Review Article on Comparative Study of Intelligence Robot in Surgical Era

Shahzaib Shafiquq
Department of Computer Science and BS Computer Science, The Superior College Lahore, 31 Ferozepur Road, Kalma Chowk Flyover, New Tipu Block Garden Town, Lahore, Punjab, Pakistan

Corresponding Author:
Shahzaib Shafiquq
Department of Computer Science and BS Computer Science, The Superior College Lahore, 31 Ferozepur Road, Kalma Chowk Flyover, New Tipu Block Garden Town, Lahore, Punjab, Pakistan

Abstract: The aim of the study is to provide the comprehensive review and to provide the information about the method, technologies, techniques and algorithm for ornamental the performance of medical robotic system that how top robots work during surgery and to whom companies that robots belongs to. In this review article, author present the interaction of medical robots and discuss about the deficiency and drawbacks of those robots. Researcher discuss variety of robots in surgical area that these robots lesser the work of human with the help of artificial intelligent. But companies ignore some little deficiencies in it that thy doesn't properly during some specific surgery, like some time doctor have handle the robot manually which increase the work rather provided facilities. Researcher also discus some cloud and mobile metropolitan robot that isn't the part of surgical era but these robots have much drawbacks and deficiency. The major purpose of this article is to enlighten to provide or describe deficiency to companies that they neglect while making surgical robot.

INTRODUCTION

The field of AI is generally have to started at a conference in July, 1956 at Dartmouth college where the artificial intelligence was ever first used (Brunette *et al*., 2009). Artificial intelligence is field of computer science that aims to impersonate human thought, learning capacity and knowledge storage (Krittanawong *et al*., 2017). Artificial intelligence is also the mimicking cognition by computers (Jha and Topol, 2016). Many robots used in different fields, but we will discuss about the top medical robots that are used for surgery. Robotics system used for the surgery are Computer Integrated System (CIS) and medical robots second (Taylor and Stoianovici, 2003). The interaction of human and robot is very diverse research and design activity (Sheridan, 2016). Robot Programming by Demonstration (RPD) is a

method through which robot learn skills through human guidance (Calinon and Billard, 2007). The RPD tends to consider the humans as expert model and then robots observe passively the demonstration (Sheridan, 2016). Robot surgical system are the most complex cyber-physical systems (Alemzadeh *et al*., 2016).

Robotics system have extended the reach of human beings in sensing, manipulating and transforming the world around us (Li *et al*., 2017). Traditionally, the robotics is the combination of electronics software and mechatronics (Haidegger and Rudas, 2016). A rapidly growing field is the medical robotics field which contain rehabilitation robotics and surgical system. Nowaday's surgical robotic system is also become the famous example of information technology infiltrating in our daily lives. Today the Machine Learning (ML) is the fastest growing technical fields and health is the greatest

challenge of this field (Holzinger, 2016). There are 5 top robots that are used for heavy and tough surgeries. Basically the robotic system is to provide the physical action in complex ways to influence the society. There are five top companies that have robots which is used in surgical methods. The robots that are used in the surgical methods are not robot that are move from one place to another place using legs, wheels or by slithering locomotion (Puopolo *et al.*, 2018). According to the scientific paper the researcher examined the possibility of adaptation and low frequency vibration that are used in the robotic assembly parts (Vartanov and Martynovich, 2016).

Intuitive surgical is the American company da Vinci surgical system that improve the patient outcome through minimally invasive surgery. In 2017, there are 4,271 robots are installed of this company worldwide. Hansen medical is also one of the top robotic surgery company that is based out of Silicon Valley, California. Auris and Sensei robot are two robot which is used for the treatment of cardiac arrhythmia and vascular related surgeries. Med robotics is also the top famous due to its product flex robotic system. Verb surgical company is also looking for developing the digital surgery platform combine robotics and advanced instrumentation. Microbat is also top US-based robotic surgery that offers the nanobot technology. The famous robot of this company is (VI Rob and TipCAT). The surgical robots provide a unique advantages over traditional robotic technologies in terms of reusability and ease for treatment (Chennareddy *et al.*, 2017) surgical robot is very efficient for treatment but treatment of these robots is quite costly.

LITERATURE REVIEW

Artificial intelligence significantly getting better in the field of medicine. In the past year of health and the medical specialties the review article summarizes the current strength as well as the challenges in surgical era. Doctor which are in leadership should aware from how quickly the AI is getting better in surgical field and how new robots are working. Now AI is behaving as humans in the diagnosis of medical conditions and more effective (Loh, 2018).

In surgical automation the da Vinci Surgical System is the surgical robot developed by intuitive surgical Inc. and the steady hand robot developed at Johns Hopkins university which is used to manipulate the retinal surgery. The surgical procedures are intricacies that is depend on patient information. The Cyber Knife robot invented at Sandford university which is used to cure the tumor that is located on patients body (Yip and Das, 2017).

AI solve the complexity of surgeries like what is the role of AI or robotic doctor and what is the role of human doctor as compared to AI robotic doctor. According to the biomedical research pharma AI is the pharmaceutical artificial intelligence division of Insilco medicine that is

launches in 2016 by the Hopkins university which focus on drug discovery programmers for cancer. It also deal with the Parkinson's, Alzheimer's and other health issues (Arnold and Wilson, 2017).

After many years of research, the most amazing robot da Vinci system face the market competition from other companies that also made different surgical robot in the AI field. Some new companies try to maintain the stability of surgical robot and also less the cost of robotic surgery which is similar to that of the laparoscopy. But the Cambridge medical robotics decide to create the new robot machine which is costly but much better than previous robot as compare to hardware outlay, maintenance and instruments. According to Cambridge medical robotics this will attractive to multidisciplinary expansion in the East (Aruni *et al.*, 2018).

In past studies, the issue creates n surgical robot was the use of camera that sometime camera become insufficient during the surgery but now the automating surgical camera has reduced the burden on the surgeons and also remove the problem to handle camera manually. After studies the companies enhance the camera and resolve the problem that is automatic viewpoint selection. Now mostly companies are using SPRK research kit to handle the camera movement and study the camera motion in surgical robotics just like Di Vinci robot which give the master control system and also allow to control the platform and tools as clinical moveable endoscope (Ji *et al.*, 2018).

The researcher suggests probabilistic model that identify the image which is close to the camera focal point. This experiment considers as the surgical debridement situation on silicone specters with external forms of changing hue and form. It also assesses the degree to which the system properly sections candidate debridement marks and correctly positions those boards (rank correctness) (Ji *et al.*, 2018).

There are many advantages of medical robot according to research but is also risky because the implementation of the erudite policy lead to the crash and other disappointments. If we try to add explicitness to avoid the unsafe state become more complex and almost impossible. The researcher proposes derivative-free recovery which is a two-phase method in which the system of robot will come to rest after any task for a while then do a next task due to which the chances of failure decrease. The researcher also propose a time-varying technique for consecutive task. In second phase there is a switching policy for employee to understand and keep the robot away from the frontier of backing if it drifts too close. A DFR (derivative free recovery) will reduce collision up to 83% while on a physical tasks by using DI Vinci robot the DFR can reduce the collision up to 84% (Lee *et al.*, 2018).

To enhance the automated bin selection when chunks cannot clutched then the pushing action have ability to separate the objects from bin walls and corners to move

away from them. The Dexterity Network (DEX-NET) robot use for grasping framework the author present the two novel push authority which is based on the diffusing cluster and the targeting free space, then compare these two policies with the earlier three policies using four metrices. After some experiments on the Dex-Net the Dex-Net couldn't grasp the object but can increase the chance of performing a positive clutch by >15%. Also, in cases where grasp excellence can be healthier, the new rules outdo a quasi-random zero by nearly 2 times. In bodily trials on an ABB YuMi, the maximum execution push policy rises grasp excellence by 24% (Danielczuk *et al.*, 2018).

In this study, the researcher considers the problem of multirobot directing in vineyards, a task interested by our ongoing project aiming at making a co-robotic system to instrument precision irrigation on large gage commercial vineyards. The problem is related to a combinatorial optimization problem on charts known as the "team orienteering problem". Team orienteering is recognized to be NP-hard, thus motivating the development of experiential solutions that can scale to large problem examples. Three different approaches conversant by the domain we consider and associate the magainst a general-purpose experiential formerly industrialized and widely used. In many standards derived from data gathered in a profitable vineyard, we prove that our solutions outperform the general purpose experiential and are accessible, thus agreeing us to solve cases with hundreds of thousands of apexes in the charts (Thayer *et al.*, 2018).

The problem of artificial intelligence and robot are almost same. These two fields are getting success rapidly and also facing many problems. Recent technologies like computation robotics and miniaturization technologies carry us to the development and futuristic phases. The need of surgical robot are getting wide just because of the diseases getting wide rapidly (Tirgul and Naik, 2016).

The artificial intelligence also implemented nursing robots in both fields that is medical and surgical robot instruments. The robotics in nursing and health care now a day have much importance but as we see the past only some companies know about this technology and working on it, then made many successful robots like Di Vinci robot which much help in surgical era and lesser the work and also perform the work with accuracy every time (Erikson and Salzmann-Erikson, 2016).

The use of drugs and polypharmacy have displayed many times just because of the fact that polypharmacy present that is a well-known factor also. This fact regards patient health due to diverse of drugs or reaction of drugs. The researcher said that just like the surgical field we need some robots in the polypharmacy that analyze and cure the patient health.

The removing diseased and dead tissue fragments are the sub tasks that are perform with the help of surgical assistants like Di Vinci robotic system. It is also a challenging task in the surgical field to inherit the non-linearities. The researcher presents the method through which we can handle this task sufficiently also place a red calibration marker on the end effector and let the marker to move over set of rings to analyze the internal robot end-effector configurations (Seita *et al.*, 2018).

Imitation is also a powerful thing for robots to increase their skills acquisition. In study the researcher represent that there are many robots in past but some robots get famous just because of their work and their accuracy that they behave like humans, all the robots behave like human and lesser the human work but some get famous just because of their skill and accuracy. We can used the hand tracking hardware tools can be used them to perform the complex tasks by robot. Hand tracking hardware tools are much using in the surgical fields because in some area we need t handle the robot manually for surgery (Zhang *et al.*, 2018).

There are many surgical robots that are used for surgeries but the robot assisted minimally invasive surgery is the difficulty surgery as compared to other surgery RIMS is use for localizing the subcutaneous vessels by using the hell effect sensor first it judge the prob tip deflection then spherical is moved smoothly in all the surface of blood vessel phantom with the help of Di Vinci needle driver. So, RIMS is the finest and difficulty surgery but can cure through robotics now (Mckinley *et al.*, 2014).

About 12 months ago the Nomura Research Institute (NRI) conduct the survey in japan on the topic of robots and artificial intelligence. Japan define the term robots as humanoid robot that the robot is those that less the human work and behave like human also w hen they took survey on the robots that are in the surgical field, they come to a conclusion that the surgical robots are costly but much helpful in nature but also people don't have much knowledge about the surgical robots.

Robotic surgery is assertive the limits of health skill novelty to improve scientific outcomes. The researcher discusses the development of five peers of robotic medical platforms including stereotaxic, endoscopic, bio inspired and the future growth of independent systems. We examine the tests, fences and limits of robotic surgery and its upcoming possibilities, counting real-time combined anatomic and resistant histological imaging and data integration with better haptic response. We consider current indication, cost-effectiveness and the knowledge curve in relation to operation. The advance dimpression of this expertise could principal to transformative medical developments. However, in spite of more than 30 years of liberal improvement, the advanced procedure remains critical (Ashrafian *et al.*, 2017).

Medical robots are flourishing and there are many robots in the markets now a days. Instinctive Medical still has the control of mechanical laparoscopic operation but for how long? Is da Vinci behave like the revolution or evolution? health care improvement, value formation is necessary and the C will count more as ever count in the purchasing decisions. The value proposal for robotic surgery is contentious because of:

- Services and cost
- Serious, patient's heavy injuries
- Murali *et al.* (2018) clinical results

The Di Vinci robot 67% installed in the us and 75 robotics work is happening now in the universe as compared to world. Robotic technology and the cumulative difficulty of artificial intelligence are disorderly novelties with important development forecasts and the possible to disturb the financial and public features of ordinary life. Few studies have examined growths in robotics novelty. According to past studies the cost of industrial and surgical robot are increasing rapidly with the passage of time, so, now companies are working on it to provide the most facilities in the reasonable cost or if the coast increased at this speed the surgical robot become in sufficient (Keisner *et al.*, 2015).

Indoor floras in homes and marketable buildings such as shopping centers, offices, airports and hotels can advantage from accuracy irrigation to keep healthy development and lessen water ingesting. Since, active regulators are too costly and physical incessant change of drip emitters is unreasonable. To provide enough accuracy to the client try to design the lightweight camera, so that, during surgery robot may not affected by camera. According to the recent studies camera is also the major defect of the surgical robotic system. The researcher presents the idea that the robot should take rest after every task during surgery, so that, camera couldn't heat up and produce some deficiencies. Nowaday's camera can handle both automatically and manually which resolve many issues in the surgical field (Berenstein *et al.*, 2018).

Researcher also discuss that in past the robot was for simple works but with the passage of time many robots developed in medical arena also. Researcher also discuss the deficiency of camera that camera isn't work properly during surgery. The top and famous robot for work is Di Vinci system. There are many benefits of robot in surgical field but also have many defects. In past years and now a day's robot are much beneficial for humanoids according to previous researches (Mahler *et al.*, 2018) (Table 1).

Table 1: Comparison

Researchers	Techniques	Results	Drawbacks	Solutions
West (2015)	Telemanipulators	The telemanipulators use the surgeon's actions on one side to control the effector on the other side	Increased the time of surgery Need for the specially-trained surgeons and the surgica teams Cost of the surgery	The CRL telemanipulators extend the dexterous manipulative capabilities of the human operator remotely into the high radiation or the hazardous environment. Typical the tasks range from operation of the laboratory instruments to the maintenance of a large process equipment and all requiring dexterous manipulations. These tasks are generally unstructured and require real-time human interference
Sayburn (2017)	Telepresence robots	Telepresence robots allow off-site medical professionals to move, look around, communicate and also participate from remote locations	Increased the time of surgery Need for the specially-trained surgeons and the surgical teams Cost of the surgery Cost of the surgery	To prove the suitability of the proposed architecture based on the open-source technologies like HTML5, WebRTC, IoT protocols and RCAs to integrate videoconferencing and the robotic control features in real time
Mahler *et al.* (2018)	Pharmacy automation	The robotic systems to dispense oral solids in the retail pharmacy setting or preparing sterile IV admixtures in a hospital pharmacy setting	Variety Mistakes Breakdown Software Problem	Vial filling Pouch packing Workflow Software
Cunha *et al.* (2015)	Rehabilitation robots	These robots provide support and facilities the lives of unwell, elderly people or those whose body parts effect during some movement. These robots are also used for the rehabilitation and related events such as guidance and treatment	Privacy Human Contact Regression Complexity	
Thayer *et al.* (2018)	Biorobots	A group of robots designed to imitate the cognition of the humans and animals	Capital cost Expertise Limitations	Rising demand for the laparoscopic surgery and the surgical robotics Challenges of laparoscope control

Table 1: Continue

Researchers	Techniques	Results	Drawbacks	Solutions
Mahler *et al.* (2017)	Surgical robots	Surgical robots either allow surgical operations to be carried out with the greater precision than an unaided human surgeon or allow remote surgery where a human surgeon is not physically present with the patient	Increased the time of surgery Need for the specially-trained surgeons and the surgical teams Cost of the surgery	posed by the surgeon-controlled Surgical robots Introducing the Automap Image-guided laparoscope control
Tian *et al.* (2018)	Haptic technology	It allows touch-enabled user interaction with the real and virtual environments. some robots allow to stimulate the mechanical property of virtual substance which users can experience from end to end their intelligence of touch	Barriers Prevalence	Simulation Teleoperation Leading-edge technology Other Application
Li *et al.* (2018)	Swarm robotics	The behavior of swarms of thousands of tiny robots which perform a useful task together such as finding something hidden, cleaning or spying	Despite its potential to promote heftiness, scalability and the flexibility, swarm robotics has yet to be adopted for solving the real-world problems. Various limiting factors are the preventing the real-world uptake of swarm robotics systems	Swarm robotics is a very promising technological solution to reduce the time of multiple types of the operations. However, maintenance for the robots and the any other hardware or operational cost involved in the inspection operations could be represent a crucial constraint on how many quadrotors or robots could be economically optimal to handle at the given time (Couceiro, 2014; Navarro and Matía, 2013)
Berenstein *et al.* (2018)	Nanorobotics	Nanorobotics is the emerging technology field of creating the machines or robots whose components are at or close to the microscopic scale of a nanometer (10-9 m)	The nanorobot should be very accurate, otherwise it may be harmful effects may occur. The initial design of nanorobot cost is very high. The structure of the nano-robotics are much complicated	Some important problems and the related solutions in the region of the nanorobotic control have been pointed out. For design of the relevant dynamical model of a nanorobot motion the author introduced the Hamiltonian for the multipotential field and the related canonical equations

CONCLUSION

After analyzing all the aspects researcher conclude that the first and major drawback of the surgical robots is the movement of camera that it doesn't work properly during surgeries. And the main conclusion after reading all the articles on artificial intelligent robot in surgical area the researcher concludes that the robots just work according to the human in structions, they don't have any feeling that a human can feel pain during surgery. Robots can do more and efficient work as compare to humans.

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