Technology Review

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Github fork: https://github.com/sab6486/tech_review

Startup/Top platforms Survey

"Identify leading startups that use AI in Medical Domain and also detail what sort of techniques already exist with respect to data science and use of text retrieval in the field of Medicine."

This decade will be remembered for humanity's efforts in dealing with a new infectious disease known as COVID-19. Through human history we have faced such pandemics that cause global health crisis and have often come out victorious mainly due to the efforts of thousands of doctors and scientists. This was made possible due to meticulous medical documentation. From the days of tribal doctors prescribing medicine on leaves with reed brushes to modern day electronic health care (EHR), electronic patient record (EPR) and hospital info systems (HIS) we have come a long way. The Healthcare industry is today overflowing with data in the form of doctor's notes, medical journals, EHRs, EPRs, clinical trials of vaccines, IOT data (e.g., FitBit, fitness apps), health Insurance data, social media etc. so much that leading scientists compare this to crude oil, saying that it is useless unless effort is put into refining it. Use of Artificial Intelligence and Data Science in the medical domain is expected to play a huge role in the future with respect to tuning unstructured data and this paper covers some of the existing techniques and upcoming startups in the industry.

While EHRs have vastly improved the day-to-day functioning (when compared to paper files) and are able to provide a certain level of insight into patient data it still needs manual intervention and the system is not potent enough to make its own decisions and predictions. This is where we need to leverage the power of AI and Data science which can bring in machine learning algorithms that can add the needed intelligence to improve some of the challenges medical staff face today. Natural Language Processing (NLP) coupled with text analytics are critical for converting this unstructured data into a regularized form for AI systems to consume.

Some use cases of AI in medical domain:

- **Rule Based Expert Systems:** This is a somewhat older technology but was useful in the 1980s and was used for clinical decisions based out of an if-then-else rule book. It is now being overwritten by ML algorithms.
- **Digital Scribes:** Can listen in on a conversation between a patient and their doctor, parse the text and fill in the relevant information into the EHR. All this is done as part of NLP.
- **Named Entity Recognition (NER):** Used to identify medical terms such as clinical procedures, drug names and dosages from chunks of text data to assist billing systems, prescription recommendation systems etc.

- **Knowledge Discovery:** Use of NLP to study scientific articles and social media events to discover new hypothesis. A 2018 study was able to correlate social media users with a high tendency of committing suicide or self-harm by observing use of certain emojis like 'broken heart emoji' etc. Sentiment analysis is another technique used to identify angry or sad tweets to determine a population's mental health.
- **Image recognition:** Machine Learning and Deep Learning algorithms using neural networks are particularly useful in early cancer detection. They are able to identify clinically relevant features which cannot be seen by the human eye thus providing higher accuracy.
- **Text Summarization and Classification:** Use of topic mining using EM algorithms such as PLSA/LDA to categorizing clinical notes and EHRs to classify the text content which saves time for medical professionals.
- **Comparison Algorithms:** used to list the likelihood of side effects with drug option 'XYZ' versus 'ABC' considering the patient's history and recommending alternatives similar to what Amazon does today for online shopping.
- **Identifying Contextual Information:** AI systems can study patient's own words from recordings and provide contextual information such as living conditions, patient's family, how they perceive their illness. This would previously be very invasive but now made possible with AI.
- **Administrative purposes:** Automation of lot of the mundane activities with respect to patient data. Also, improving the ergonomics of healthcare facilities and finding cost saving options which were previously not explored because there are certain permutations which the human mind may not make or certain insights pop up only when data is cleaned and structured.

Some AI based startups operating in the medical domain:

Saykara – Seatle, USA based startup founded in 2017 designed an iOS app named Kara that uses voice recognition to capture conversations between patients and their doctors and picks up only the relevant information from the session.

Beyond Verbal – Israeli startup company that uses a voice-based AI to extract emotion from speech to reveal vocal biomarkers to indicate signs of possible respiratory illness.

Subtle Medical – Company that use deep learning algorithms for early detection of cancer in women and men. They are now partnering with AWS and Google cloud to bring AI to major hospitals.

Babylon Health – startup based out of UK that pioneered way back in 2013 helps create face to face appointments with doctors via video call. During this ongoing pandemic people may find this facility very helpful.

Saliency AI – founded in 2020, this company helps the pharmaceutical industry in their R&D work by performing data labelling, unification etc. Of scientific data and clinical trials.

Quid – This startup was founded in 2010 and specializes in text analytics. It mainly deals with big data and creates insights on the information based off millions of documents.

Artelus – Based out of Bangalore, India this startup helps provide contactless screening for diabetic retinopathy. Their focus is to create early warning systems to prevent fatal diseases and ailments.

Aknamed – cloud and AI based startup that specializes in optimizing infrastructure of hospitals by providing ML tools that provide suggestions to improve the entire supply chain from procurement to consumption thus reducing areas of waste in terms of medicines, oxygen cylinders, room vacancy etc.

The list of AI startups is exhaustive and each of these companies are on the brink of something exciting. There are also the big players such as Microsoft Azure's healthcare services, IBM Watson, Google health studies etc. that partner with these startups. As it has always been the case when the big players get involved questions arise on the ethical implications such as accountability, transparency, permission and privacy.

A patient who has been informed that they have been diagnosed with a certain disease may want to know how or why the algorithm predicted it, or they may rather choose to have this message delivered to them by a caring human doctor rather than an AI based one. Healthcare workers may also be concerned that automation may replace them and take away jobs. Lastly, for these AI tools to be used efficiently they need to be regularized and standardized with government approval. This shows us that AI in medical domain is in its nascent stage and plenty of teething problems will occur, a lot of controversy to be dealt with in the future as we evolve to adopting these technologies but one thing is certain that there is no going back. The path for humans and AI based systems to move along side by side is laid out and only time will tell how we best use this to our advantage.

Github fork

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