

ELEC0139

Final Blog Submission

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Abstract

This report contains the PDF version of the final blog. The chosen domain was Healthcare. It can be verified that the total word count of the blog is 940 Words. The online version hosted on a website can be seen by clicking [HERE](#) or using this link : <https://ucl-elec0139-blog.netlify.app>

Part 1 of the Blog

Evolution of AI from Theory to Reality

In the 1950s, Alan Turing had posed his famous question “Can Machines Think?”. Back then, he considered the question to be vague & ambiguous and instead proposed the Turing Test as a way to measure the intelligence of machines [1]. It had human evaluators judge conversation transcripts between a machine and a human and identify which was the machine. Seven decades later, we are closer than ever to hitting this benchmark with the latest large language models (LLMs) like GPT o4, Deepseek R1 easily passing the Turing Test [2]. They are capable of complex thought & reasoning, fluent dialogue, and even image generation. AI/ML models have been theorized for and even implemented such as the M.P. neuron or the Perceptron for over half a century. From these theoretical concepts, it has evolved massively with the potential to be embedded in all aspects of modern life as seen below.

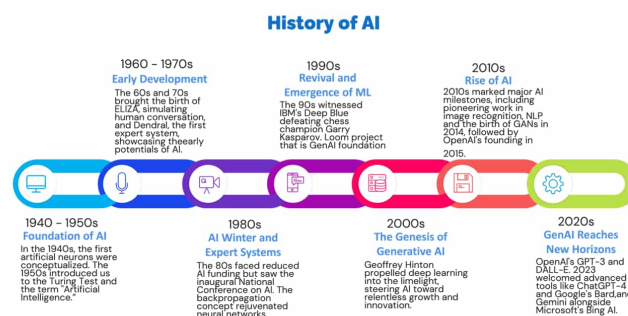


Figure 3. Chronicles of AI: From Turing’s Test to Today’s Tech Titans

Figure 1: History of AI

While its capabilities are real and growing, so is the hype surrounding it with many arguing that we are currently in an AI bubble where companies are adding AI features that weren’t even asked for such as smart AI enabled toothbrushes or another AI startup whose entire business model is just a wrapper around ChatGPT. But while gimmicky AI products dominate headlines, the healthcare sector shows where AI might actually be revolutionary, benefitting significantly from recent advancements in AI.

The Global Healthcare Crisis

Currently, healthcare systems around the world are in unprecedented strain due to multiple challenges. One of the main issues is the growing gap between patient demand and availability of medical facilities. The World Health Organisation (WHO) estimates a shortage of 10 million health sector workers by 2030, with it disproportionately affecting low and middle income countries [3] (as seen in this map below made by the WHO). Even in developed countries like the UK, the National Health Service (NHS) is currently facing a record backlog with millions of patients still awaiting treatment with delays in surgery, appointments and even diagnostics [4] as seen in this graph.

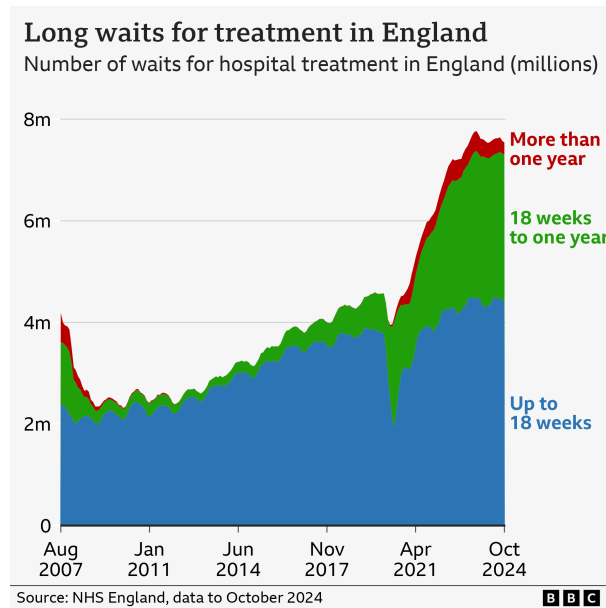


Figure 2: NHS Backlog

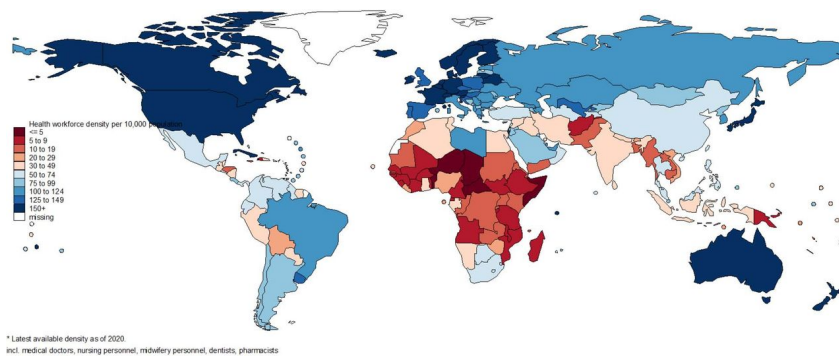


Figure 3: WHO map showing current density of healthcare workers

The issue is made even worse due to aging populations in developed countries and negative population growth (as seen in this figure of Italy's pop. pyramid), growth in life expectancy has led to issues like diabetes, cancer and heart disease more common. The demographic issues put extra pressure on a system that's already stretched thin. Healthcare worker burnout has reached critical levels made worse by the Covid-19 pandemic [5]. Studies have shown that higher levels of stress & fatigue among medical workers have caused lower productivity and increased medical errors.

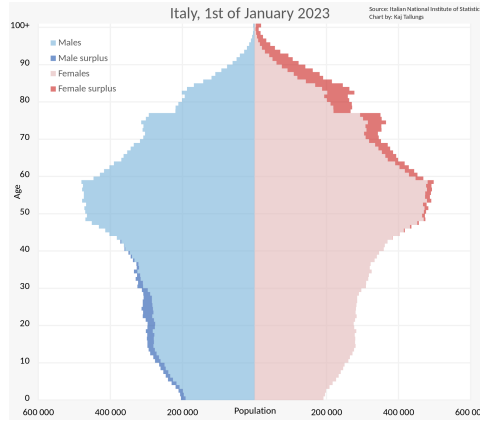


Figure 4: Population Pyramid of Italy (2023)

Another major issue facing the sector is inefficiencies in the healthcare delivery process. Manual documentation and using outdated systems often lead to poor coordination leading to misdiagnosis and delayed treatment. Studies have shown that this affects 1 in 20 patients in the USA, a figure that is extremely high when considering the exorbitant costs of healthcare in the country [6]. Access to healthcare is also another issue. Rural areas offer suffer from limited access to specialist staff, testing equipment, or even having no hospitals itself. Medical problems deemed less important like mental health services are usually underfunded and understaffed in such rural areas [7].

How AI/ML can Increase Accuracy/Efficiency and Improve Access

AI and ML techniques can offer a viable and much needed augmentation to the entire domain. Advancements in computer vision and deep learning have created previously unimaginable diagnostic capabilities. Studies have shown that AI based systems utilizing computer vision can match or even outperform expert radiologists in tasks like detecting pneumonia from chest X-rays or even identifying early signs of cardiovascular disease. DeepMind by Google developed an AI model that outperformed human specialists in breast cancer detection from mammograms. There are already startups like Viz.ai and Aidoc [8], that help hospitals integrate AI image analysis tools into their workflow. Furthermore, AI systems can also analyze patient records and real-time health data to create personal treatment plans unique to each patient. It has the potential to dramatically expand access to healthcare in lower resource regions of the world, supporting healthcare workers by automating triage and reducing burden on the already over-worked staff.



Figure 5: Futuristic AI integration in pediatric healthcare

AI chatbots and virtual assistants have already been deployed by the NHS (North West London NHS Trust) during the Covid-19 global pandemic which is a real example of AI expanding access to healthcare and reducing the burden on healthcare staff. The chatbots were available 24/7, offer basic advice regarding symptoms, triage non-emergency queries and even followed up previous messages like a human conversation. This automation helped reduce the burden on clinical staff and freed up doctors to focus on more complex cases [9]. Early preventative care is another area where AI shows significant potential. ML models can identify patients at risk well in advance of traditional screening methods by analysing data such as lifestyle choices, genetic data and health records. By having earlier interventions, such systems can reduce hospital visits which lowers healthcare costs and can save lives. The integration of AI with wearable health devices like fitness trackers, is further reshaping the healthcare landscape. They allow patients to monitor various vital health metrics themselves without needing to visit clinics.

However, the integration of AI into healthcare comes with its own issues regarding bias, ethical concerns, lack of transparency, and questions of accountability. Thus, it is essential that fairness, trust and safety are prioritized considering healthcare is a field where accuracy and speed could be the difference between recovery and death. The next section of the blog will cover how different AI/ML technologies address the aforementioned challenges in the healthcare domain in much more detail and is complemented with a brief description of such ML/AI technologies.

Part 2 of the Blog

Part 3 of the Blog

References

- [1] A. M. Turing, “Computing machinery and intelligence,” *Mind*, vol. 59, no. 236, pp. 433–460, 1950.
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