, race, and religion. For instance, women were prioritized in job adverts for roles in nursing or secretarial work, whereas job ads for janitors and taxi drivers had been mostly shown to men, in particular men from minority backgrounds.

As a result, Facebook will no longer allow employers to specify age, gender or race targeting in its ads.

Will AI ever be completely unbiased?

Technically, yes. An AI system can be as good as the quality of its input data. If you can clean your training dataset from conscious and unconscious assumptions on race, gender, or other ideological concepts, you are able to build an AI system that makes unbiased data-driven decisions.

However, in real world, we don't expect AI to ever be completely unbiased any time soon due to the same argument we provided above. AI can be as good as data and people are the ones who create data. There are numerous human biases and ongoing identification of new biases is increasing the total number constantly. Therefore, it may not be possible to have a completely unbiased human mind so does AI system. After all, humans are creating the biased data while humans and human-made algorithms are checking the data to identify and remove biases.

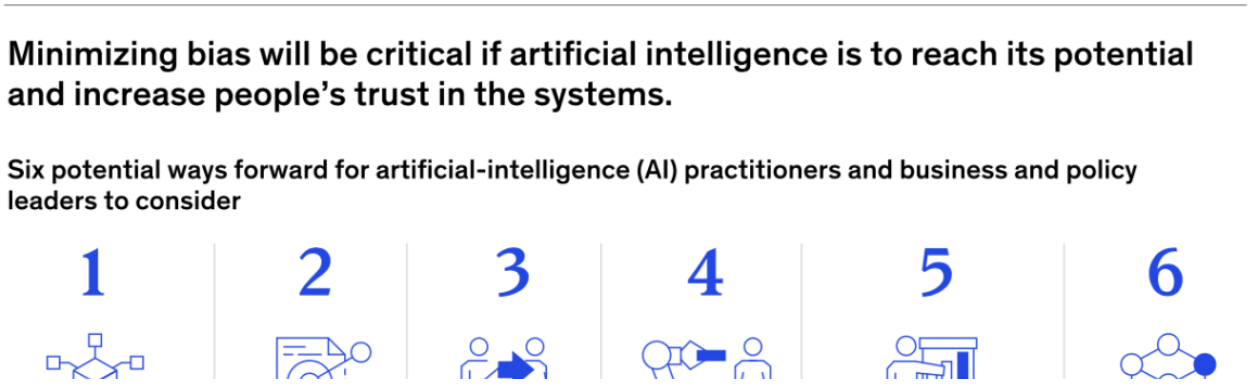
What we can do for AI bias is to minimize it by performing tests on data and algorithms and applying other best practices.

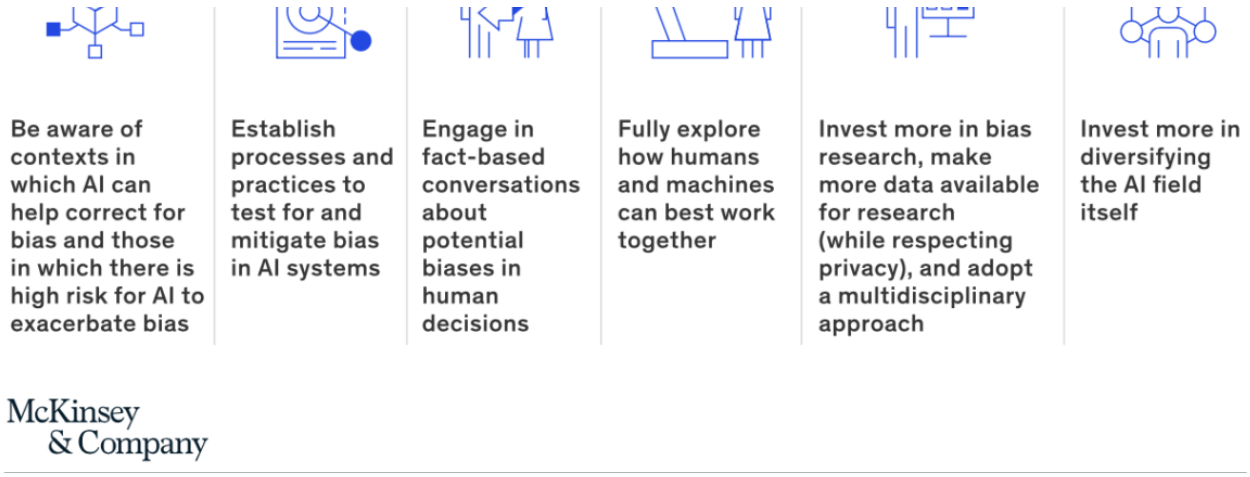
How to fix biases in machine learning algorithms?

Firstly, if your data set is complete, you should acknowledge that AI biases can only happen due to the prejudices of humankind and you should focus on removing those prejudices from the data set. However, it is not as easy as it sounds.

A naive approach is removing protected classes (such as sex or race) from data is to delete the labels that make the algorithm bias, yet, this approach may not work because removed labels may affect the understanding of the model and your results' accuracy may get worse.

So there are no quick fixes to removing all biases but there are high level recommendations from consultants like Mckinsey highlighting the best practices of AI bias minimization:





Source: Mckinsey

Steps to fixing bias in AI systems:

1. **You should fully understand the algorithm and data** to assess where the risk of unfairness is high
2. **You should establish a debiasing strategy** that contains a portfolio of technical, operational and organizational actions:
   - **Technical strategy** involves tools that can help you identify potential sources of bias and reveal the traits in the data that affects the accuracy of the model
   - **Operational strategies** include improving data collection processes using internal "red teams" and third party auditors. You can find more practices from Google AI's research on fairness
   - **Organizational strategy** includes establishing a workplace where metrics and processes are transparently presented
3. **As you identify biases in training data, you should consider how human-driven processes might be improved.** Model building and evaluation can highlight biases that have gone noticed for a long time. In the process of building AI models, companies can identify these biases and use this knowledge to understand the reasons for bias. Through training, process design and cultural changes, companies can improve the actual process to reduce bias
4. **Decide on use cases where automated decision making should be preferred** and when humans should be involved
5. **Research and development** are key to minimizing the bias in data sets and algorithms. Eliminating bias is a multidisciplinary strategy that consists of ethicists, social scientists, and experts who best understand the nuances of each application area in the process. Therefore, companies should seek to include such experts in their AI projects
6. **Diversity in the AI community** eases the identification of biases. People that first notice bias issues are mostly users who are from that specific minority community. Therefore, maintaining a diverse AI team can help you mitigate unwanted AI biases

Tools to reduce bias

AI Fairness 360

IBM released an open-source library to detect and mitigate biases in unsupervised learning algorithms that has currently 34 contributors (as of September 2020) on Github. The library is called AI Fairness 360 and it enables AI programmers to

- test biases in models and datasets with a comprehensive set of metrics.
- mitigate biases with the help of 12 packaged algorithms such as Learning Fair Representations, Reject Option Classification, Disparate Impact Remover.

However, AI Fairness 360's bias detection and mitigation algorithms are designed for binary classification problems that's why it needs to be extended to multiclass and regression problems if your problem is more complex.

IBM Watson OpenScale

IBM's Watson OpenScale performs bias checking and mitigation in real time when AI is making its decisions.

Google's What-If Tool

Using What-If Tool, you can test performance in hypothetical situations, analyze the importance of different data features, and visualize model behavior across multiple models and subsets of input data, and for different ML fairness metrics.

Extra resources

Krita Sharma's Ted Talk

Krita Sharma, who is an artificial intelligence technologist and business executive, is explaining how the lack of diversity in tech is creeping into AI and is providing three ways to make more ethical algorithms:

Barak Turovsky at 2020 Shelly Palmer Innovation Series Summit

Barak Turovsky, who is the product director at Google AI, is explaining how Google Translate is dealing with AI bias:

Hope this clarifies some of the major points regarding biases in AI. For more on how AI is changing the world, you can check out articles on AI, AI technologies and AI applications in marketing, sales, customer service, IT, data or analytics.

We help make enterprise AI practical and understandable. If you lead an enterprise AI company, feel free to contact us via this form to participate in our enterprise AI event in August to share your company's unique approach with our audience:

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IDENTIFY PARTNERS TO BUILD CUSTOM AI SOLUTIONS

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Cem Dilmegani

Cem founded the high tech industry analyst AIMultiple in 2017. AIMultiple informs ~1M businesses (as per similarWeb) including 55% of Fortune 500 every month.

Throughout his career, Cem served as a tech consultant, tech buyer and tech entrepreneur. He advised enterprises on their technology decisions at McKinsey & Company and Altman Solon for more than a decade. He led technology strategy and procurement of a telco while reporting to the CEO. He has also led commercial growth of deep tech companies that reached from 0 to 3M annual recurring revenue within 2 years.

Cem regularly speaks at international technology conferences. He graduated from Bogazici University as a computer engineer and holds an MBA from Columbia Business School.

"Life is struggle"
Karl Marx

"Der Mensch bedarf der Schwierigkeiten, sie gehören zu seiner Gesundheit."

Carl Jung

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