

Accelerating Adoption of Artificial Intelligence in Healthcare

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ABSTRACT

Artificial intelligence (AI) has entered the popular mind for the past few years. Unlike many technical buzzwords, AI has stronger staying power. There has been a spurt in employing AI in many fields like aviation, package delivery to homes, stock trading, media, music, video games, telecom, and many others. However, the field of health has seen limited permeation, especially given its huge size.

It should be noted that some branches in healthcare do have strong AI usage like robotic surgery, computer-aided diagnosis, clinical decision support systems, eye scan analysis, but they are limited to advanced institutions and highly trained doctors. AI can truly revolutionize healthcare when applications employing it can be used at the grassroots level. For medical practitioners, uninitiated in AI technologies, it could be hard to visualize the kind of problems AI can solve in their professional field. Several examples are also provided where healthcare could leverage AI for the benefit of the masses. For a couple of examples, more details to the problem and a corresponding AI based solution are also provided. Several barriers to AI adoption are also presented followed by a conclusion which suggests a simple strategy to boost AI adoption.

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Artificial intelligence (AI) has entered the popular mind for the past few years. Unlike many technical buzzwords, AI has stronger staying power. Although concepts like AI-powered robots developing consciousness and subsequently subduing humans is a bit far fetched, AI offers many effective solutions for today, like self-driving cars, smart traffic lights, military, automated customer service, etc.

The field of AI was effectively established in 1956 at a workshop in Dartmouth College, New Hampshire, USA. The 60+ years since then have seen explosive growth with an also intermittent lull in enthusiasm

(called 'AI winter'). Presently, AI is firmly established with, according to a survey,¹ 1 in 5 companies reported they have incorporated AI in one or more of their offerings and processes.

Very close to AI is the field of data science² which is frequently equated with statistics. Data science has become immensely popular in the past decade to the extent that data scientist is one of most sought after job title in Silicon Valley. It comprises many sophisticated techniques to slice and dice data, the past history, from several viewpoints. Which events happened, what was the information associated with them? What was the outcome? What patterns can be derived from the past data?

Using AI does not necessarily mean employing high powered robots to do complex maneuvers like self-driving cars. Applications as small as a word suggestion utility which automatically learns common words in your vocabulary, as you type text in an application, also effectively leverage AI. Such an application can save a lot of time for a doctor writing prescriptions or ordering lab tests.

Although there has been a spurt in employing AI in many fields like aviation, package delivery to homes, stock trading, media, music, video games, telecom, the field of health has seen limited permeation, especially given its huge size. It should be noted that some branches in healthcare do have strong AI usage like robotic surgery, computer-aided diagnosis,³ clinical decision support systems, eye scan analysis, but they are limited to advanced institutions and highly trained doctors. AI can truly revolutionize HealthCare when applications employing it can be used at the grassroots level. Unless the reader is quite familiar with AI, it could be hard to visualize the kind of problems AI can solve in their professional field.

Several examples related to the healthcare are provided below where AI can help make better decisions by understanding the past data. For the first two examples, more details to the problem and an AI-based solution are also provided. A more technical review of applications of Artificial Intelligence in healthcare can be found here.⁴

Example Problems

(a) Help Doctors and Health Workers in Periphery or Remote Regions to Diagnose Complex Diseases

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Problem

- Patients exist everywhere, but specialist doctors do not. This is especially true for the far-flung regions of the country, hilly areas, tribal regions, remote villages.
- Well-equipped hospitals might be hundreds of kilometers away from them, and it may take several hours to travel that distance
- Proper diagnosis becomes very critical in such area as the wrong diagnosis could either cost a life or be economically very expensive for the patient and her attendants.

AI-based Solution

- Past patient's history, symptoms, and the confirmed diagnosis provide a rich source of information. Such tuples of history, symptoms and the diagnosis form a dataset. The datasets can be created for a specific disease or cover an entire specialty. Once prepared, a dataset can be divided into two parts: training dataset and testing dataset, in, lets say, 90% and 10% proportions, respectively. The training dataset can be used to learn a predictive model. Such a model can predict a patient's diagnosis given a patient's history and the symptoms. The model can also predict differential diagnosis with corresponding probability or confidence score. The accuracy of the model can be tested over the testing dataset.
- Few iterations would be needed to fine tune the model. There are many techniques to do so, but they are quite technical and should be covered in a separate article.
- Such a model can help a health worker diagnose a disease even in the absence of a specialist doctor. The model can be consulted via an App in any standard smartphone.
- The datasets explained above can be created at the region, state, and country levels.
- While training classifier for a specific disease, data of patients with other diseases can be mixed along with the specific disease to get more robustness.
- Such classifiers can be trained for several diseases separately
- Classifiers for several diseases can be kept in a single mobile app
- The mobile app can remain connected with a nearby designated Tertiary Care Hospital to provide expert intervention if needed.

There are several popular examples where AI offers competitive diagnosis capabilities compared to doctors, for example, heart disease and lung cancer, Alzheimer's Disease.

- (b) Decongest Tertiary Care Hospitals by helping back-referral of stabilized patients to hospitals near their residence

Problem

- Frequently, a patient after getting a major surgery at a Tertiary Care Hospital needs to recuperate in the hospital for some time before she can be discharged to her home.
- However, in such cases, the patient does not need to stay in the Tertiary Care Hospital as her situation is stable and can be handled in a secondary care hospital
- Additionally, patients' attendants to feel a bit confused as to stay with the patient or intermittently join their job. This becomes more problematic when the Tertiary Care is far away from the residence of the patient (and attendants)
- It is better to shift the patient to a hospital near her home which can provide her with the services which need while she recuperates.

AI-based Solution

- When a patient is ready for a non-routine discharge from, his residence area can be input to the AI based back referral system. all hospitals near patient's residence can be automatically searched and shown.
 - Past back referrals to the region can be consulted by the AI-based algorithm to put forward recommendations.
 - The hospitals can be filtered based on any criteria the patient/doctors/staff feel necessary.
 - After filtering hospitals, a query (standard or customized) can be sent to all qualifying hospitals. The query may be about bed availability or any desired infrastructure
 - Chat/phone/video-call communications can be opened up with the representatives of the qualifying hospitals
 - The patient can also be brought in the loop for any special query/need.
 - Upon discussion, one of the qualifying hospitals can be selected to send the patient to
 - After the patient discharge, follow up questions can be asked by a ChatBot to ensure proper treatment of the patient and provide suggestions (or loop in a doctor) if further help is needed.
3. Connect an ambulance carrying a serious patient to several hospitals quickly and find the nearest best option and open communication channels with them. A Hospital once selected would be able to provide any directions to the ambulance staff in case a patient needs immediate assistance.

- Analyze past patient data from geographical and symptom dimensions and recommend local healthcare options. Data collected over the patients traveling for treatment can provide suggestions to future patients
- Automatic and regular monitoring of facilities in existing Healthcare Centres to detect gaps, for example, a faulty CT Scan machine may be causing more referrals than normal from a secondary healthcare center
- Trend detection to quickly detect epidemics in a population
- Anomaly detection to audit regularly generated reports to detect fake data
- But still, the progress in this area is rather slow. Following reasons can be cited for this.

Barriers to Adoption of AI in Healthcare

Lack of Publicly Available Datasets

The world is getting smaller. Experts in one region can help solve problems in another. A significant ingredient to invoke AI to solve a problem is the dataset belonging to the underlying problem. Big institutions like PGI encounter tens of thousands of patients every day. Each day a huge amount of data is generated for even relatively rare diseases. Part of this data can be used to create publicly available datasets for AI developers to experiment their algorithms. Any information about a patient or healthcare staff can be anonymized before publicizing the dataset. Datasets can be created to request solutions to a specific problem. Datasets can also be made generally available for developer community or students to apply their creativity. A stunningly successful example of such a move was the Netflix prize.⁵ It developed huge participation by both students and professionals leading to vigorous and healthy competition. Many such datasets are available in the public domain, but Indian institutions still have to catch up with the West on making important datasets available to the developer/student community. Recently, the Indian government also initiated a move to share some of its data (<https://data.gov.in/>) to the underscoring public importance of sharing people's data with people.

Lack of Expertise

Artificial intelligence (AI) is a relatively new field, and local AI experts could be hard to come by. Local Healthcare stakeholders may want to have face-to-face discussion or brainstorming sessions. Regular seminars could be scheduled to invite faculty and students of local universities and colleges. Corporates and Startups working in the field of AI could also be invited to speak about their solutions and have brainstorming sessions over major problems faced locally.

Ambiguity as to Where to Start?

There are no clear avenues on where to start, who to contact, which specific problem to work on for any budding or seasoned AI expert. Approaching any Bureaucrat or Head of Department in a Hospital without proper introductions wastes lots of time and can also be fruitless.

Fear of Failure

This can be touted as one of the biggest barrier to not just AI but to any technology initiative or rather, any initiative. Healthcare deals with the lives of patients. This sobering consideration, rightly, gives way to a 'Safety First' approach. Controlled experimentation, however, should be generally kept out of this mindset. We can keep a very high threshold of success to solutions coming out of experiments. Given India's billion-plus aspiring population with per capita \$6,490 (as against \$15,500 of China), too much caution may damage our future prospects.

Feeling of Being Overburdened

There is a universal camaraderie in Healthcare workforce about being overburdened by regular work. This does seem true when we see the patient rush at most premier hospitals. However, being 24x 7 overburdened is unsustainable. If it is true, then we have all the more reason to look for optimizations in our daily work schedule. A consistently over-worked workforce naturally deals only with "today's problems" and poses a big risk to the Nation's tomorrow.

No Incentivization

There is no widely known clear Government strategy to incentivize advancements in AI to benefit HealthCare. Even at local levels, it is not easy to find incentives offered by institutions like PGI for contribution to research, especially technology. The decision makers and stakeholders need a clear incentivized process to be able to contribute innovations with vigor.

Limitations of Artificial Intelligence

It is also important to realize what AI cannot do. For all its technical prowess, AI cannot replace the human factor needed in taking the best care of the patient. The psychological comfort a patient gets while talking to a doctor and the medical staff is difficult for a machine to provide, if not impossible. Most AI applications exploit past data to find important patterns and help predict future decisions. Without some degree of involvement from researchers, the AI algorithms may not be able to solve the future problems.

CONCLUSION

India is in a very enviable position to kickstart a revolution in adopting AI to better its healthcare. Its huge population, with some world-class healthcare institutions, huge and thriving Techie diaspora in Silicon Valley are the very ingredients needed to create world-leading AI-based applications to benefit not just the billion plus Indians but the planet's whole population. India's premier healthcare institutions can lead the way by following a rather simple strategy:

- Regularly publish major problems faced by the Healthcare Institutions. For example, a department can describe the biggest problems they are facing in their daily operations on their official website
- Assign a reward to each problem and ignite competition. A monetary award or a certificate of accomplishment would attract many students to prove their mettle and improve skill set.
- Invite AI experts to have brainstorming sessions. Regular workshops or seminars where experts from the AI world meet healthcare experts would help them get on the same page and improve collaboration.
- Incentivize institution staff who move the needle. To ensure that the institution's staff actively participates

in AI-based problem solving, clear incentives like research grants should be made public.

With ever-increasing penetration of technology in our lives, we are generating more and more data. Artificial Intelligence has the power to put this data to good use and help our masses. We have all the tools at our disposal. Active discussions and persistent efforts can do wonders.

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