Do we need an Hippocratic Oath for Data Science and AI?

Dr Detlef Nauck
Distinguished Engineer and
Head of AI & Data Science Research

https://trueskyenergy.com/bill-mahers-trouble-with-solar/

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Bill Maher

Source: Bill Maher's Trouble with Solar | True Sky Energy
Show host Bill Maher (Real Time on HBO) began his journey on the solar coaster in 2018. On average, solar installations can take anywhere from 10 days to 2 months, mostly depending on the local and state laws, as well as other regulations that need to be followed. Getting through all the red tape can be frustrating, as the audience of "Real Time with Bill Maher" learned.
For a long time, the Bill Maher show often started with his "solar clock", which showed how many days he had been waiting for the solar system he had purchased to be ready for grid connection. After 1,131 days, there was finally a change in status: his solar installation was switched on!

Hippocrates

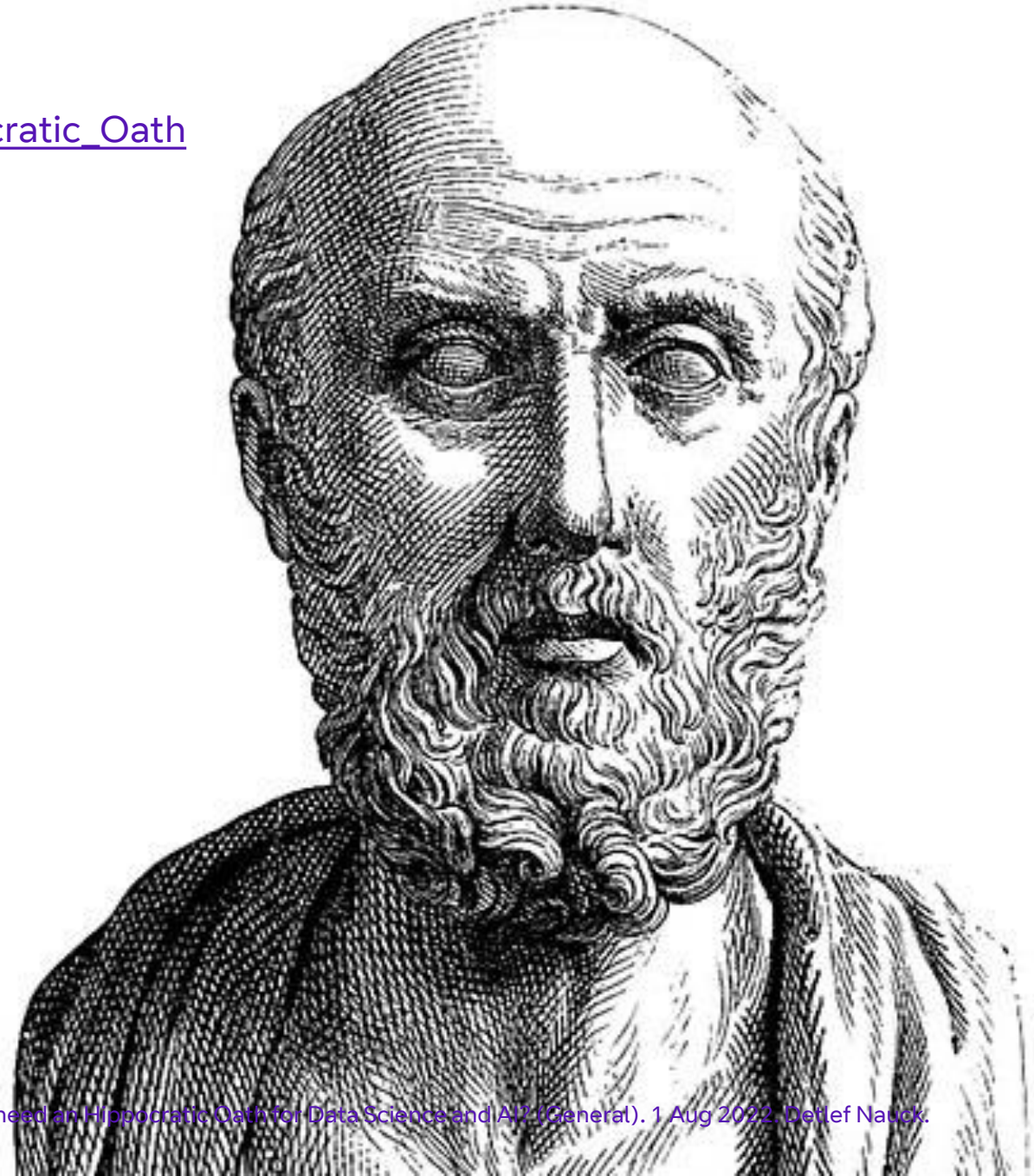
For a modern version see https://en.wikipedia.org/wiki/Hippocratic_Oath

No requirement to take an oath in the UK, but some medical schools use an oath as part of graduation

In the UK registration with the General Medical Council requires signing a declaration, part of which reads:

"I have read *Good Medical Practice* and understand my actions may be judged against the standards and principles it contains".

Hippocratic Oaths for scientist have been suggested.
https://en.wikipedia.org/wiki/Hippocratic_Oath_for_scientists



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Hippocratic Oath

Source Wikipedia: Hippocratic Oath – Wikipedia

The oath is the earliest expression of medical ethics in the Western world, establishing several principles of medical ethics which remain of paramount significance today. These include the principles of medical confidentiality and non-maleficence. As the seminal articulation of certain principles that continue to guide and inform medical practice, the ancient text is of more than historic and symbolic value. It is enshrined in the legal statutes of various jurisdictions, such that violations of the oath may carry criminal or other liability beyond the oath's symbolic nature.
The original oath was written in Ionic Greek, between the fifth and third centuries BC.[1] Although it is traditionally attributed to the Greek doctor Hippocrates (c. 460-c. 370BC)and it is usually included in the Hippocratic Corpus, most modern scholars do not regard it as having been written by Hippocrates himself.

Most professional societies have code of conduct or code of ethics

Example: Royal Statistical Society

Some links

[RSS - Code of conduct]

[Rules of Conduct (theiet.org)]

[Engineering Council (engc.org.uk)]

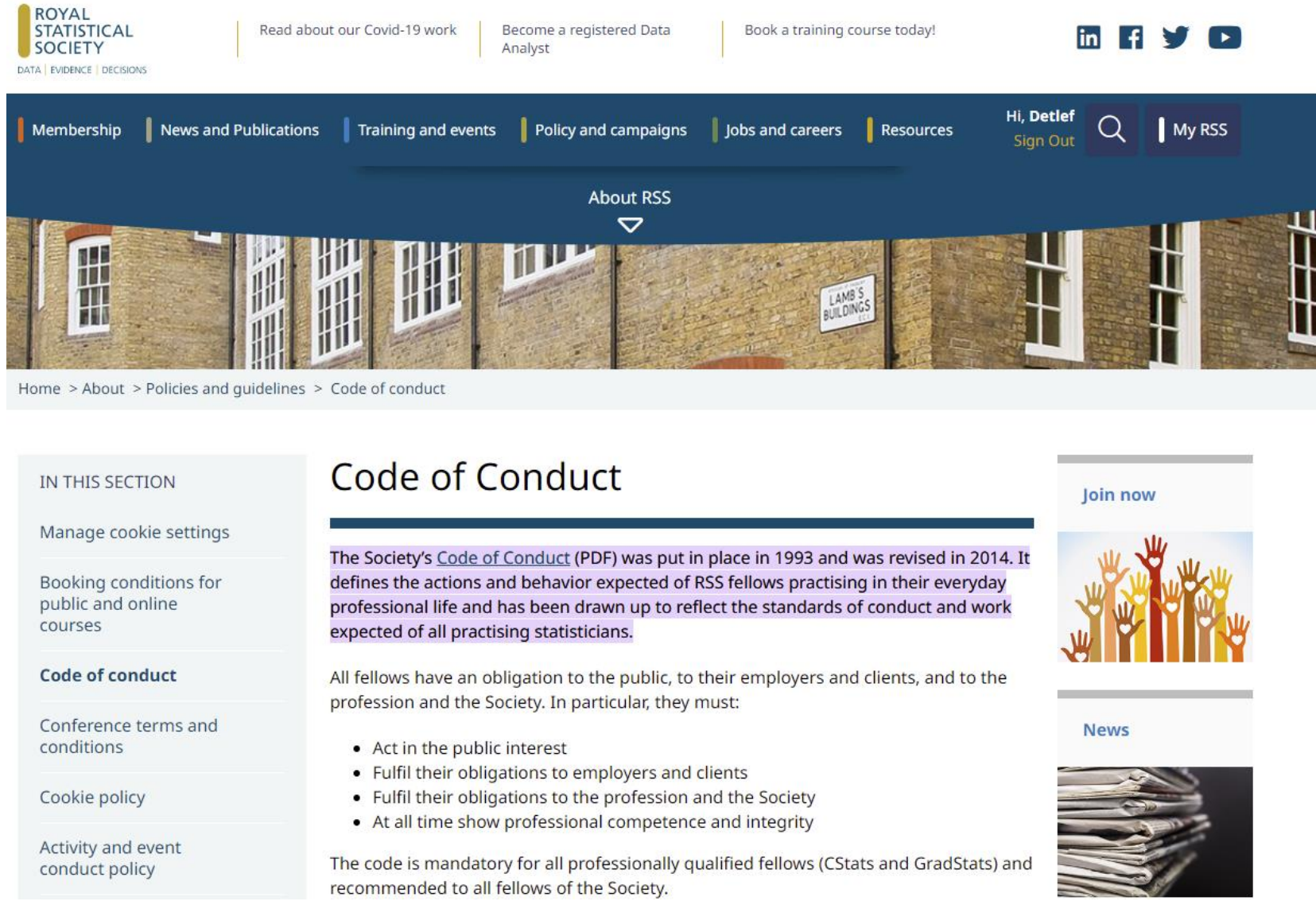
[BCS Code of Conduct for members - Ethics for IT professionals | BCS]

[IEEE - IEEE Code of Ethics]

[Code of Ethics (acm.org)]

[Ethical Principles - The OR Society]

[Research Ethics & Conduct | Royal Society]



Examples for strong regulation:

Civil Engineering

Aviation

Medicine

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Tacoma Narrows Bridge

Mistakes can happened despite standards, regulations and following best practice.

Source: Tacoma Narrows Bridge (1940) - Wikipedia
Tacoma Narrows bridge got the nickname Galloping Gertie when winds created a harmonic resonance in the bridge structure despite several dampening measures. It collapsed on 7th Nov 1940 after it was opened to traffic on 1 July 1940.

The Collapse — UW Libraries (washington.edu)

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Boeing 737 Max

Source: https://en.wikipedia.org/wiki/Boeing_737_MAX and https://en.wikipedia.org/wiki/Maneuvering_Characteristics_Augmentation_System
On October 29, 2018, Lion Air Flight 610 (pictured), 737 MAX 8 registration PK-LQP, plunged into the Java Sea 13 minutes after takeoff from Soekarno–Hatta International Airport, Jakarta, Indonesia. The flight was a scheduled domestic flight to Depati Amir Airport, Pangkal Pinang, Indonesia. All 189 people on board died. This was the first fatal aviation crash and first hull loss of a 737 MAX. The aircraft had been delivered to Lion Air two months earlier.[213][214] People familiar with the investigation reported that during a flight piloted by a different crew on the day before the crash, the same aircraft experienced a similar malfunction but an extra pilot sitting in the cockpit jumpseat correctly diagnosed the problem and told the crew how to disable the malfunctioning MCAS flight-control system.[215] Indonesia's National Transportation Safety Committee released its final report into the crash on October 25, 2019,[216] attributing the crash to the MCAS pushing the aircraft into a dive due to data from a faulty angle-of-attack sensor. Following the Lion Air crash, Boeing issued an operational manual guidance, advising airlines on how to address erroneous cockpit readings.[217]
On March 10, 2019, Ethiopian Airlines Flight 302, 737 MAX 8 registration ET-AVJ, crashed approximately six minutes after takeoff from Addis Ababa, Ethiopia,[218] on a scheduled flight to Nairobi, Kenya,[219] killing all 149 passengers and 8 crew members on board. The aircraft was four months old at the time.[220] The cause of the crash was initially unclear, though the aircraft's vertical speed after takeoff was reported to be unstable.[221] Evidence retrieved on the crash site suggests, that at the time of the crash, the aircraft was configured to dive, similar to Lion Air Flight 610.[222] On April 4, Ethiopian transport minister Dagmawit Moges stated that the crew "performed all the procedures repeatedly provided by the manufacturer but was not able to control the aircraft."[223]
The similarity of the physical and flight data evidence from the accidents led to the global 737 MAX groundings beginning on the day of the second accident.[224]

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Boeing 737 Max

Source: https://en.wikipedia.org/wiki/Maneuvering_Characteristics_Augmentation_System

The **Maneuvering Characteristics Augmentation System** (**MCAS**) is a flight stabilizing program developed by Boeing that became notorious for its role in two fatal accidents of the 737 MAX, which killed all passengers and crew on both flights, 346 people in total.

Flawed information from a single external sensor (angle of attack) fed into the system caused it to repeatedly push the planes' noses down as pilots struggled to keep them in the air before both crashes.

Single point of failure (just one angle of attack sensor), design kept from pilots to avoid costly retraining. Boeing was allowed to self-certify instead of having to use the regulator.

The MCAS design parameters originally envisioned automated corrective actions to be taken in cases of high AoA and g-forces beyond normal flight conditions. Test pilots routinely push aircraft to such extremes, as the FAA requires airplanes to perform as expected. Before the MCAS, test pilot Ray Craig determined the plane did not fly smoothly, in part due to the larger engines. Craig would have preferred an aerodynamic solution, but Boeing decided to implement a control law in software.

According to a news report in the *Wall Street Journal*, engineers who had worked on the KC-46A Pegasus tanker, which includes an MCAS function, suggested MCAS to the design team.[51]

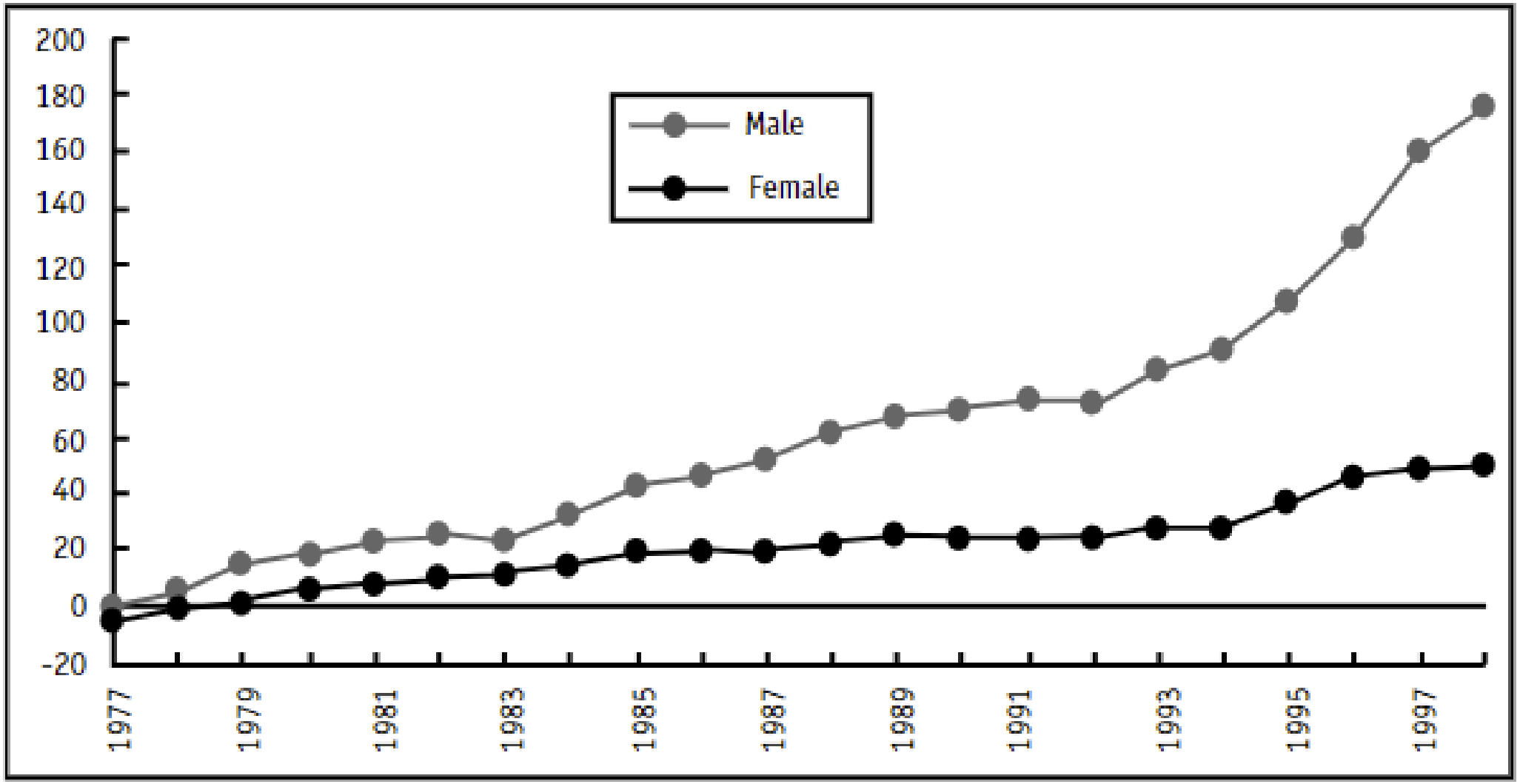
With the MCAS implemented, new test pilot Ed Wilson said the "MAX wasn't handling well when nearing stalls at low speeds" and recommended MCAS to apply across a broader range of flight conditions. This required the MCAS to function under normal g-forces and, at stalling speeds, deflect the vertical trim more rapidly and to a greater extent—but now it reads a single AoA sensor, creating a single point of failure that allowed false data to trigger MCAS to pitch the nose downward and force the aircraft into a dive.[52][42] "Inadvertently, the door was now opened to serious system misbehavior during the busy and stressful moments right after takeoff", said Jenkins of *The Wall Street Journal*.[53]

The FAA did not conduct a safety analysis on the changes. It had already approved the previous version of MCAS, and the agency's rules did not require it to take a second look because the changes did not affect how the plane operated in extreme situations.[54]

The Joint Authorities Technical Review found the technology unprecedented: "If the FAA technical staff had been fully aware of the details of the MCAS function, the JATR team believes the agency likely would have required an issue paper for using the stabilizer in a way that it had not previously been used. MCAS used the stabilizer to change the column force feel, not trim the aircraft. This is a case of using the control surface in a new way that the regulations never accounted for and should have required an issue paper for further analysis by the FAA. If an issue paper had been required, the JATR team believes it likely would have identified the potential for the stabilizer to overpower the elevator."[35]

In November 2019, Jim Marko, a manager of aircraft integration and safety assessment at Transport Canada aviation regulator's National Aircraft Certification Branch questioned the readiness of MCAS. Because new problems kept emerging, he suggested to his peers at FAA, ANAC and EASA to consider the safety benefits of removing MCAS from the MAX.[55]

Figure 2. Cumulative excess death certificates signed by Shipman, for people older than 64 and who died at home or in his practice



Source: David Spiegelhalter, Nicky Best: Shipman's statistical legacy. Significance Vol 1 No 1 pp10-12, March 2004.
https://rss.onlinelibrary.wiley.com/doi/epdf/10.1111/j.1740-9713.2004.00002.x

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Harold Shipman

Standards, regulations and oaths don’t help against malicious individuals. Harold Shipman was a GP who killed in excess of 215 people in his care. He was finally arrested in 1998.
If statistical monitoring would have been in place he was theoretically detectable at the end of 1985. Only theoretically because the necessary data was never collected.

What about software?

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https://docs.microsoft.com/en-us/legal/information-protection/software-license-terms

https://raygun.com/blog/costly-software-errors-history/

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First computer virus

Source: 11 of the most costly software errors in history · Raygun Blog
Not all costly software errors are worn by big companies or government organizations. In fact, one of the most costly software bugs ever was caused by a single student. A Cornell University student created a worm as part of an experiment, which ended up spreading like wildfire and crashing tens of thousands of computers due to a coding error.
The computers were all connected through a very early version of the internet, making the Morris worm essentially the first infectious computer virus. Graduate student Robert Tappan Morris was eventually charged and convicted of criminal hacking and fined $10,000, although the cost of the mess he created was estimated to be as high as $10 million.
History has forgiven Morris though, with the incident now widely credited for exposing a vulnerability and improving digital security. These days, Morris is a professor at MIT and the worm's source code has been kept as a museum piece on a floppy disc at the University of Boston.

https://www.thecivilengineer.org/news/video-maeslantkering-the-biggest-storm-surge-barrier-in-the-world

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Maeslantkering – storm surge barrier at Rotterdam

- https://www.thecivilengineer.org/news/video-maeslantkering-the-biggest-storm-surge-barrier-in-the-world
- Closing decision made by computer system BOS: inputs are just water conditions and weather forecast. BES is the computer system that fully automatically closes the barrier.
- Software engineers used formal methods to prove code has been written to specifications.

- When the water level exceeds more than 3 m from the surface of the water, then the moving parts of the barrier are activated. The waterway with a width of 360m can then be completely closed. At first sight, it is almost unbelievable that such a barrier is capable of such an achievement. The Maeslant barrier has a length almost as the height of the Eiffel tower and weighs about four times as much. It is the only storm surge barrier in the world with such large movable parts. Each of the mobile ports has length equal to 240 m. Normally, the doors are fully open so that ships to access the harbor of Rotterdam. When the barrier is open, the doors are disposed along the two banks of the river.
- During inclement weather, the special sockets of the doors are flooded and start to float. Then, they slip into the sea by means of a traction mechanism and this procedure lasts about half an hour. When the doors are now in the middle of the river, special valves open when the flooding ports sink downward due to their increased weight. In the bottom there has been constructed a reinforcing concrete layer, while a large amount of sludge is concentrated on it. To completely seal the waterway mobile ports of the barrier must be in perfect contact with the bottom concrete layer. The ports are not placed immediately above in this layer, but essentially are suspended just above them. The speed of the flow due to reduction of the flow area becomes so strong that the sludge is entrained away. After approximately an hour, the doors can be placed on the concrete layer which is mud free. The water level in the sea then becomes higher than the water level of the river side. The force applied to the doors during a storm is about 350 MN and this force is equal to the weight of 350,000 strong men weighing 100 pounds each. Furthermore, the difference of pressure between the sides of the doors is so big that a ship of equal dimensions with the barrier would be reversed immediately.
- The Maeslant barrier is necessary for several reasons. It is the most important measure for the protection of Rotterdam and the surrounding area, while the seawater threatens more and more land due to the rising sea level.
- The mobile gates of the barrier are actually a human achievement. However, the Maeslantkering barrier is controlled by a computer. In case of a storm, the decision whether or not to close the barrier is obtained by a computer system (BOS) since the probability of errors is greatly increased if people were to take that decision. A computer will follow the predefined procedures and does not take last minute decisions as it is not affected by poor environmental conditions. The system takes into account only the water conditions and the weather forecast bulletins. According to these, it estimates the expected levels of water level in Rotterdam, Dordrecht and Spijkenisse. When the system BOS decides to close the barrier, it gives orders to another computer system BES. This system works completely automatically, but it remains under the constant human supervision on the procedures followed.

https://manifesto.responsiblesoftware.org/

Manifesto for Responsible Software Development

In order to foster a free and fair society I affirm that I will practice my profession with responsibility and with dignity. I will abide by the following principles:

I am ethically responsible for my decisions and I will act according to my conscience.

The impact of software is growing continuously in all areas of our lives. I acknowledge the consequences to humanity and the environment that evolve from our work.

I will not develop software that is intended to violate human rights and civil liberties.

It is increasingly possible to violate personal and human rights with the use of software as the boundaries between real and digital world become blurred.

I know that I can't control software once it is released so I have a responsibility to consider the potential for my software to violate people's rights before I start to implement it. I will reject projects which facilitate this abuse.

I will be worthy of the faith in me as an expert of my profession.

The possible negative consequences of the improper use of complex software are inconceivable to most users. Therefore it is our responsibility as software developers to communicate the boundaries of proper use clearly.

When I realize that a software that I released is not applicable anymore, my minimum responsibility is to let potential and existing users know.

I will collect only the data that is essential for my task. I will store it only as long as needed.

My applications are likely to collect personal information. I will safeguard this, and use it only as the provider of the information intended. I will treat their data as if it were my own.

I will do my very best to prevent the waste of energy and resources.

The increasing number of devices that contain software has a strong impact on the global use of resources and energy.

I make these promises solemnly, freely and upon my honor.

SIGN THE MANIFESTO

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Automated Decision = Data + Software

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AI = Decision Making at Scale

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Joy Buolamwini: “AI, Ain’t I a Woman?”

Joy Buolamwini’s seminal study Gender Shades demonstrated the gender and racial bias in facial image recognition software.

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https://www.rockefellerfoundation.org/case-study/unpacking-biases-in-algorithms-that-perpetuate-inequity/

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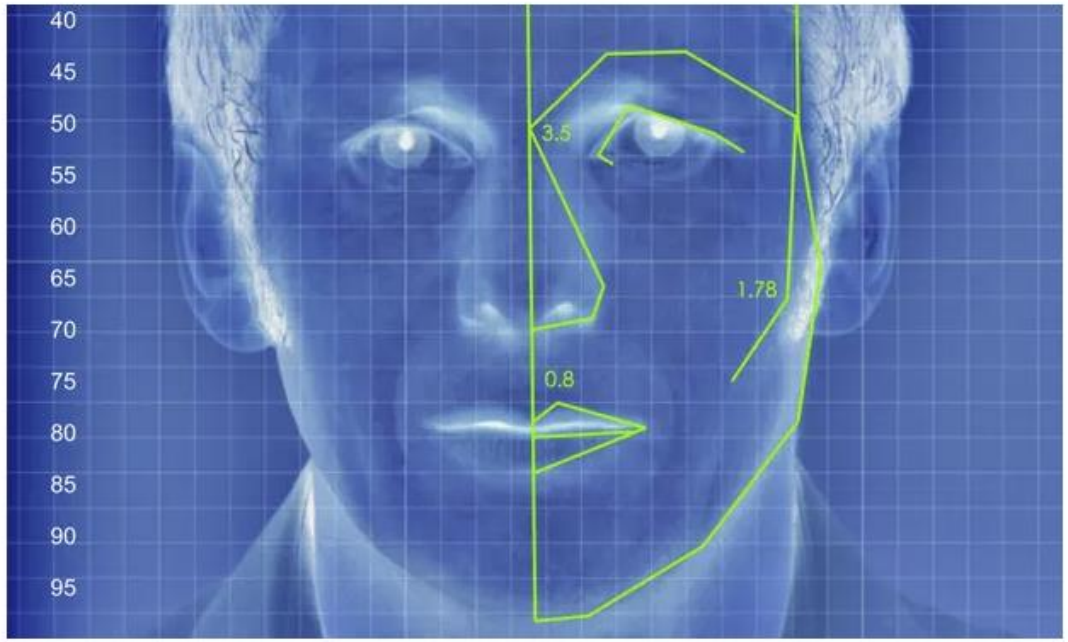
Coded Gaze

The Coded Gaze: Unpacking Biases in Algorithms That Perpetuate Inequity
https://www.rockefellerfoundation.org/case-study/unpacking-biases-in-algorithms-that-perpetuate-inequity/

Why would you ever want to do this?

New AI can guess whether you're gay or straight from a photograph

An algorithm deduced the sexuality of people on a dating site with up to 91% accuracy, raising tricky ethical questions



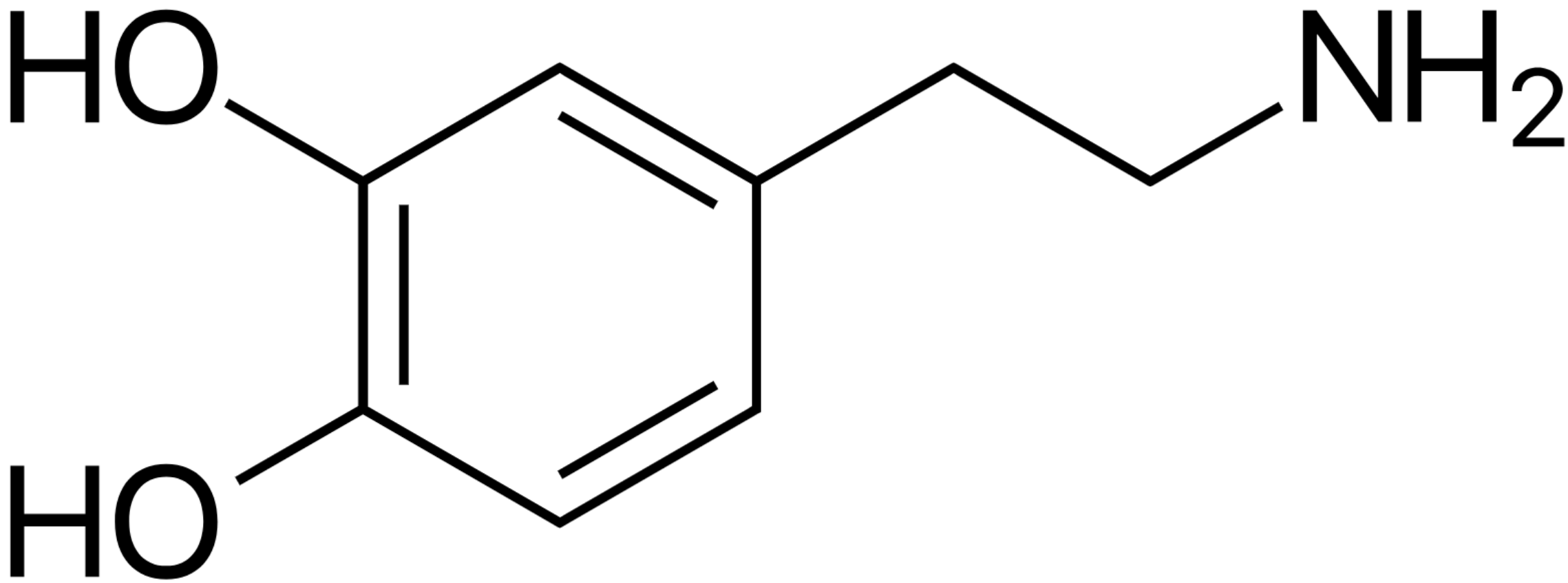
An illustrated depiction of facial analysis technology similar to that used in the experiment. Illustration: Alamy

Source: Guardian 8 Sep 2017. Based on a study at Stanford University.
https://www.theguardian.com/technology/2017/sep/07/new-artificial-intelligence-can-tell-whether-youre-gay-or-straight-from-a-photograph

What are the kind of predictions we should not make?

https://gizmodo.com/data-brokers-selling-pregnancy-roe-v-wade-abortion-1849148426 (30 July 2022)

Digital Dopamine and Behaviour Modification: How Much is too Much?



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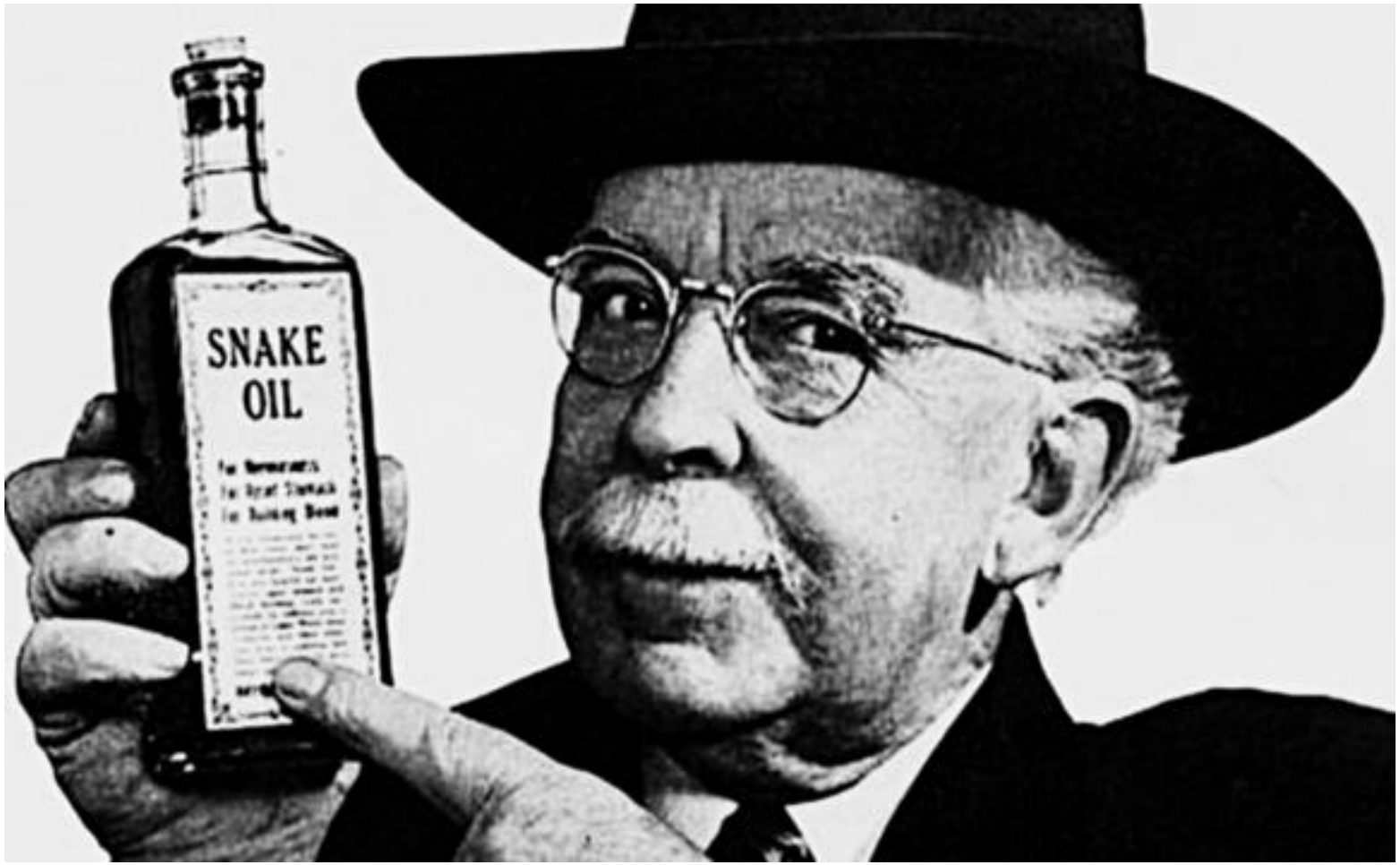
Dopamine

Skeletal formula of dopamine

https://en.wikipedia.org/wiki/Dopamine
In popular culture and media, dopamine is often portrayed as the main chemical of pleasure, but the current opinion in pharmacology is that dopamine instead confers motivational salience;[6][7][8] in other words, dopamine signals the perceived motivational

Beware the AI Snake Oil!



See here for more examples: https://www.cs.princeton.edu/~arvindn/talks/MIT-STS-AI-snakeoil.pdf

Bad Science: Emotion Recognition

Alberto Romero

May 17, 2021 · 6 min read ★ · Listen

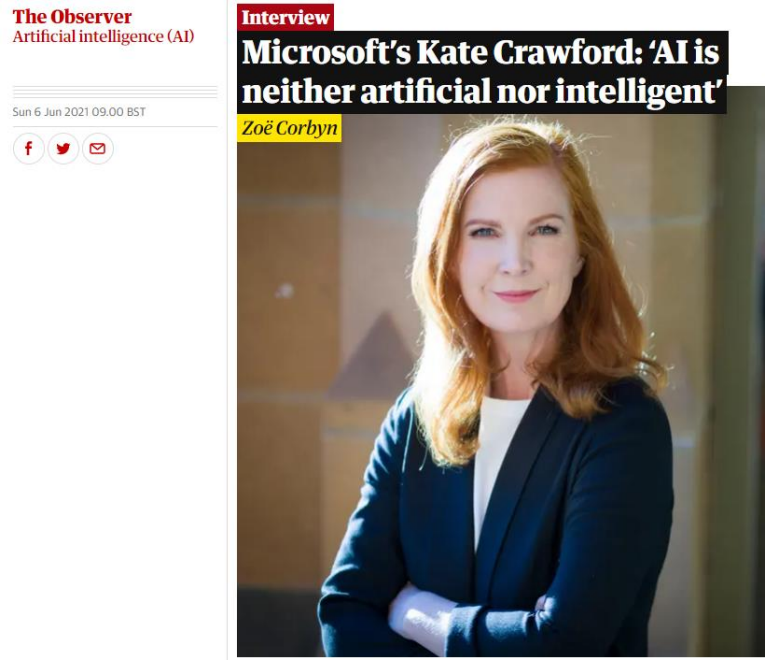
ARTIFICIAL INTELLIGENCE

We Have to Stop Doing AI Emotion Recognition

What does it mean for the multi-billion-dollar industry?

Photo by Sydney Sims on Unsplash

https://towardsdatascience.com/we-have-to-stop-doing-ai-emotion-recognition-ca5ed159370



The Observer
Artificial intelligence (AI)

Sun 6 Jun 2021 09.00 BST

Interview

Microsoft's Kate Crawford: 'AI is neither artificial nor intelligent'

Zoë Corbyn

Kate Crawford:
"The idea that you can see from somebody's face what they are feeling is deeply flawed.
I don't think that's possible. I have argued that it is one of the most urgently needed domains for regulation."

https://www.theguardian.com/technology/2021/jun/06/microsofts-kate-crawford-ai-is-neither-artificial-nor-intelligent

Bad Science: Hiring Tools

BR24

Objective or Biased

BACKGROUND

OCEAN RESULTS

A bookshelf alters the results even more than the picture frame. The result calculated by the AI differs significantly from that of the original version.

See: Objective or Biased. On the questionable use of Artificial Intelligence for job applications.
https://web.br.de/interaktiv/ki-bewerbung/en/

Also see:
MIT Technology Podcast: In Machines We Trust
https://www.technologyreview.com/podcast/in-machines-we-trust/

Watch: BBC3 – Computer Says No
https://youtu.be/-Mlma9nLduo

So what should we do?

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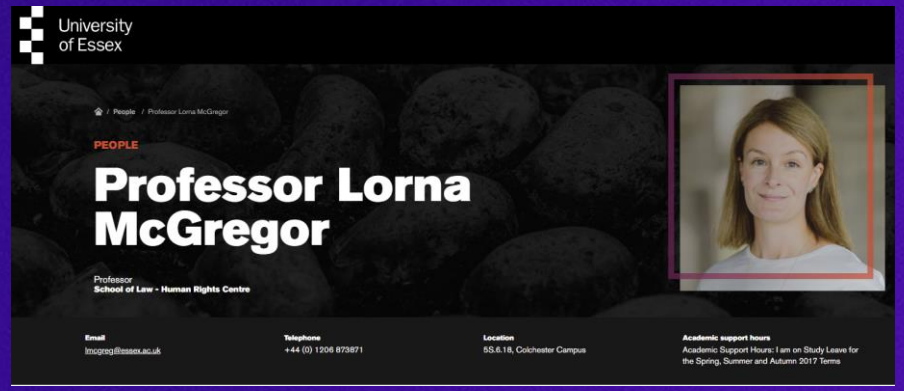
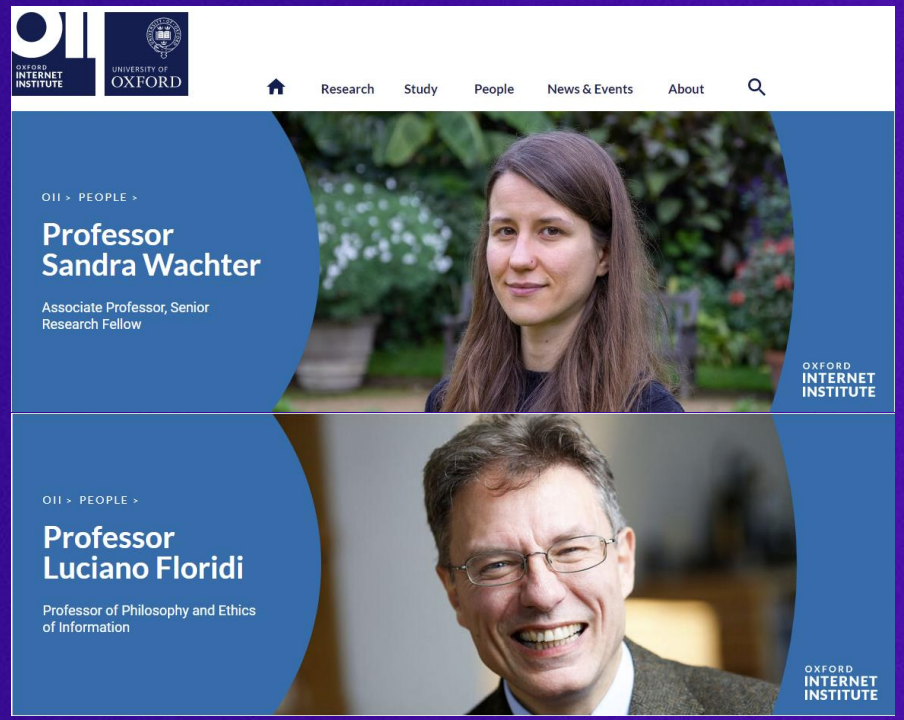
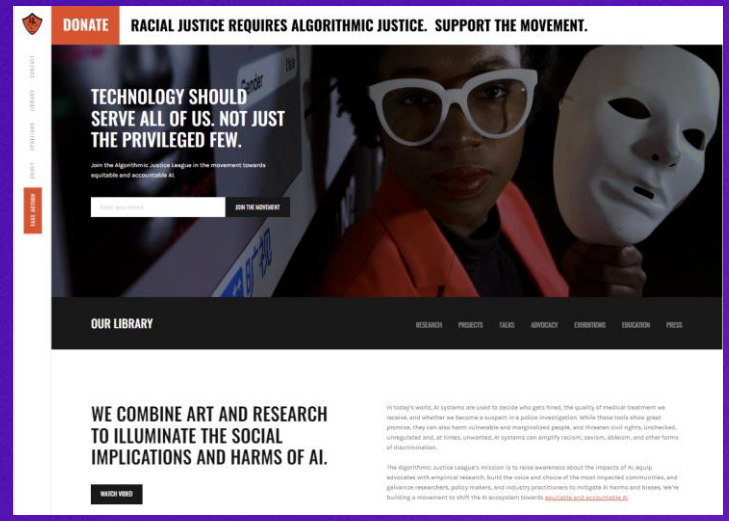
Academic Research – Human Rights, Law, Philosophy and Ethics, Beneficial AI







[Algorithmic Justice League - Unmasking AI harms and biases (ajl.org)]

[Stuart Russell (berkeley.edu)]
Provably Beneficial AI: [https://youtu.be/SYqVKrY8XpA?t=1307]

Organisations

Government Organisations
Develop internationally compatible regulation

Universities
Teach best practices and turn Data Science and Machine Learning into engineering disciplines

Private Sector
Develop risk management and governance frameworks

Professional Societies and NGOs
Work together on standards

And you?

Keep learning and look beyond your discipline.

Join a professional society whose code of ethics you can subscribe to.

Join the discussion.

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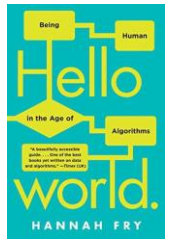
Suggested Reading, Listening, and Viewing around Human and Artificial Intelligence

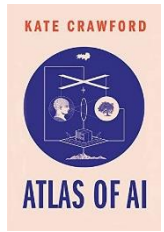
Topical Books

Hannah Fry: Hello World: Being Human in the Age of Algorithms.



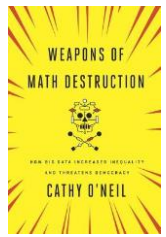
Great read to get familiar with AI if the area is new to you or if you want to discuss it with family & friends.

Kate Crawford: Atlas of AI



Explains the hidden costs of artificial intelligence, from natural resources and labour to privacy, equality, and freedom.

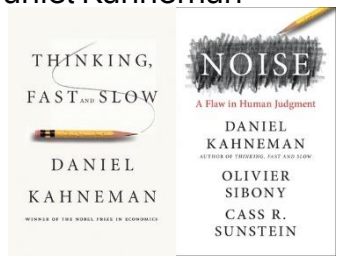
Cathy O'Neil: Weapons of Math Destruction.



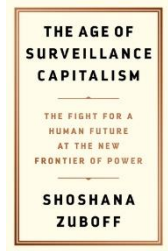
Already a classic, this books explains the impact of uncontested and unregulated machine prediction of social outcomes.

Background Reading

I recommend the books by Daniel Kahneman "Thinking, Fast and Slow" and his latest book "Noise". They explain the science of human decision making which has a direct link to how we are and should be building systems through machine learning that make automated decisions.

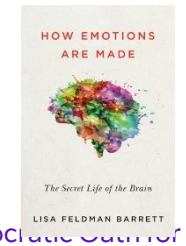


Shoshana Zuboff: The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power.



Explains the AI business model of the big technology companies and how it impacts human behaviour.

Lisa Feldman Barrett: How Emotions Are Made: The Secret Life of the Brain.



Explains the science of emotion and the recent paradigm shift in the area.

Talks, Podcasts, Blogs, Documentaries

Cassie Kozyrkov's YouTube channel and blog on Medium. Cassie is Google's Chief Decision Scientist and presents complex topics about AI in an interesting and relatable way.

Arvind Narayanan: How to Recognize AI Snake Oil. Computer Science Department at Princeton University
Great talk with a great discussion afterwards.

In Machines We Trust. Podcast by the MIT Technology Review. Covers a lot of AI related topics.

The Joy of Data – https://youtu.be/bGq9OVce6Eg
BBC Documentary presented by Hannah Fry.
What is data and why is it so important for AI?

Coded Bias (available on Netflix)
I highly recommend watching this documentary. It investigates the bias in algorithms after MIT Media Lab researcher Joy Buolamwini uncovered flaws in facial recognition technology.

Computer Says No – https://youtu.be/-Mlma9nLduo
How do you secure your dream job when computers are driving the hiring decisions?
BBC Three documentary, 16 Mar 2022
Available on BBC iPlayer and YouTube