

How can the current problems in healthcare be minimised using AI and technology?

“It’s not artificial intelligence I’m worried about, it’s human stupidity.”

- Dr Neil Jacobstein, Chair of Artificial Intelligence, Singularity University

Doctors have adapted to new technologies for hundreds of years, for example, when the thermometer was first introduced to medicine in 1717, there was a great debate in the medical sphere as to its efficacy. It was initially met with scepticism by physicians who insisted that its mathematical nature didn’t capture the details of patients’ descriptions of “feverish heat”. Ultimately, the thermometer demonstrated it’s worth and now no doctor would practice without it. Artificial Intelligence (AI) will likely follow a comparable trajectory, because it too, is another instrument yet to be added to the doctor’s toolkit. In fact, Dr Jacobstein predicts that within 10 years doctors who do not use AI might be sued for medical malpractice.

While robots can hold artificial intelligence, AI itself is a branch of computer science¹ dealing with the simulation of intellectual behaviour within computers. AI encompasses a myriad of potential, especially in medicine. Fuelled by big data, these algorithms can be used to make sense of large data sets by revealing patterns, trends and relationships. Though programs cannot yet equal the complexity of human intellect, they can be programmed to deliver highly specific tasks. Their uses are extensive and range from medical diagnosis to voice or handwriting recognition.

An example showcasing the benefits of AI came from Google-owned DeepMind. The company has a scanner competent in detecting over 50 different eye-related conditions. The technology has an accuracy rate of 94%; these numbers are every bit as precise as

¹ Webster’s New World College Dictionary. 4th Edition. (2010): *artificial intelligence in American English*. [online] Available at: <https://www.collinsdictionary.com/dictionary/english/artificial-intelligence> [Accessed 27th December 2019]

How can the current problems in healthcare be minimised using AI and technology?

a human doctor. Therefore, it is no wonder that AI in healthcare has a market valued at around \$600 million, but forecasters anticipate that figure to soar to more than \$6 billion in the next 3 years. ²

DATA ANALYSIS

AI's promising outlook starts with medical records. Most probably have multiple records, spread around various hospitals, family doctors and specialists. It is an outdated system, but, given the right tools, AI could bring together all your valuable health data in one place.

AI is starting to play a part in analysing said data. An advantage of the current trend of paperless patient records is that this allows researchers to examine anonymised datasets to create and test hypotheses, as well as the ability to monitor outcomes, helping to suggest how to maximise efficiency with treatments and procedures.

MEDICAL IMAGING

Computers can work without exhaustion and under certain situations are quicker and more accurate at making judgments. In 2017, a study at Stanford University³ created an algorithm that could detect pneumonia with a better average F1 metric than the radiologists involved in that trial. The added benefit is that patients can receive a diagnosis and treatment quicker, improving their overall prognosis.

² Smith, A. (2018) *Artificial Intelligence (AI) In Healthcare - Benefits And Challenges*. [online] Available at: <https://www.firstquotehealth.com/health-insurance-news/artificial-intelligence-ai-healthcare> [Accessed 27th December 2019]

³ Kubota, T. (2017) *Stanford algorithm can diagnose pneumonia better than radiologists*. [online] Available at: <https://news.stanford.edu/2017/11/15/algorithm-outperforms-radiologists-diagnosing-pneumonia/> [Accessed 28th December 2019]

How can the current problems in healthcare be minimised using AI and technology?

AI, however, should not be confused with technology already in use, such as robot-assisted surgery. This type of surgery does not operate AI because the surgeon remains in control of the robot during the procedure. The same principle applies to imaging technology. While robots help produce imaging, it is the radiologists who typically view images, analyse information, make the diagnosis and suggest appropriate treatment. Nevertheless, AI could be used in the future to decipher images and aiding the diagnosis of diseases. For some routine diagnoses such as skin lesions, algorithms have also shown to have an advantage against humans. ⁴

In reality, medical imaging produces huge amounts of data. According to the most recent Diagnostic Imaging Dataset Statistical Release, there were 41.3 million imaging tests reported in England during the year from February 2017 to February 2018, as shown in Figure 1.⁵

⁴ Kubota, T. (2017) *Deep learning algorithm does as well as dermatologists in identifying skin cancer*. [online] Available at: <https://news.stanford.edu/2017/01/25/artificial-intelligence-used-identify-skin-cancer/> [Accessed 28th December 2019]

⁵ NHS England. (2018) *Diagnostic Imaging Dataset Statistical Release*. [online] Available at: <https://www.england.nhs.uk/statistics/wp-content/uploads/sites/2/2018/06/Provisional-Monthly-Diagnostic-Imaging-Dataset-Statistics-2018-06-21.pdf> [Accessed 27th December 2019]

How can the current problems in healthcare be minimised using AI and technology?

Table 1: Count of imaging activity in England, on NHS Patients, February 2017 to February 2018

	X-ray	Ultrasound	CT Scan	MRI	Fluoro-scropy	Nuclear Medicine	PET-CT Scans	SPECT Scans	Medical Photography	% organisations included	Total ¹
Feb	1,793,425	742,730	389,935	273,915	81,720	33,400	11,105	3,000	2,715	98.9%	3,331,940
Mar	2,064,615	850,630	440,290	306,045	95,595	38,540	13,035	3,450	2,955	98.3%	3,815,155
Apr ²	1,711,865	688,210	377,525	263,500	74,185	29,085	10,540	2,520	2,155	96.5%	3,159,580
May	1,896,290	791,775	406,440	277,465	86,810	33,945	12,645	3,015	2,675	97.7%	3,511,055
Jun	1,898,270	802,805	414,015	282,770	87,990	34,585	12,530	3,015	2,980	97.7%	3,538,965
Jul	1,745,180	726,875	393,365	273,705	79,275	31,755	12,100	2,880	2,365	93.1%	3,267,500
Aug	1,764,380	780,645	421,020	286,280	84,665	34,880	12,640	3,340	2,920	96.0%	3,390,765
Sep	1,761,130	759,355	414,245	281,110	83,620	33,540	12,140	3,235	2,990	97.7%	3,351,365
Oct	1,882,955	812,225	433,870	294,285	88,195	36,580	13,160	3,375	3,195	98.2%	3,567,835
Nov	1,865,390	822,170	431,440	293,280	90,130	36,770	13,465	3,815	3,375	98.2%	3,559,830
Dec	1,680,865	695,920	407,115	266,565	75,545	29,555	11,685	2,960	2,765	98.2%	3,172,970
Jan	1,972,740	841,350	453,200	296,825	84,965	37,245	13,995	3,765	3,770	98.2%	3,707,855
Feb	1,730,520	735,630	406,060	274,710	75,770	32,040	12,715	3,160	3,430	98.2%	3,274,040
Total ³	21,974,195	9,307,590	4,998,585	3,396,535	1,006,740	408,510	150,645	38,535	35,585	-	41,316,920

1. Total calculated as the sum of all activity for that month. Totals may not always equal the sum of the parts due to rounding. Activity not matched to a known organisation is omitted.
2. Data from April 2017 onwards are provisional and may be subject to change.
3. Total row represents a rolling 12 month total and does not include activity from the earliest month in the table. Totals may not always equal the sum of the parts due to rounding.

Figure 1

Employing AI technologies could reconstruct radiologists' roles by authorising computerised diagnosis' so that specialist radiologists can focus solely on more challenging and complex cases requiring immediate attention.

IMPROVING DOCTOR-PATIENT RELATIONSHIPS

Doctors play a vital role in communication, empathy, teamwork and leadership - a combination of qualities and skills known as 'human factors' - which cannot yet be fully expressed by an AI system.

An example of how AI technologies are currently being used in the NHS is a decision support tool called “C the Signs”. Used in 95 practices,⁶ this application aims to help General Practitioners distinguish patients at risk of cancer earlier. ‘C the Signs’ equip GPs with the capacity to compare orders of symptoms and risk factors digitally during consultations. This app helps identify what further examinations are needed and

⁶ NHS England. (2018) *C the Signs - How artificial intelligence (AI) is supporting referrals*. [online] Available at: <https://www.england.nhs.uk/cancer/case-studies/c-the-signs-how-artificial-intelligence-ai-is-supporting-referrals/> [Accessed 28th December 2019]

How can the current problems in healthcare be minimised using AI and technology?

whether specialist referral is required depending on the perceived risk, therefore improving the quality of GP consultations and making the referral process more effective.

It is anticipated that with AI, conditions could be spotted early on, enabling doctors to treat and stop their progression. The most prominent of all potential benefits of AI is speed. The earlier more symptoms are recognized, diseases are caught and accurately diagnosed, the easier and cheaper they are to treat. This leads to better outcomes for patients and longer life spans.

REDUCING COSTS & TIME

Additionally, AI could assist emergency triage by delegating degrees of urgency to patients to help prioritise the order in which they receive treatment. Some private primary care providers have already produced online processes that draw on AI algorithms. Patients record their symptoms and are guided either towards self-care, their GP, an out-of-hours clinic or A&E. These are generally more specific than non-AI search engines, as the latter tend to be overly risk-averse and can unnecessarily drive people to the wrong health care system.

Another way in which AI could improve the control of accessible resources is through automating basic tasks and freeing up administrative time, which is likely to be organised more efficiently by a computer. As these schedules need flexibility, an AI program could better accommodate regular breaks and travel between wards, potentially reducing waiting times and improving the overall atmosphere of a hospital.

How can the current problems in healthcare be minimised using AI and technology?

In Japan, robots maintaining AI are being used to care for the elderly.⁷ They aim to diminish the burden on nursing staff and promote autonomy of patients living at home. The cost and mind-set that only people can operate at the frontline of caregiving have slowed down the influx of these new technologies.

CHALLENGES FACING AI

Like any new technology, the trials of AI entering the healthcare industry are real. The medical community watches with a certain wariness, as doctors have spent decades developing universally accepted checklists and procedures, meticulously created to keep patients safe. There is a concern that AI would not recognise the value of these systems, or circumvent them altogether.

Likewise, there is also the subject of data security. Patient privacy and confidentiality have long been an area of concern, but as AI progression calls for the sharing of more data, despite the lives it may save, many are concerned that the data would be susceptible to cyberattacks. The elemental challenge of AI appears to be combining new technologies into current safety and privacy protocols.

Additionally, in *Deep Medicine*,⁸ Dr Eric Topol argues that medicine, as practised today, is “shallow” rather than deep, referring to the need of more meaningful encounters between clinician and patient, rather than a cruelly short consultation. To get to a world of “deep medicine,” Topol argues that artificial intelligence will play a crucial role.

⁷ Hurst, D. (2018) *Japan lays groundwork for boom in robot carers*. [online] Available at: <https://www.theguardian.com/world/2018/feb/06/japan-robots-will-care-for-80-of-elderly-by-2020> [Accessed 27th December 2019]

⁸ Topol, E. (2019) *Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again*. First Edition.

How can the current problems in healthcare be minimised using AI and technology?

A Mayo Clinic study found that only 12% of second opinions from the clinic agreed with the original diagnosis.⁹ Some of these mistakes may be because clinicians are overworked and have limited time to study particular cases, as Topol notes, there are over 10,000 different diseases and not even the best doctor “could recall a fraction of them.”

One of the most interesting applications of AI is as personal medical assistants. With wearables like the AppleWatch and FitBit becoming popular, individuals are able to collect real-time health information. Combining this with medical records can mean that AI-enabled assistants can give advice, including being virtual real-time health coaches, with hopes of decreasing obesity rates and therefore minimizing risks of cancers and other diseases. This would benefit healthcare systems as they do not have to spend extra money treating illnesses as individuals can be targeted before their situation escalates into needing immediate medical attention. Topol is right to argue that people should have a right to all their health data in machine-readable forms.

CONCLUSION

Ultimately, AI can definitely minimise our current healthcare problems, but also has potential to transform medicine by enhancing patient care and accelerating medical research. However, this new technology will need to win over all stakeholders, including the government, healthcare experts and the general public before it can be integrated into the NHS. The technology industry pushes back at any claims of entirely superseding the human side of medicine, arguing that AI should complement, not substitute, a doctor’s human skill and touch.

⁹ Mayo Clinic (2017) *The value of second opinions demonstrated in study*. [online] Available at: <https://www.sciencedaily.com/releases/2017/04/170404084442.htm> [Accessed 27th December 2019]

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