

What is the importance of ethics in data science?

Ethics, as moral philosophy, helps to define the rules by which we should live. Distinguishing right from wrong at its core, ethics attempts to embody how morality should regulate our actions, including how as a society we gather data and use information derived from that data. But with the rise of the internet, the ability to store and cross-connect vast amounts of data, plus powerful analytical tools ('big data'), we have had to revise our attitudes towards privacy and the exploitation of data. As humankind has developed these new technologies, long-standing, irreconcilable tensions between personal privacy and public good have intensified. Not only have we witnessed a growing number of high-profile data scandals and breaches in recent years, but we now have governmental bodies such as the EU increasingly regulating the use of data to avoid 'data harm' – defined broadly as the impairment of the interests of an entity or society as a whole [1]. In the future, ethical guidelines for data use may prove to be one of few safeguards we have against any form of information mismanagement, especially in protecting our digital selves – something that is becoming more intertwined with our own physical identities. The concerns have gone beyond just the issue of privacy – ethics in data science now reflect the delicate balance between the rights of individuals and the welfare of society at large.

In 1990, global internet traffic amounted to the equivalent of less than 450 Blu-ray discs of information. Thirty years later, the scale of global internet traffic is now 3 million times larger [2]. As databases move from isolated physical documents to integrated digital systems accessible from anywhere on the planet, data privacy and ethical data management have become more important than ever. Data science has emerged as a major discipline, using new analytical tools to extract insights or knowledge ('information') from these vast amounts of data. Forty years ago, data science was primarily focused on data analysis to provide intelligence for businesses to make decisions and, later, data models were developed to help people make these decisions. Today's data science

applications are often automated, using algorithms and machine learning to make decisions without the need for humans.

Data science can be a tool for innovation and optimisation. It can even save lives by identifying a patient's medical conditions more efficiently than a human brain on its own. But profit or political motives can also exploit this capability. Scandals such as that of Cambridge Analytica – which acquired the private Facebook data of tens of millions of users for targeted political advertising [3] – have heightened public awareness about the potential exploitation of personal information. At the same time, the introduction of new legislation like the EU's GDPR represents a strong step forward towards more ethical treatment of private data. Our society now has one of its biggest moral challenges, and the groundwork laid today for ethics in data science will determine the course of data use – or misuse – into the future. Our increasing reliance on algorithms and Artificial Intelligence ('AI') raises further questions about decision-making and its automation. Ethics need to be the lighthouse in data science amid this dangerous fog of uncertainty.

As data becomes an increasingly valuable currency, new risks of misuse continue to emerge from this fog. The creation of countless new data sources – whether social media posts, subscription lists or stored browser cookies – has led to more opportunities for cross-connecting this data, opening the doors to possibilities for lucrative data exploitation. Vast amounts of data about people are passed between entities every day without those people being aware that they have implicitly or explicitly allowed this to happen. Sometimes it may be for governments to carry out their regulatory duties, more often it is in exchange for money - and usually, the buyer has a morally defendable motive such as targeted advertising. Most US high school students would not be aware that the College Board, the national organisation managing tests for university applications, sells a student's name and details 18 times on average, with some sold more than 70 times to US universities [4]; it is

debatable whether the resultant targeted advertising to these students can create harm. But sometimes the profit motive can lead to sales of data that most of us would consider immoral because of the potential for harm. Public interest groups such as the World Privacy Forum report data brokers selling lists of rape victims, addresses of domestic violence shelters, and sufferers of addiction that could put those listed at risk of discrimination or even physical harm [5].

Faulty analytical models can result in harm, as in the case of a man who found his credit rating had reduced despite having a perfect credit record - a banking algorithm had determined that his retail patterns reflected those of customers with poor repayment histories [6]. Perhaps even more pressing is the risk of innate bias in algorithms, with the increasing automation of decision-making producing instances of machine-driven discrimination using ethnic profiling that restricts access to services such as housing and insurance [7]. Gender prejudice has been another concerning impact of algorithmic bias, with built-in male preference having been uncovered in systems ranging from job recruitment artificial intelligence to predictive tools on music platforms [8, 9].

Most of the 'harm' from data science applications has not come from deliberate misuse but from the lack of human oversight. We rightly do not trust the current level of AI to understand and apply human emotions such as fairness or compassion but too often we omit the human in the decision chain. Even in 1976, Joseph Weizenbaum, a professor at MIT and one of the fathers of AI, stated that AI should not replace humans in roles which need care or respect, be it nursing or policing [10]. However, we already see many such functions increasingly being semi-automated and we lack guidelines to establish how far this should go. Our problem in AI is not the lack of technical experts but the lack of moral philosophers. We need a moral framework: ethics needs to be at the core of data science and of its application in society.

Data science plays a critical role in addressing many of the modern world's challenges and it has been the architect of the worldwide response to the COVID-19 pandemic. Public health mandates including orders to stay at home, mandatory mask-wearing, and social distancing were developed based on the large-scale analysis of disease behaviour across the world. Artificial intelligence platforms, for example tracking mobile phone data, have allowed researchers to learn more about the spread of the virus. The disease surveillance platform BlueDot even spotted the emergence of COVID-19 in late 2019, over a week before the WHO had issued any statements, identifying an unusual cluster of pneumonia cases occurring around a market in Wuhan, China [11].

Greater capacities for surveillance, such as COVID-19 tracking tools create personal security concerns of their own. Although data science has enabled us to tackle disease in a way that was impossible during the Spanish Flu one hundred years ago, both its ethical issues and its failings in adequately controlling the pandemic have raised urgent questions about its use. Innovative data collection and analysis tools were developed in the UK to tackle the virus, but UK privacy and freedom concepts prevented a full 'track and trace' system, and the UK initially failed to control the spread of the virus. By contrast, societies such as China and Singapore had more intrusive 'track and trace' apps which allowed the governments to swiftly control virus outbreaks. The trade-off between individual harm and societal welfare has never been under a more scrutinised spotlight – did data ethics constrain our response to the pandemic to the point of causing more deaths?

Professional education and public debate should hold the key to unlocking a transparent and accountable world of data science. Groups such as the Turing Institute conduct training in data ethics, while others like the Ada Lovelace Institute continue to encourage research into socio-

technical questions about data and AI [12, 13]. Universities such as Stanford and Cardiff already have research units to help understanding in this debate. It is critical that other universities follow the example of NCH in establishing undergraduate cross-disciplinary courses in the ethics of data science so as to shine light and truth in the debate for data scientists.

Just as in the discipline of medicine, data science needs a fundamental code of conduct. A Hippocratic Oath for data science would enable the regulation of its application in the interests of society at large, while further legislation could equip governments and organisations with the power to punish ethical breaches. Parallels can be drawn from the field of genetics, where attempts to define the ethical limits of genome editing pivot around the possibilities of misuse. Data science should be no different – in considering the endless possibilities of improving our quality of life, we must not forget that we have to improve transparency, accountability, and oversight in order to prevent the creation of a monster.

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