Endoscopic Image Tracking of Surgical Instrument for Robotic Assisted Laparoscopic Surgery

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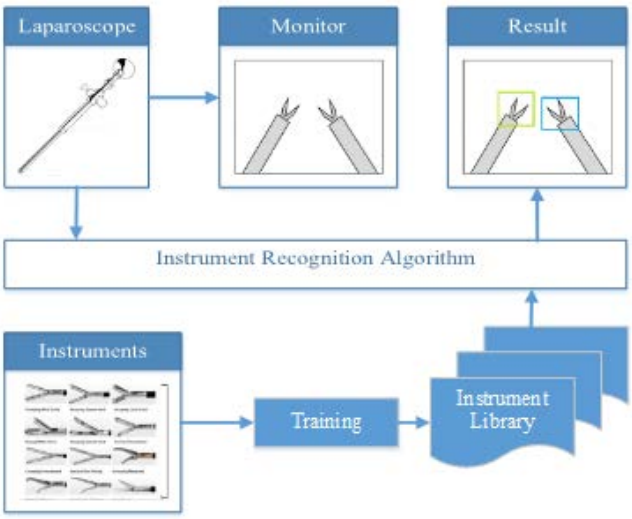
Minimally invasive procedures are gaining popularity in modern abdominal surgery practice due to a number of advantages compared to the traditional procedures. Among them less operational trauma, faster patient recovery and therefore less hospital stay. To enable robot-assisted operations it is crucial to create methods for automatic instrument tracking.

In this research a novel algorithm for multiple-instrument tracking for endoscopic system during Minimally Invasive Surgery (MIS) is developed. Algorithm uses spiking neural network(SNN) to detect laparoscopic instruments based on their natural features and introduces Instrument Library for multiple tool recognition. Further, a Kalman filter is implemented to assure stable instrument tracking.

The proposed solution has been tested on a laparoscopic surgery system and showed high performance of 8.7fps and detection rate 89% for a set of three different surgical instruments.

The algorithm has been implemented on the Huatuo robot – a courtesy of Asian Institute of Telesurgery (AITS) and IRCAD under real pig surgery conditions and on the training box.



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