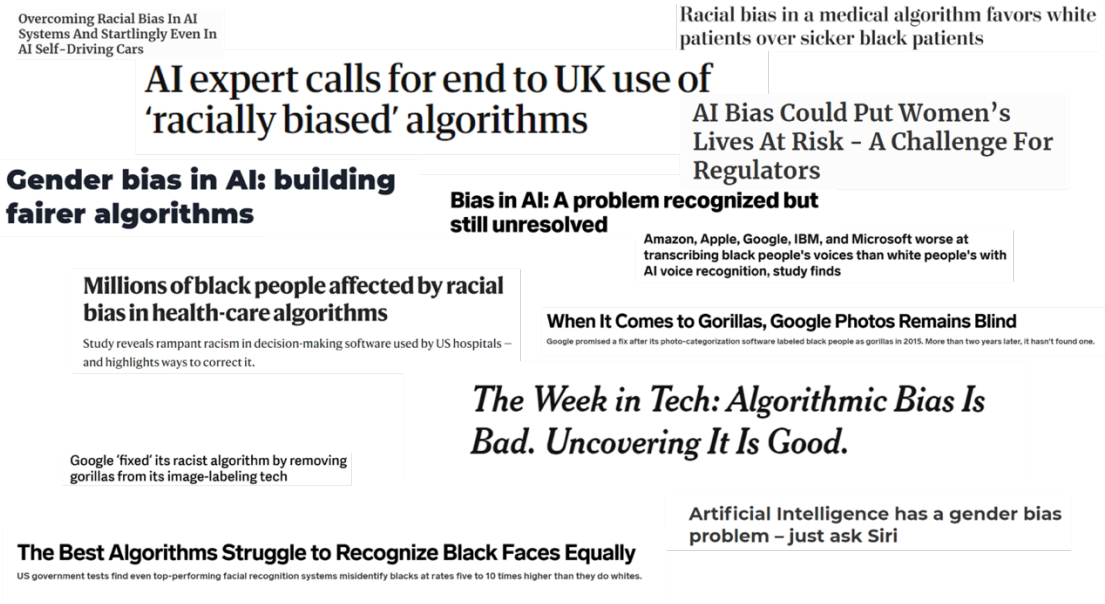
Gemensam vinjett TGTU82 och TATA24

Model bias and linear algebra

Earlier news headlines on bias in algorithms (source [1]):



Today one of the most popular kind of machine learning model is the Large Language Model (LLM), such as ChatGPT. What about bias in LLMs? Does it exist? What effects can it have? How can it be uncovered, studied and maybe even addressed?

What do you need to know about LLMs to understand and study the potential biases? (For an introduction to Natural Language Processing, see [2], and other sources on the web.) How do LLMs relate to things you are learning in linear algebra – how do they represent words and their meaning, e.g. using embeddings? In your reading for the TGTU82 seminar you find [3]. How do word embeddings work? Can your knowledge about vectors be used to study LLMs then? How is bias represented in the vector space?

Where does bias in LLMs come from? What are you correcting when you try to counter bias? And what remains uncorrected? Can you think of different ways to counter unwanted biases in LLMs? How would you address the problem?

If you want to see how things work in practice, try out a simple language model using the Jupyter notebook at [4] and try to find some biases, or try some of the other examples there. How is a word represented? What does "similar" mean, and how can you see if something is 'close' in this model? What happens if we do a calculation like "king" – "man" + "woman" or "king" – "he" + "she"? What happens in the vector space? What results do you get? What about "doctor" – "he" + "she"? Are the results expected? Unexpected? What about other gender-identities? Can you generate results that reflect a non-binary gender perspective? Why or why not?

References:

[1] https://towardsdatascience.com/algorithm-bias-in-artificial-intelligence-needs-to-be-discussed-and-addressed-8d369d675a70
[2] https://foundations-of-ai-and-ml.ida.liu.se/content/nlp/intro
[3] Gonen, H. & Y. Goldberg (2019) Lipstick on a Pig: Debiasing Methods Cover up Systemic Gender Biases in Word Embeddings But do not Remove Them. arXiv:1903.03862v2 (på Lisam eller här: https://arxiv.org/abs/1903.03862v2)
[4] https://gitlab.liu.se/jansn19/jts-tata24/-/blob/main/Kod/wordembeddings-new.ipynb