Automated Objective Structured Assessment of Meta-competencies (A-OSAM) in Laparoscopic Cholecystectomy Using Computer Vision

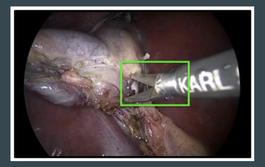
Why?

There is a need to expand surgical workforce to adequately address basic healthcare demands. Both the United States and the rest of the world suffer from shortfall in surgical professionals. Traditionally, surgical training mirrors the ancient master/apprentice model which is an effective, but time consuming, process. While video reviewing is commonly embraced in professional sports, its usage in surgical training remains rare.

How?

By using computer vision, we aim to create a rapid, accurate, and automated assessment/feedback model, to accelerate training. The target group is surgical residents performing their first 25 laparoscopic cholecystectomies, however, we strongly believe all residents, in any stage of their training, can benefit from the it. Our goal is to significantly reduce the time and number of procedures required for trainees to attain surgical competency.

After every procedure, the trainee will have access to a video library and will receive an objective evaluation of every step of the case, paired with relevant video clips from their own procedure to watch.

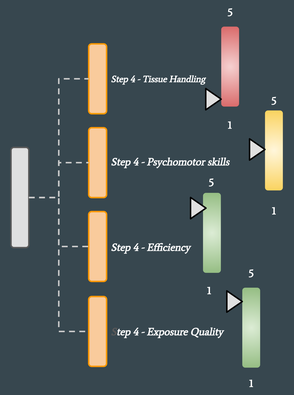


Procedural Steps

1. Exposing Gallbladder
2. Dissection of Hepatocystic triangle
3. Ligation & Division
4. Gallbladder Dissection
5. Removal of Gallbladder

Meta-competencies (1-5)

1. Tissue Handling
2. Psychomotor Skills
3. Efficiency
4. Dissection Quality
5. Exposure Quality
6. End Product
   a. Critical View of Safety
   b. Liverbed



Multiple meta-competencies are automatically rated on a scale (1-5) for each procedural step.

–> A step-based comprehensive assessment of the technical performance

Poor (1)	Fair (2)	Good (3)	Very Good (4)	Excellent (5)
Struggles with movement coordination and overshooting of instruments for most of the step with tentative, awkward movements.	Some proficiency with use of instruments but often struggles with movement coordination.	Developing proficiency in use of both instruments, sometimes struggles with movement coordination.	Smooth use of instruments, rarely with minor deviations in movement coordination and visualization of tips.	Fluid movement with both instruments, always keeping tips in view.

Psychomotor Skills - Typical scoring rubric

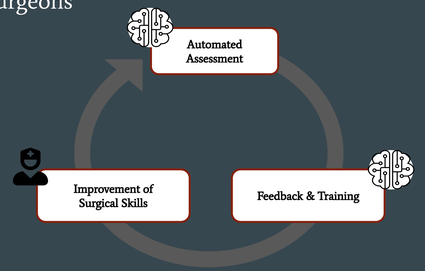
Preliminary Results

Development of a new rubric assessment tool, specifically constructed for a computer vision model, based on important surgical meta-competencies and predefined end products.

Data Acquisition
> 250 procedures - manually annotated by surgically trained MDs

Future Work
- Add another 1000 annotated laparoscopic cholecystectomies
- Continue training, validation, and refinement of the computer vision model

Pilot Study
- Planned for Q4 2024
- Trainees at educational institutions in the US, Mexico, and Europe
- Collect feedback and suggestions for improvement from trainees and attending surgeons



Perspectives

- Continue to collect videos from all institutions participating in the program
- Compile videos into a user-friendly video library, readily accessible for both trainees and supervisors
- Expand to other laparoscopic procedures (i.e appendectomy, right-sided hemicolectomy)

By liberating trainees from total dependence on human (attending) raters the assessment/feedback procedure becomes more robust, more reliable, and more objective. This will give the trainee an opportunity to develop their surgical skills and accelerate their learning curve. In the everyday life of busy clinic, highlighted competencies accompanied with relevant shorter video clips can be efficiently reviewed manually. Before entering the OR, the trainee will also have access to watch specific highlighted cases performed by attending surgeons in their institution.

SOAR

Surgery Objective Analysis and Review

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