**Problem Statement**

\gls{rmis} has come significantly in the last decade due to advances in surgical robotics such as artificial intelligence and the \gls{da Vinci platform}. Pose estimation of surgical instruments has become an important task in \gls{rmis}.

Nowadays there are many external devices like depth camera, electromagnetic trackers etc. available for space estimation in surgical instruments but they are not practical in in vivo surgeries because of space and hardware constraints\cite{ doi:10.1080/21681163.2021.1997647}. There are some vision-based methods that use external markers to track the instruments. However, these methods have major limitations; the markers must always be visible in the camera's field of view and are sensitive to background changes and occlusions\cite{10160287}. In this case, a vision-based markerless instrument tracking method that does not require any modifications to the hardware setup or external markers is necessary. The main aim of this project is to develop a deep learning based markerless 6DoF surgical instrument pose estimation system. The system will be designed to provide highly accurate surgical instrument 6DoF estimation without relying on external markers or complex hardware.

\begin{figure}[H]

\centering

\includegraphics[width=0.8\textwidth]{6Dof.png}

\caption{Initialize}

\end{figure}

图片包含 室内, 食物, 刀, 切

描述已自动生成

***Appendix and Glossary:***

\newglossaryentry{davinci}{

name= da Vinci platform,

description={ The da Vinci system is composed of three primary components: the patient-side cart, the surgeon console, and the vision cart. Notably, the da Vinci SP and da Vinci 5 systems stand out for offering seven degree-of-freedom (DOF) through their wristed instruments, whereas the da Vinci Xi system utilizes five DOF. The surgeon console, positioned a short distance away from the operating table, enables the surgeon to manipulate the surgical instruments and camera. The purpose of the vision cart is to provide reliable and intuitive control over the instruments, offer [six DOF](https://www.sciencedirect.com/topics/medicine-and-dentistry/six-degrees-of-freedom) in terms of dexterity, and deliver immersive three-dimensional (3D) visualization. }

}

\newabbreviation{rmis}{RMIS}{

Robot-assisted minimally invasive surgery}

***BIB:***

@article{ASADIZEIDABADI202460,

title = {Comparison of da Vinci 5 with previous versions of da Vinci and Sina: A review},

journal = {Laparoscopic, Endoscopic and Robotic Surgery},

volume = {7},

number = {2},

pages = {60-65},

year = {2024},

issn = {2468-9009},

doi = {https://doi.org/10.1016/j.lers.2024.04.006},

url = {https://www.sciencedirect.com/science/article/pii/S2468900924000288},

author = {Arya Asadizeidabadi and Seyedmohammadamin Hosseini and Fedor Vetshev and Sergey Osminin and Seyedali Hosseini},

keywords = {Robot-assisted surgery, Robotic surgery, da Vinci 5, da Vinci, Sina, Telesurgery},

abstract = {Robotic systems have become popular in modern surgical procedures. The option of telesurgery has effectively addressed geographic limitations. These systems are offered by numerous companies worldwide. In this review article, we discuss four models of robotic systems to determine their advantages: the Sina flex system from Iran and the da Vinci Xi, SP, and 5 systems from the USA. We compared aspects such as architecture, instruments, visualizations, clinical use, and costs. Our findings suggest that the da Vinci robot, which was introduced earlier than the Sina system, utilizes proprietary and limited-use EndoWrist instruments with diameters ranging from 8 to 12 mm and features advanced imaging capabilities, including three-dimensional optical, tomographic, and fluorescence imaging. It is well established and widely utilized in various surgical procedures. Conversely, the Sina flex system employs single-use 5 mm instruments and is equipped with two-dimensional optical imaging as a standard, with optional three-dimensional and fluorescence imaging upgrades available. Despite its affordability, the Sina flex system is relatively new and has not yet been clinically tested. Additionally, the Sina flex system is more user-friendly.}

}

@INPROCEEDINGS{10160287,

author={Xu, Haozheng and Runciman, Mark and Cartucho, João and Xu, Chi and Giannarou, Stamatia},

booktitle={2023 IEEE International Conference on Robotics and Automation (ICRA)},

title={Graph-based Pose Estimation of Texture-less Surgical Tools for Autonomous Robot Control},

year={2023},

volume={},

number={},

pages={2731-2737},

keywords={Shafts;Visualization;Pose estimation;Lighting;Soft robotics;Visual servoing;Real-time systems},

doi={10.1109/ICRA48891.2023.10160287}}

@article{doi:10.1080/21681163.2021.1997647,

author = {João Cartucho, Chiyu Wang, Baoru Huang, Dan S. Elson, Ara Darzi and Stamatia Giannarou},

title = {An enhanced marker pattern that achieves improved accuracy in surgical tool tracking},

journal = {Computer Methods in Biomechanics and Biomedical Engineering: Imaging \& Visualization},

volume = {10},

number = {4},

pages = {400--408},

year = {2022},

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doi = {10.1080/21681163.2021.1997647},

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