S-S01

Surgical Navigation Robot of Thermal Ablation for Liver Surgery and Related Phantom Design

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According to statistics on the global market development trend of surgical robots, the current economic scale of surgical robots will increase to 13 billion U.S. dollars by 2025, showing its high development potential. Additionally, according to a report from the World Health Organization (WHO), liver cancer is the second deadliest cancer in the world. Currently, how to preserve more parts of the liver during surgery in order to still be able to sustain the life of the patient is clinically an important issue. Presently, thermal ablation is one of the most suitable treatment methods for patients with tumors smaller than 2 cm or liver cancer patients with multiple tumors. However, during the treatment, it is necessary to rely on preoperative analysis of Computed Tomography (CT), intraoperative machine vision and real-time ultrasound image analysis to assist the doctors in puncturing the precise position of liver tumor to perform thermal ablation. This surgical method is suitable for using navigation of robotic-assisted system to assist in spatial positioning. This system can also perform real-time ultrasound image analysis and information feedback of thermal ablation. Moreover, in this research not only is there be an introduction to the navigation of robotic-assisted system, but also takes the dual-arm robotic-assisted system of liver cancer thermal ablation as an example to introduce the required spatial positioning technology of machine vision, interactive robotic arm control, ultrasonic image, and thermal ablation information etc., as well as conduct a phantom experiment to show its results. The phantom production method designed in this study can also be extended to other surgical training or research areas, such as thyroid needle biopsy training phantoms, bladder phantoms, etc.

S-S02

Technique and Outcome of Laparoscopic-assisted Ultrasound-guided RF Ablation for Malignant Hepatic Tumors: Next Step? Robotic/ AI Navigation System?

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To demonstrate the technique, tricks, and experience of laparoscopic-assisted ultrasound-guided RF ablation for malignant hepatic tumors and how we conquer the difficulties of ablative procedures at difficult locations.

In the meantime, it will also present the long-term outcome of our study. To emphasize that fully laparoscopic ultrasound-guided radiofrequency ablation is a safe and effective treatment for malignant hepatic tumors, even in difficult percutaneous ablation or laparoscopic liver resection areas.

To discuss the next step of the laparoscopic-assisted ultrasound-guided ablative procedure, including new devices and Robotic/ AI navigation systems, if they can improve the patient's outcome.

S-S03

Realizing Medical Image AI at the Edge: Applications to Thyroid and Breast Ultrasound

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In recent years, the convergence of artificial intelligence (AI) and medical imaging has sparked a revolution in the field of healthcare. One of the

notable advancements in this domain is the integration of Edge AI with medical imaging, a synergy that holds the potential to transform diagnostics, treatment, and patient care. Edge AI refers to the deployment of AI algorithms directly on edge devices, such as medical imaging equipment or localized processing units, rather than relying solely on centralized cloud servers. This approach offers numerous benefits, including reduced latency, improved privacy, and enhanced real-time decision-making capabilities.

Medical ultrasound imaging has been an invaluable diagnostic tool for decades, offering non-invasive visualization of internal organs and tissues. As technology advances, the integration of Edge AI into ultrasound devices has ushered in a new era of enhanced capabilities, portability, and accessibility in healthcare. This synergy between Edge AI and medical ultrasound imaging holds the promise of revolutionizing the way clinicians obtain and interpret real-time ultrasound data. Edge AI enables the ultrasound devices to analyze images in real-time, detecting anomalies, identifying patterns, and highlighting potential areas of concern. This allows for rapid decision-making through workflow automation at the point of care, reducing the time it takes to obtain results and potentially expediting treatment plans. In this talk, real-time thyroid and breast detection and diagnosis will be used to demonstrate the advantages of integrating Edge AI and ultrasound imaging.

S-S04

The Application of Artificial Intelligence with Ultrasonography in Automatic Detection and Diagnosis of Liver Tumors

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Background: Hepatocellular carcinoma (HCC) can be diagnosed by abdominal ultrasound (US), computed tomography (CT) or magnetic resonance imaging (MRI) without passing through pathological sections. US is the most convenient and rapid tool for diagnosing HCC and liver tumors. Based on the need for regular liver cancer screening among the general population, US plays an indispensable role. Therefore, the use of artificial intelligence (AI) in automatic detection and diagnosis of liver tumors will provide an important reference for US diagnosis of liver tumors in the future.

Methods and results: We collected 6,001 US images with liver tumors in 1,576 patients at National Taiwan University Hospital from 2002 to 2020. Those patients were diagnosed with HCC, cholangiocarcinoma, liver metastases, hemangiomas, hepatic hyperplastic nodules, hepatic cysts, focal fatty sparing, and other benign tumors by CT or/and MRI imaging or pathologic results. These images were labeled out tumor parts by certified physicians. We experiment with some models and compare those results; finally, we use several models such as Swin-B for the classification and YOLOR-D6 for the object detection. The area under the curve (AUC) of classification for malignant or benign tumors is 0.9. The mean average precision of automatic detection of liver tumors is 56.31%.

Conclusions: This AI system with automatic detection and a high predictive rate for liver tumors can assist doctors and technicians in diagnosing the nature of liver tumors with ultrasonography.

S-P01

Endometriosis after Cesarean Section - A case report

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Background: Abdominal wall scar endometriosis is endometrial tissue developed at abdominal wall scar which is a rare condition in patients who received cesarean section,

hysterectomy or myomectomy with an incident rate about 0.03%~0.15%. Palpable mass with cyclical pain during menstrual period is one of the most common symptoms. Surgical excision including the surrounding fibrotic tissue is the curative treatment for the abdominal wall scar endometriosis.

Materials and Methods: A 38 years old female suffered from intermittent pain over a right lower abdominal wall mass lesion which was closed to previous cesarean section scar. Ultrasound was scheduled for the patient which showed an irregular border, heterogeneous, hypoechoic subcutaneous mass with vascularity present.

Result: The abdominal wall scar mass was completely resected with a free margin. Pathology report confirmed the diagnosis of endometriosis. Patient returned three months after the operation for follow up which showed no sign of recurrence under the ultrasound.

Conclusion: Ultrasound is a safe, repeatable, non-invasive, non-radiative and low cost tool for evaluating soft tissue mass. Surgical excision is the golden standard for abdominal wall scar endometriosis treatment.