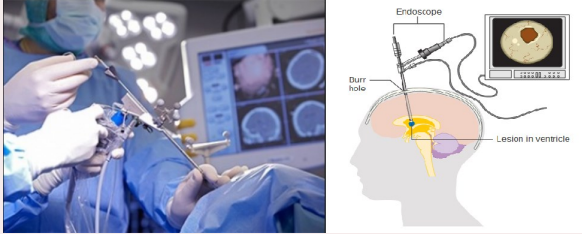## Neuroendoscopy

Neuroendoscopy is a minimally-invasive surgical procedure in which the neurosurgeon removes the tumor through small holes (about the size of a dime) in the skull or through the mouth or nose.

Neuroendoscopy enables neurosurgeons to:

♦ Access areas of the brain that cannot be reached with traditional surgery

♦ Remove the tumor without cutting or harming other parts of the skull

Image-Guided Navigation

Image-Guided Navigation is a surgical concept and set of methods that use Image-Guided technology for surgical planning, and for guiding or performing surgical interventions.

This method is widely used in minimally invasive surgery areas including, Brain Endoscopic Surgery, Laparoscopy, Endonasal and Skull Base Surgery, Endoscopic Orthopedic Surgery.
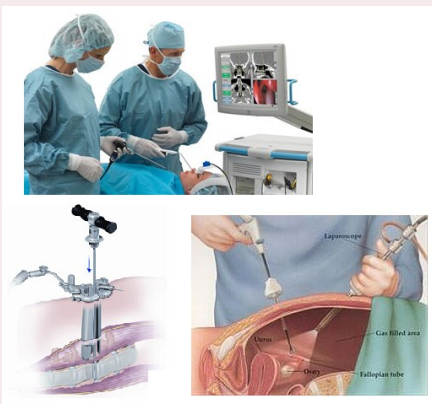
Scopy Image and Video Analysis research Group

Registration of endoscopic video to preoperative Data facilitates high-precision surgery. The goal of this group is to be able to accurately track the location of the endoscope in real-time and thus be able to determine endoscope location within the body cavities. The advantages to being able to do real-time visual tracking are quite substantial as current tool tracking systems for surgeries require additional equipment beyond the endoscope camera that are subject to line-of-sight issue or electromagnetic distortion depending on the modality of tracking use.

The main goal of this group is to be able to employ Scopic data as non-invasive intra-operative sensors using vision and augmented reality techniques.

Various research projects with clinical applications are defined in this research center which can be chosen by either master and PhD students or researchers.

Goals:

♦ **Basic Processing**: Frame Selection, Calibration, Key point Extraction, Alignment , Matching

♦ **Object Detection**: Segmentation, Contouring, Classification

♦ **2D/3D Registration**: Template Based, Point Based

♦ **2D/3D Tracking**: Recursive Bayesian Filtering, Batch probabilistic methods, Non- probabilistic methods

♦ **Model Building**: 3D Reconstruction, Optimization, Robust Estimation

♦ **SLAM**: Localization, Mapping

Areas of Interests:

♦ Neuroendoscopy

♦ Image-guided navigation

♦ Capsule endoscopes

♦ Computer aided diagnosis

♦ Virtual scopy

Scopy Image and Video Analysis Research Group

School of Advanced Technologies in Medicine, Isfahan University of Medical Sciences

Road Map

5 SLAM Localization Mapping

4 Model Building 3D Reconstruction Optimization Robust Estimation

1 Object Detection Segmentation Contouring Classifiction

Endoscopic Video Frame Selection Calibration Key point Extraction Alignment Matching

3 2D/3D Tracking Recursive Bayesian Filtering Batch probabilistic methods Non- probabilistic methods

2 2D/3D Registration Template Based Point Based

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Virtual Scopy

Virtual scopic simulators have a great potential in scopic training. The aim of endoscopy is to achieve the best diagnostic-therapeutic result while minimizing the risks of the patient. Acquiring skills to perform endoscopy needs experience and time and depends on the ability of the trainee, the feedback given by an experienced supervisor and the method of endoscopy training. Traditionally, novice residents commence their training by performing endoscopies on patients, which might result in prolonged procedure time and abdominal pain and discomfort for the patient due to lack of experience.
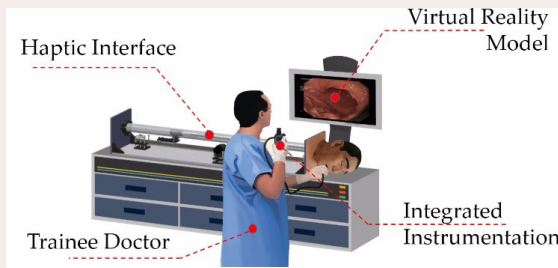
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Capsule Endoscopes

Conventionally, flexible endoscopes are used for Gastro-intestinal (GI) endoscopy. These devices fail to examine small intestine. Furthermore, they cause difficulties for both the physicians and the patients, such as handling the control elements that physicians face to and endoscopic complications like bleeding for the patient. These problems lead to introducing a new technique that is called wireless capsule endoscopy (WCE). This technique can be done by two types of capsule endoscopes: active capsules and passive capsules. Passive capsule endoscopes are already used in clinics for examining the small intestines, while using active capsules in different parts of GI
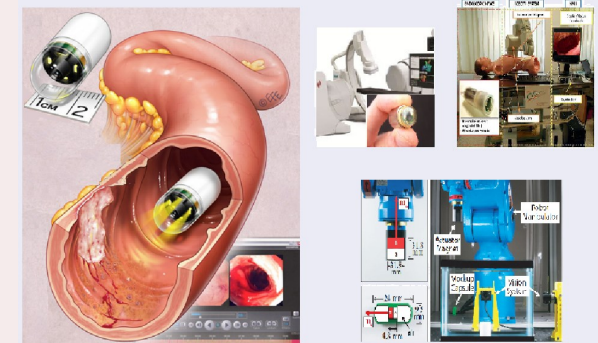
tract, especially in the stomach, have a lot of challenges

Computer Aided Diagnosis

Recently, computer-aided diagnosis (CAD) has become a part of the routine clinical work for detection of different diseases. This technique can help the physicians to accurate detection of disorders and taking biopsies from suspected regions of GI tracts.