**Outcomes of robotic liver resections for colorectal liver metastases. A multi-institutional analysis of minimally invasive ultrasound-guided roboticsurgery**

Minimally invasive surgery has seen a massive increase over the past couple decades due to the insurgence of state-of-the-art robotic assisted technologies. The relatively recent procedure has gained momentum in surgical practices in comparison to its alternate, traditional open surgery, due to the benefits it provides over the latter. Incisions are much smaller, there is a lower risk of infection, quicker recovery time, and less scarring to provide a few examples. This also allows surgeons to perform increasingly complex and innovative procedures with incredible precision.

The article addresses the increasing use of surgical robotics in minimally invasive liver surgery for colorectal liver metastases, and attempts to construct a detailed analysis on this specific procedure to determine if there are any short- and long-term damages on patients following liver resection. The authors of the study gathered data from three center who performed the surgery and monitored each qualifying patients’ baseline data, surgical procedure details, and postoperative outcomes. All centers used the same surgical robot, a four-arm da Vinci Surgical Robot, in order to eliminate any unforeseen variables. In addition, all procedures followed standard protocol. The study followed 59 patient liver resections. The study highlights the disease free and overall survival rates after a 1-year and 3-year follow-up, with additional data such as hospital stay. The study concluded that robotic liver surgery doesn’t impair surgical outcomes and oncological rates for this specific surgery.

The study focuses on a very specific topic due to the scarcity of data for minimally invasive liver surgery. Therefore, it’s conclusions are limited to only this specific type of liver surgery. However, this is combatted by the nature of the medical field as various complications can arise with the smallest deviations. Advancements in medicine ultimately take time and can proceed relatively slow compared to other fields as the error for a miscalculation can be a great one. Thus, increased precautions are needed prior to delivering an absolute clear sign.

The study itself is limited by its retrospective nature as it cannot use a secondary group for comparison. Regardless, it provides a unique undertaking as data regarding short and long-term repercussions is scarce and more reproducible information is needed. Furthermore, despite controlling the type of surgical robot used for all surgeries, the authors were not able to take into account the varying experiences of each centers’ surgical teams, and did not display the results accordingly. Rather, as the focus was an overall comparison to traditional open surgery, the data was an aggregate and accurately displayed the overall results. It was understood that any surgeon leading an operation of this scope will have the appropriate knowledge and experience.

Despite these various limitations, the article ultimately succeeds in highlighting the overall benefits of robotic liver surgery, a highly-demanding procedure, in which there is slower advancements in technological applications. It brings to light one of the first analyses on robotic surgery as a valid option to resect colorectal liver metastases competently.

**ROS-based Autonomous Navigation Wheelchair using Omnidirectional Sensor**

While wheelchairs have provided those with lost movement function the ability to move again, the current solution and models are dependent on other capabilities. The original wheelchair lacks any electronic options and requires either the individual to roll themselves or the assistance of another to push them wherever needed. With the increase in electronic advancements, electrical components have been combined in many medical assistance devices, including the original wheelchair design. The new models, while expensive, allow for greater mobility and independence as it removes the aforementioned required components. However, the current solutions unfortunately do not work for all individuals who require the assistance of a wheelchair for mobility as there are many who have even more advance mobility disabilities.

This study aims to provide a possible answer to the advanced cases by attempting to implement an autonomous navigation algorithm for both static and dynamic conditions. The authors utilize a novel tool in image-based geolocalization within an existing powered wheelchair, and within the robot operating system framework. They primarily focus on an indoor solution as it is a more controlled environment. Some tools they used were an ultrasound and infrared sensor, laser range finder, and a Kinect for sensory information as well various electric boards and arduinos. They proposed three major steps for their solution which were defined as calibration of the onboard camera, features detection, and vision matrix which provided the relative position of one sensor to another. They also developed a simulation system after building an ROS architecture to test the scripts before loading onto the robot. Once the simulation was completed, they detail the packages they upload to the robot and how they ensure that they can avoid collisions.

The algorithm used provided low errors in both curved and straight line paths, but accuracy begins to fail as the complexity of the path increases as in their more involved Z-shaped path. The study does not have a current solution ready to be deployed, but it offers a possible direction to move forward. The application the authors are pursuing is analogous to large-scaled self-driving vehicles, and as a result, will require more time for optimization. The next steps needed for improving the proposed solution is embedded in the optimization of the algorithms for larger data processing and determining of an optimal path choice. However, access to the algorithm itself is limited as it is not available to the public currently. Thus, difficulties will arise in recreating the study in regards to the initial development of the algorithm itself. However, the authors detail which hardware is utilized for the wheelchair tests so it is possible in a sense to recreate a very similar device for experimentation. This can allow for at least some type of improvements as it’s possible the hardware selections the team made can also be improved. With different electrical components and different combinations, it is possible that improvements can be made in the wheelchair’s processing power or even just lowering the cost of the robot without sacrificing the efficacy of the system.

There is much room for improvement in the field of autonomous wheelchairs as it is a recent concept, but the eventual success will impact millions. Then further steps can be taken to reduce the overall cost as current electric wheelchairs have become increasingly expensive. The overall aim to provide as much help to those who need it is a noble goal and a worthy cause.

References

<https://www.mayoclinic.org/tests-procedures/robotic-surgery/about/pac-20394974>

<https://med.nyu.edu/robotic-surgery/physicians/what-robotic-surgery/how-da-vinci-si-works>

<https://www.tandfonline.com/doi/abs/10.7305/automatika.2017.02.1421>

<https://oig.hhs.gov/oei/reports/oei-03-03-00460.pdf>

<http://news.mit.edu/2017/featured-video-self-driving-wheelchair-0726>

**Team Paper Reviews**

**Yanyu Zhang**

This paper acts more of an introduction to ROS. It begins by detailing the features of the system and provides a few examples of current robots utilizing the operating system. It then provides more information on the main core concepts of ROS and provides a high level explanation. There is also a brief tutorial on installing ROS in Ubuntu which would be very helpful to those who are seeking a quick rundown on how to get started themselves. It concludes by briefly mentioning ROS based wheelchairs but doesn’t go into detail. It shows that ROS is a broad platform with a lot of potential.

**Yu Liu**

Not submitted

**Shengyao Shao**

This paper looks at utilizing ROS for an autonomous wheelchair. It gives a brief overview of the wheelchair software and hardware components. It also provides general advantages and disadvantages to ROS, and ultimately seems to display a favorable tone towards the platform. Further details of the system’s capabilities and limitations can be discovered in the linked article as well.

**Matthew Boyd**

This paper provides a comparison of ROS 1 versus ROS 2 and provides a well thought analysis with supported facts. It begins by providing brief background information on the origins of ROS 1 and how it evolved as the field of robotics developed. It thus went mainstream for commercial use. The paper then begins to describe how it fared in commercial use, listing some of the limitations of ROS 1. It then transitions over to the newer iteration in ROS 2. The author shows a favorable tone in its presentation of the platform, describing it as “the future of ROS” even, but also sharing where improvements are made. The author recognizes that its still a new software that has many limitations currently as it is still being developed. There are many linked references the author has provided showcasing the range of resources they have gone through. There is a well detailed and organized analysis and recommendation section which displays the author’s findings in a convenient chart. The analysis compares common features and functions between the two and in which way their support differs. In the recommendation chart, the author gives his thoughts on the type of people who would utilize ROS and which system would be best for them. He concludes that ROS 2 is definitely going to be the primary tool in the future but recommends that with the abundant amount of resources available for ROS 1 is best suited for beginners or individual projects. ROS 2 is currently best reserved for the more experienced crowd as their background information in ROS will help guide them in a new platform.