International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182, Print ISSN: 2349-5979, Impact Factor: RJIF 5.72
www.allsubjectjournal.com
Volume 4; Issue 4; April 2017; Page No. 34-39

A study on the perception of medical professionals towards artificial intelligence

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Abstract
The research paper attempts to understand the acceptance, application and future prospects of Artificial Intelligence (AI) in reference to the field of medicine. The paper gives an overview of application of Artificial Intelligence in the current scenario.
The current study includes dentists, cardiologists, surgeons and ophthalmologists. The sample size for the study is 73 doctors from Ahmadabad, Surat, Baroda, Rajsamand (Rajasthan).Personal and telephonic interviews are undertaken to understand the awareness and perception of the respondents towards artificial intelligence.
Most of the respondents are aware about artificial intelligence interventions in their field and some of them are already using certain using it. Nevertheless, though the doctors are in agreement with the relevance and advantages of AI, the also perceive certain disadvantages in terms of high cost and lack of human touch. But the technologies approaching from this field may profoundly transform the society for better in the coming decades.

Keywords: artificial intelligence, medical field, autonomous vs. human driven AI

1. Introduction
The rapid technological advancements are changing the way we do things every day. The machines getting smarter and more useful and there's no denying the fact that machines are expected to outperform humans in almost all the aspects. With Artificial Intelligence (AI), computers have become exponentially better in understanding the world.

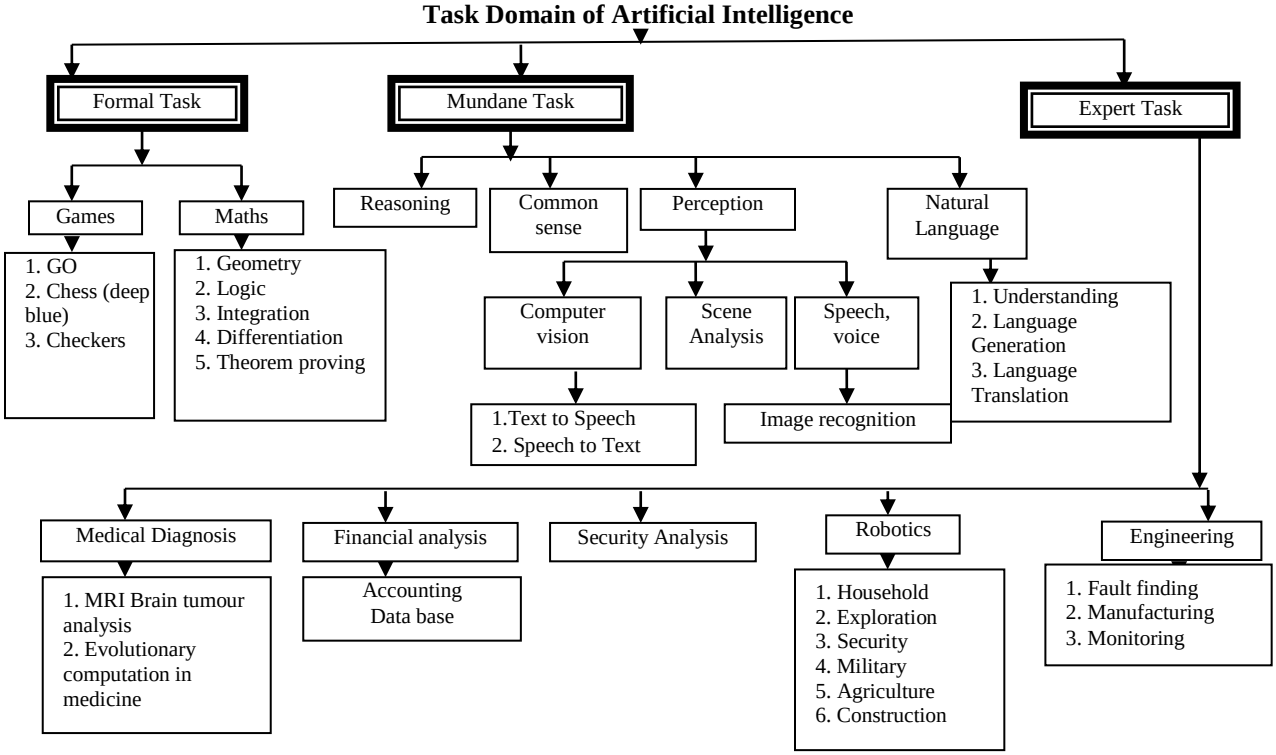
Artificial Intelligence refers to branch of human science that is concerned with the automation of intelligence behaviour. It may include activities associated with human thinking, activities such as decision-making, problem solving, learning etc. (Bellman, 1978) [2].

According to (Norvig & Russell, 2009) [18] Artificial Intelligence can be classified into four categories namely:

1. System that thinks like humans.
2. System that acts like human.
3. System that think rationally.
4. System that acts rationally.

Artificial intelligence can also be classified into narrow AI and general AI. Narrow AI (or weak AI) is designed to perform narrow task such as internet searches, facial recognition, driving car etc. However, the long-term goal is to create general AI (or strong AI) (Lewis, 2016) [13]. Thus, narrow AI may be able to perform specific tasks like playing chess or equation solving and even outperform humans in these tasks while general AI would be able to outperform humans at almost every cognitive task.

Artificial Intelligence has a wide application in almost all the possible fields. It is currently used to solve the complex problems in the field of science, engineering, data analysis, business, medicine, etc. The areas employing the technology of Artificial Intelligence have seen an increase both in the quality and efficiency. The following chart elaborates on the different task domains of artificial intelligence as well as the prominent areas where AI has penetrated like medical analysis, financial analysis, security analysis, robotics and engineering. The list is not comprehensive, it only represents the prominent application areas of artificial intelligence.



***Source*:** https://www.tutorialspoint.com/artificial_intelligence/artificial_intelligence_research_areas.htm

Fig 1: Classification of AI domains (Artificial Intelligence - Research Areas)

The researchers have attempted to understand the impact of artificial intelligence on different fields. Woolf *et al* (2009) [25] conducted a study on the importance of AI in education involving AI instructional systems that support rich experiences for researchers and learners as well as personalised learning combined with computational tools that enhance students' learning experience. Some of the challenges identified for AI in education include virtual mentors for every learner, addressing 21st century skills, analysis of interaction data, provide opportunities for global classrooms and lifelong and life wide technologies (Kurshan, 2016) [12].

Artificial intelligence is widely prevalent in the field of gaming. Many Chess playing programs have been developed through AI techniques like Deep Blue by IBM. This was even able to defeat Garry Kasparov, the world chess champion (Swearingen, 2016) [24]. AI is dominating even the Grand Masters, and that isn't the fullest potential of AI. IBM Watson, a computer system has beaten Jeopardy Champs (Herkewitz, 2014) [9] and Google's AlphaGO, a deep neural network which defeated GO master (GO is a game which is much more complex than Chess) mark major milestone in AI development (Bennett, 2016) [3].

For household purposes, vacuum cleaning robots at homes are the live applications of AI. Also, Amazon Echo, based on cloud-based voice service, can interact and respond to any question or command (Nuñez, 2015) [19].

Healthcare domain of AI is unquestionably of great importance where AI applications can improve health outcomes for the patients as well as efficiency for the providers. *"Healthcare is one of the highest cost areas for all modern economies, which makes it ripe for AI as providers look for efficiency to care for patients," says Dan Housman, chief technology officer at Converge Health by Deloitte.* Healthcare is a complex industry and requires vast volumes of data from imaging, genomics, sensors, daily care and scientific research for decision making and appropriate actions. *"AI can generate insights from data that people can't easily do, so again it makes healthcare a good fit for the technology."* (Buckland, 2016) [5].

Artificial Intelligence in medical field can be defined as *branch of computer science capable of analysing complex medical data. It's potential to exploit meaningful relationship with in a data set which can be used in the diagnosis, treatment and predicting outcome in many clinical scenarios.* (Ramesh, Kambhampati, Monson, & Drew, 2004) [21].

Various researchers have elaborated on the benefits of AI in the medical field. Moustakis & Charissis (1999) [17] surveyed about the role of Machine Learning in medical field. The extensive paper on various Machine Learning applications in medical field helped the doctors who want to apply methods of machine learning in order to improve the quality and efficiency of medical decision making systems. The main stress point in this work was the issues of comprehensibility, which tells about the understanding of medical expert and the use of the results from a system that applies machine learning techniques.

Another branch of AI techniques is Fuzzy logic. It is a reasoning method that resembles human reasoning. Fuzzy relational inference was applied by Meng (1996) [15] in medical diagnosis. It was used within Clinaid, a medical knowledge system which deals with treatment, diagnostic activity, recommendations and patient's administration.

AI techniques in medicine summarized by Hoong (1988) [10] are as follows:

- Integrates activities in medical and other sciences.
- Produces new tools to support medical decision making, training and research.

- Offers a content-rich discipline for future scientific medical speciality.
- Provides a lab for the examination, organisation, representation and cataloguing of medical knowledge.

Partridge *et al* (1996) [20] listed several potential of Neural Networks over conventional computation and manual analysis:

- Automated real-time diagnosis and analysis.
- Rapid input data identification and classification.
- Eliminates error linked with human fatigue and habituation.
- Based on past data and trend recognition, prediction of future indicator values.

Artificial intelligence of Experienced Based Medical Diagnosis System is an interactive medical diagnostic system accessible through the Internet which can help the new doctors as well as patients in decision making (Manickam & Abidi, 1999) [14]. Case Based Reasoning (CBR) is employed to utilise the specific knowledge of previously experienced and concrete problems and cases. The system can be used by patients to diagnose themselves without having to make frequent visit to doctors to extend their knowledge in domain cases (breast cancer).

In order to obtain the best available medical evidence, practitioners require Evidence-based medicine practice. They also require this while improving the quality of the evidence i.e. when making clinical decisions. The manual appraisal of the quality of evidence becomes a time-consuming process, because of the plethora of electronically available data from the medical literature. Abeed Sarkar *et al* (2015) [23] presented a fully automatic approach which predicts the quality of medical evidence that can aid practitioners at point-of-care with the use of a highly scalable and portable approach using a sequence of high precision classifiers, and introduced average error distance (AED), a simple evaluation metric system.

There is a list of Successful robotic systems and tons of researches have been conducted involving the number of surgery types and the application of each robotic system. Few of these researches are:

1. Morgan (2010) [16] – Pathfinder (Prosurgics, formely Armstrong Healthcare Ltd.)
2. Joskowicz (2011) [11] – Renaissance (Spine Surgery, Mazor Robotics)
3. Halperin *et al* (2004) [8] – AutoPulse Plus (ZOLL Medical Corp.)
4. D'Attellis *et al*. (2002) [6] – DAVINCI and the ZEUS Robotic Surgical System (Evolution of AESOP Robot)

Artificial intelligence in the medical field is becoming inevitable. As a technologically growing society, it is only a matter of time when artificial intelligence will be the standard of health care. Right now, some physicians are in agreement that AI can bring a change in medicine, while other doctors are unwilling to change. One thing is sure, whether or not physicians modify the way in which they practice, the future of medicine is shifting, and it will involve more use of artificial intelligence (RxTap, 2016) [22].

Technology is evolving very day and new inventions in the medical field keep popping around the world. The objective of integrating technology and healthcare together is to serve the population in a better way. But healthcare is a crucial and sensitive field, hence rules and regulations should be defined and many trials must be conducted before the actual application any artificial intelligence. This process may be tedious, but it is imperative so that the optimum utilization of the technology can be implemented in healthcare to find out medical conditions, symptoms as well as cure. New systems of data surveillance need to developed and implemented in order to predict future health related problems and events.

Though the technology intervention has depicted some incredible improvements in the healthcare, but there is controversy when determining if this is the right way medicine should precede because of certain concerns like violation of privacy of patients, unaffordability, misuse or improper use etc. Also, too much technological progress is responsible for unemployment (Brynjolfsson & McAfee, 2014) [4]. The main drawback of AI is that it lacks human touch; in a world of AI there is no such thing like working with passion or with a whole heart. Even in the area of creative thinking or originality, robots lack creative mind. Machines can't feel and think the way like human beings do, along with the lack of intuitive abilities which humans possess.

Artificial intelligence, like most of the technologies holds its own set of advantages and disadvantages. It is believed to be disrupting force for future of several domains including healthcare. Before employing it for human convenience, the benefits must be carefully weighed against the risks it holds.

2. Objectives of study

1. To study the awareness about Artificial Intelligence among medical professionals
2. To understand the acceptance and perception of the doctors towards Artificial Intelligence in their field

The sample consists of 20 dentists, 20 ophthalmologists, 18 cardiologists and 15surgeons leading to a total sample size of 73 respondents. The data is primarily collected by the means of semi structured Interview technique including telephonic interview as well as face-to-face interviews. Combination of convenience and snowball sampling is used to approach the doctors in the cities of Ahmadabad, Surat, Baroda, Rajsamand (Rajasthan) for data collection. Many doctors were reluctant to be interviewed due to lack to interest and time.

3. Data analysis

3.1 Dentist

Among the 20 dentists contacted, 16 are well aware about artificial intelligence techniques in their field, in general and 60% of them have used atleast some of those technologies. The most commonly used AI technique in the field of dentistry emerging out of this study are Apex locater in RCT, CAD-CAM for crown and bridge and they even use sensor to create impression send the impression to create the cap, Computer software database.

In reference to the type of AI, 60% of the dentists prefer AI to be human-driven while others want it to be autonomous. One of the dentists commented, "I would prefer AI to be more autonomous and independent but there are certain conditions which it need to be fulfilled. Firstly, it should have been carefully tested before introducing the machine to the medical field. Secondly, this type of AI is a little far-fetched, so India needs to wait before strong AI comes in to picture."

Advantages of AI in Dentistry as per the respondents are precision, reliability and simplification of work. It brings to notice minute details which may be unknowingly ignored by human. With the ability to quickly look out for medical history

it helps in faster and better diagnosis of the patient as well as better treatment management. The precision of AI, makes the gap formation and gap creation easy during dental treatment.

Some disadvantages on the other hand as suggested by the respondents include the necessity of technical expertise and appropriate knowledge for using AI. The wrong data entry otherwise will produce inaccurate results which in turn may lead to serious issues if the wrong treatment is prescribed based on that. AI also lacks emotional touch and is too expensive for every dentist to afford it. It may not understand the certain aspects of the treatment carried out with the foresight of future problems like purposely creating gaps just to ensure no cavity problem during root canal. In addition to the initial investment cost, in case of breakdown of machine it is very costly to get it repaired. Also currently the repair centres are not easily available. Moreover, a small defect in machine or a small detection error made by the machine can cause a huge loss to the patient so it is difficult to completely rely on AI because for the same problem as well, the treatment may differ from person to person.

One of the dentists said, "I will prefer AI and I will adopt it, only when it comes to a point of understanding human pain".

Commenting on the future prospects of AI after 10-15 years from now, most of the dentists think Artificial Intelligence would be used more widely due to decrease in price by that time. There will be a concentrated effort in the designing and fabrication of bio-ceramic compounds which can replace human enamel and Intra –oral computer technology which can help to take pictures in real-time and computer programs such as Clinical decision support systems (CDSS) that provide expert support to health professionals. Information technology applications for dental practice will develop rapidly and hopefully will contribute to reduce mortality of oral and maxillofacial diseases and in turn impact patient care. Digital Dentistry – the digital revolution that is transforming every aspect of our world is also impacting dentistry and medicine in a multitude of ways, from data analysis and electronic record-keeping to new diagnostic tools, novel prevention methods—and revolutionary treatment options.

New breakthroughs are creating "biomaterials" to fill cavities, like the synthetic biomaterial that could essentially allow a cavity to heal itself, a development with the potential to greatly reduce tooth deterioration that leads to expensive, painful root canals. Earlier detection of oral cancer—the sixth deadliest form of cancer—is now possible but not yet in India. The "VELscope" device uses CSI-style blue lights to pick up tissue changes that can't be seen with the naked eye, highlighting potential problems.

A more futuristic outlook could include nanobots (Gray, 2015) [7]. Some of these microscopic machines might restore or straighten teeth, deliver anaesthesia during oral surgery, diagnose diabetes and other diseases, or treat oral cancer. Others may fight bacteria which are made of antimicrobial carbon nanotubes. But nanotech research is complex, and these developments lie far in the future, as human clinical trials would be necessary to determine both efficacy and safety.

3.2 Ophthalmologist

All the 20 ophthalmologists are aware about AI techniques as well as its types in their field. They view AI positively and hence willingly shared their insights about AI in ophthalmology during the interview. The AI technique frequently used by them are of two types diagnostic and therapeutic comprising of laser of all kinds, Phacoemulsification, Femto-Lasik, ophthalmic diagnostic instruments, slit lamp, optical biometry, ophthalmic perimeter, auto-refractometer, spectacle correction machine, corneal topography, lasik operation tools, optic laser, sonography, cataract related surgery tools and many other softwares.

One of the opthalmologist commented, "We are very much at par with US technology or other countries when it comes to ophthalmology and if any new machine is introduced, then we are notified about it. This field is quite different from the other medical fields in terms of AI."

Advantages of AI in Ophthalmology mentioned by the respondents are increased accuracy & specificity for the correction and cutting perspective and time-efficiency. Lasik-operations are successfully used to treat short sightedness and long sightedness. AI helps in verifying the human generated reports for the measurement of visual acuity to minimize the error. In case of ophthalmology AI is already dominating the sector as all the ophthalmologist relies on AI.

Disadvantages of AI in this field are related to excessive dependence on machines and occasional wrong interpretation of data in case of lack of knowledge of ophthalmologists. One of the Ophthalmologist stated, "Machines will always lack emotional touch, they can't understand the pain of the patient which he/she feels during the operation". Cost factor is also significant as the machines are high–tech and most of them are imported for which ophthalmologists have to pay in dollars. Due to huge dependence on machine, break-down of machines bring things to halt. Requirement of regular upgradation increases the cost further on regular basis.

The future of ophthalmology in India seems to be quite encouraging as the cost is expected to decrease gradually with the widespread use by doctors. Artificial Intelligence is expected to bring a revolution where doctors may examine the patients' eye without touching the eye, simply by seeing a 3D created version of the eye or a dissection version of the patient's eye on the screen of their laptops or television. Though the exact nature of future ophthalmology is unpredictable, it is expected to resolve many current problems of the field like a machine to detect retinal disease and solution for RP and Dry Macular Degeneration. Also, a 3D-imagery for cataract, 3D Visualisation system and Retinal Imaging are expected to become faster and more accurate.

3.3 Surgeons

Among the 15 Surgeons contacted, 11 Surgeons are aware about AI in general whereas 66% of the surgeons claim to have used AI in their profession. Artificial Intelligence used in the field of surgery are Acrobot Precision Surgical system, Neuroarm, Medtronic stealth station, X-ray, computerized tomography (CT), magnetic resonance imaging (MRI), and ultrasound. Acrobot machine helps in improving speed, accuracy and reproducibility of joint replacement, ensuring maximum benefits for the surgeon and the patient. It also provides precision surgical systems for computer-assisted 3D planning, surgical navigation and surgeon-controlled AI surgery.

Among all the respondent 66% surgeons feels it is worth the value for money and have a positive opinion about it. 40% of the respondents prefer autonomous AI whereas others would

opt for human-driven AI. The ones who opted for autonomous AI believe that it can lessen the work load of surgeons, as they require lesser supervision and deliver greater accuracy. The advocates of human-driven AI believe that it is dangerous for AI to operate autonomously.

Advantages of AI as per the respondents are greater precision and visualization for surgeons and shorter hospitalisation, minimal blood loss, reduced risk of infection, faster recoveries and additional cosmetic benefits (e.g. no big scars) for patients

Disadvantages as suggested by the respondents include lack of existing effective tools in India, some issues with latency and high cost due leading to lesser use of certain technologies. One of the surgeons said, "Whether it is surgery or in any other medical field, AI is important and is going to create a major impact in medical science, boosting the growth as well as alleviating the pain, financial burden and other such issues of a patient which he/she undergoes during the surgery."

Indian Surgeons are eagerly waiting for breakthrough technology which is Surgical Robots like Da Vinci Surgical Robot, the Smart Tissue Autonomous Robot (STAR) which can do better surgeries than human surgeons and many other surgical robots.

From overall analysis, surgeons are personally interested in incorporating three types of AI into surgical procedures: **(a)** An AI which can store medical information more than any single human can store and also give responses to queries from surgeons, in short like an intelligent surgical assistant (eg.IBM Watson), **(b)** Machine learning algorithms which would aid doctors in recognizing a particular disease by running a sequence of systems. **(c)** AI machines which can simply learn new patterns by teaching itself and which tests new strategies to tackle a problem (Like Alpha Go).

One of the respondents stated, "There are around 30 hospitals in India which have employed surgical robots that perform urological, cardiovascular, thoracic, bariatric and other such surgeries. We are yet to see these robots operate a full-scale surgery, but there is a lot happening and India has a lot to catch up to. We are optimistically looking for such surgical robots to prevail in almost all the hospitals in the distant future."

3.4 Cardiologist

All the 18 cardiologists surveyed, are aware about AI in general, and most of them have used it in their field. Artificial Intelligence machines suggested by Cardiologists under study mainly include Ekg machine, Echocardiogram, machine for Cardiac catheterization, Holter monitors and Vascular ultrasound. Ekg machine is used to measure electrical activity of the heart. Echocardiogram is used to get the images of the heart. It helps in understanding the status of the heart in a better way. Holter monitors are used to diagnose serious issues like arrhythmias. Vascular ultrasound helps to check for the presence of plaque in the arteries that may increase the risk of stroke.

The respondents are very positive about growth of AI in their field and are willing to learn more about it. AI is worth the value for money according to 16 respondents and 81% preferred autonomous AI. The finding is particularly interesting because the proportion of doctors preferring autonomous AI is highest in the field of cardiology. In this reference one of the respondents commented that "autonomous robots are quite made for cardiology and even if it is human-driven it makes AI, part-AI and part-human. Another respondent said, "If automobile industry can have driverless cars, then why can't we have autonomous robots?"

Advantages of AI in cardiology apart from being fast, accurate and time-efficient, is reduced bleeding during the heart surgery, along with lesser chances of infection and the most importantly shorter recovery time and hospital stays.

Cardiologists like other doctors are equivocal about the cost disadvantage of AI. At this early stage in the technology, the robotic systems are very expensive. Although on the one hand, with the technology advancement and more experience gained by cardiologist the cost is expected to decrease whereas others believe that with improvement in technology, the systems will become more complicated and the costs will rise. Only when these systems will gain more widespread multidisciplinary us, the costs will become more justified.

Other issues are surgery specific, in which robotic surgery might cost twice the typical heart surgery. Robotic assisted heart surgery can take nearly twice the amount of time that a typical heart surgery takes, but it may vary depending on the surgeon's expertise and practice with the equipment.

Overall, weighing all the positives and the negatives, it seems that AI is and will be necessary for cardiologists but they are still not at par with the use of AI by cardiologists in other countries because the technology is still not widespread.

Commenting on the future prospects of AI in India in the field of cardiology many mobile applications for cardiology have been developed (but not yet in India) in order to enhance medical doctors' and medical students' research experience such as (a) 3D prototype with the help of some applications which gives picture of a human heart and allow users to observe the heart from any angle, (b) calculators used for cardiovascular medicine with the help of certain formulas, (c) samples of different types of electrocardiography (ECG), (d) tools for clinical diagnosis and practises, and (e) decision support tools including several criteria and cases. An AI-based Computer Aided Diagnosis system is designed in to assist the clinical decision of non-specialist staff in the analysis of heart failure patients. The system computes the patient's pathological condition and highlights possible aggravation.

4. Conclusion

The study suggests that the intervention of AI in medical field particularly dentistry, ophthalmology, surgery and cardiology is indispensible.AI can solve problems considered difficult and tedious by humans.AI is the key to exponential growth in knowledge, efficiency and accuracy in the field of medicine. It can bridge the existing knowledge gap and solve the medical mysteries which are yet unexplored though doctors feel that Strong AI is quite far-fetched (around 15 years) for India.

Most of the doctors expressed interest in application of artificial intelligence in their respective fields and are using it to the extent to its affordability and availability. Doctors are very optimistic about the new developments in the field of AI in near future. The major advantages of AI for doctors are accuracy; precision, reliability, time saving and simplification of work. It brings to notice minute details which may be unknowingly ignored by human. *For patients*, AI may lead to shorter hospital stays, minimal blood loss, reduced risk of infection, faster recoveries and no big scars.

The most commonly cited con of AI by the doctors is the cost of machinery, lack of emotional touch and risk of faulty data

entry and interpretation due to lack of knowledge and complexity of use of some of the AI techniques. A small defect in machine or a small detection error made by the machine can cause a huge loss to the patient. As AI has just entered the medical field in a limited way in India, still there is much more scope in the field to benefit from new artificial intelligence techniques.

5. References

1. Artificial Intelligence. Research Areas. (n.d.). Retrieved from Tutorials Point: https://www.tutorialspoint.com/index.htm
2. Bellman R. Artificial Intelligence: Can Computers Think? Boyd & Fraser, 1978.
3. Bennett J. AI Program Beats Top Human Player at the Game Go, 2016. Retrieved from Popular Mechanics: http://www.popularmechanics.com/technology/a19158/ai-program-beats-top-human-player-at-the-game-go/
4. Brynjolfsson E, McAfee A. The Second Machine Age. New York, London: W.W. Norton & Company, 2014.
5. Buckland D. Doctors and nurses will work with AI, 2016. Retrieved from Raconteur: http://raconteur.net/technology/doctors-and-nurses-will-work-with-ai
6. D'Attellis N, Loulmet D, Carpentier A, Berrebi A, Cardon C, Severac-Bastide R, *et al*. Robotic-assisted cardiac surgery: Anesthetic and postoperative considerations. Journal of Cardiothoracic and Vascular Anesthesia. 2002; 16(4):397-400.
7. Gray R. Dawn of Human 2.0? Nanobot implants could soon connect our brains to the internet and give us 'God-like' super-intelligence, 2015. Retrieved from dailymail: http://www.dailymail.co.uk/sciencetech/article-3257517/Human-2-0-Nanobot-implants-soon-connect-brains-internet-make-super-intelligent-scientist-claims.html
8. Halperin H, Paradis N, Ornato JO. Cardiopulmonary resusciation with a novel chest compression device in a porcine model of cardiac arrest: improved hemodynamics and mechanisms. Journal of the American College of Cardiology. 2004; 44(11):2214-2220.
9. Herkewitz W. Why Watson and Siri Are Not Real AI, 2014. Retrieved from Popular Mechanics: http://www.popularmechanics.com/science/a3278/why-watson-and-siri-are-not-real-ai-16477207/
10. Hoong N. Medical Information Science - Framework and Potential. Kuala Lumpur: International Seminar and Exhibition Computerization for Development, 1988.
11. Joskowicz L. Renaissance robotic system for keyhole cranial neurosurgery: in-vitro accuracy study. Mexico: Proceedings of the Simposio Mexicano en Ciruga Asistida por Computadora y Procesamiento de Imgenes Mdicas (MexCAS'11), 2011.
12. Kurshan B. The Future of Artificial Intelligence in Education, 2016. Retrieved from Forbes: http://www.forbes.com/sites/barbarakurshan/2016/03/10/the-future-of-artificial-intelligence-in-education/#5df950941e64
13. Lewis L. Difference. Site, 2016. Retrieved from STRONG AI VS, 2016. WEAK AI: http://www.difference.site/strong-ai-vs-weak-ai/
14. Manickam S, Abidi S. Experienced Based Medical Diagnosis System Over the World Wide Web (WWW). Kuala Lumpur: Proceedings of The First National Conference on Artificial Intelligence Application In Industry, 1999.
15. Meng Y. Interval-Based Reasoning in Medical Diagnosis. Kuala Lumpur: Proceedings of National Conference on Research and Development in Computer Science and Its Applications (REDECS'96), 1996.
16. Morgan P. The application accuracy of the pathfinder neurological robot. International Congress Series. 2010; 224:691-713.
17. Moustakis V, Charissis G. Machine learning and medical decision making. In proceedings of Workshop on Machine Learning in Medical Applications. Chania, Greece: Advance Course in Artificial Intelligence (ACAI99), 1999.
18. Norvig P, Russell SJ. Artificial Intelligence: A Modern Approach. Prentice Hall, 2009.
19. Nuñez M. Amazon Echo Is The First Artificial Intelligence You'll Want At Home, 2015. Retrieved from Popular Science: http://www.popsci.com/amazon-echo-first-artificial-intelligence-youll-want-home
20. Partridge D, Abidi S, Goh A. Neural Network Applications in Medicine. Kuala Lumpur: Proceedings of National Conference on Research and Development in Computer Science and Its Applications (REDECS'96), 1996.
21. Ramesh A, Kambhampati C, Monson J, Drew P. Artificial Intelligence in Medicine. Annals of The Royal College of Surgeons of England, 2004.
22. RxTap. Artificial Intelligence Future of Digital Healthcare, 2016. Retrieved from RxTap: https://www.rxtap.com/artificial-intelligence-future-digital-healthcare/
23. Sarkar A, Molla D, Paris C. Automatic evidence quality prediction to support evidence-based decision making. Artificial Intelligence in Medical Journal. 2015; 89-103.
24. Swearingen J. Why Deep Blue Beating Garry Kasparov Wasn't the Beginning of the End of the Human Race, 2016. Retrieved from Popular Mechanics: http://www.popularmechanics.com/technology/apps/a19790/what-deep-blue-beating-garry-kasparov-reveals-about-todays-artificial-intelligence-panic/
25. Woolf BP, Lane C, Chaudhri V, Kolodner J. AI Grand Challenges for Education. AI Magazine. 2009; Vol. 34(4).