

Surgical Data Challenges & The Critical View of Safety Challenge

Jennifer Eckhoff, MD

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Boston



What is a Data Challenge?

Competition

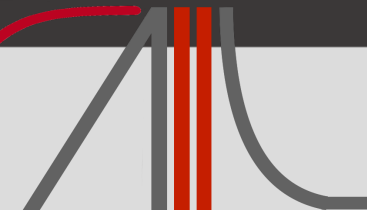
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img, video, object, embed {  
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}  
iframe { max-width: 100% }  
blockquote {  
  font-style: italic;  
  font-weight: normal;  
  font-family: Georgia,Serif;  
  font-size: 15px;  
  padding: 0 10px 20px 27px;  
  position: relative;  
  margin-top: 25px;  
}  
blockquote:after {  
  position: absolute;  
  content: "";
```

```
a:link { -webkit-tap-highlight-color:  
img, video, object, embed { blockquote:a  
max-widt!  
height: aut
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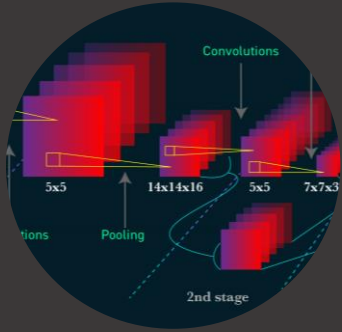
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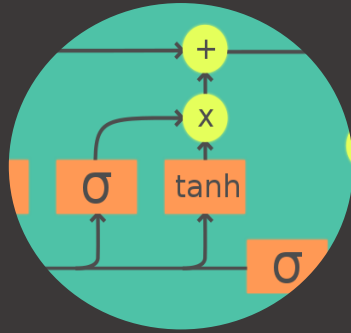
What is a Data Challenge?



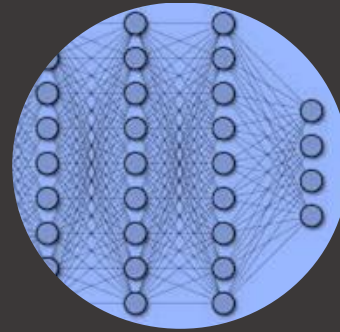
Purpose of a Data Challenge



Convolutional Neural Networks (CNN)



Long Short-Term Memory (LSTM)

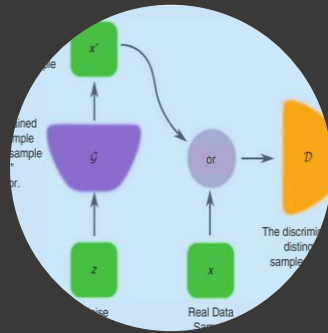


Fully Connected Networks

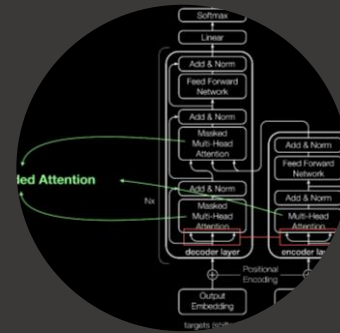
Explore
computational
solutions



Graph Neural Networks (GNN)



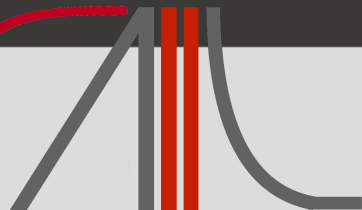
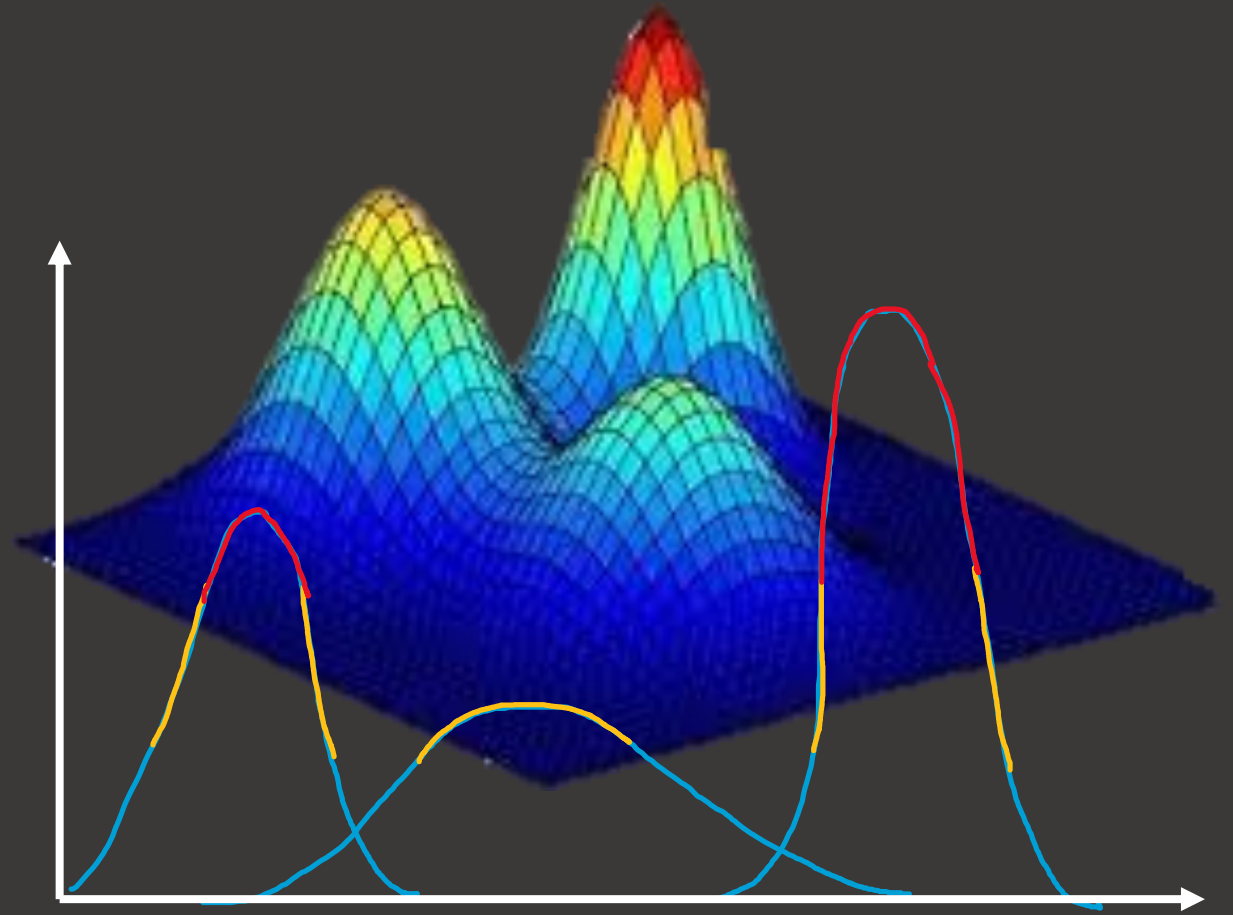
Generative Adversarial Networks (GAN)



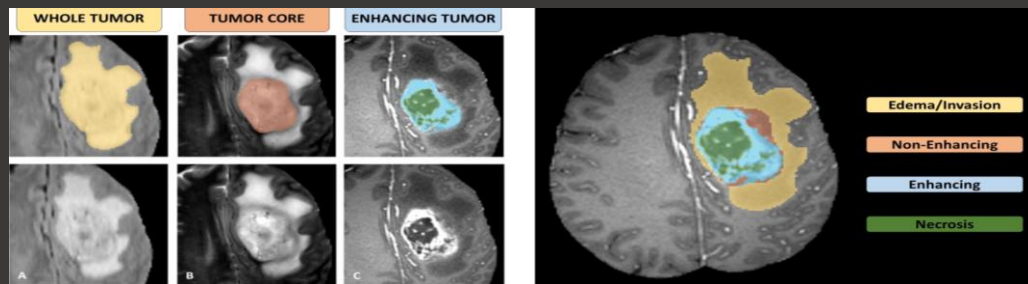
Transformers

Purpose

Explore solution space between data & target task distribution

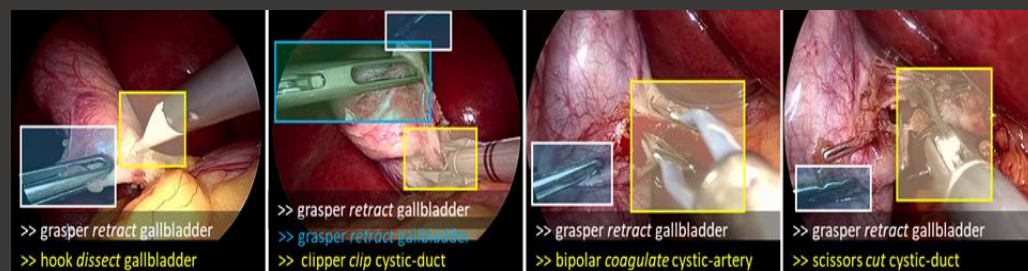


Examples in Medical Imaging



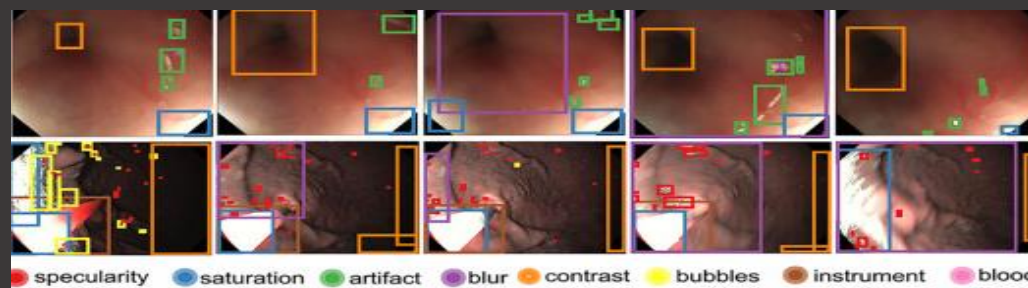
Multimodal Glioblastoma Segmentation

BraTS : 1704 MRI scans, 660 patients



Action Triplet Detection

SATD : 45 videos, approx. 7 hours



Polyp Detection

EndoCV 2.0 : 450 images / 10 videos, approx. 90 minutes

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Key Components of a Data Challenge



Data



Annotations

TRAINING
DATA

EVALUATION
DATA

Splits



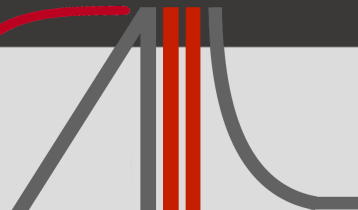
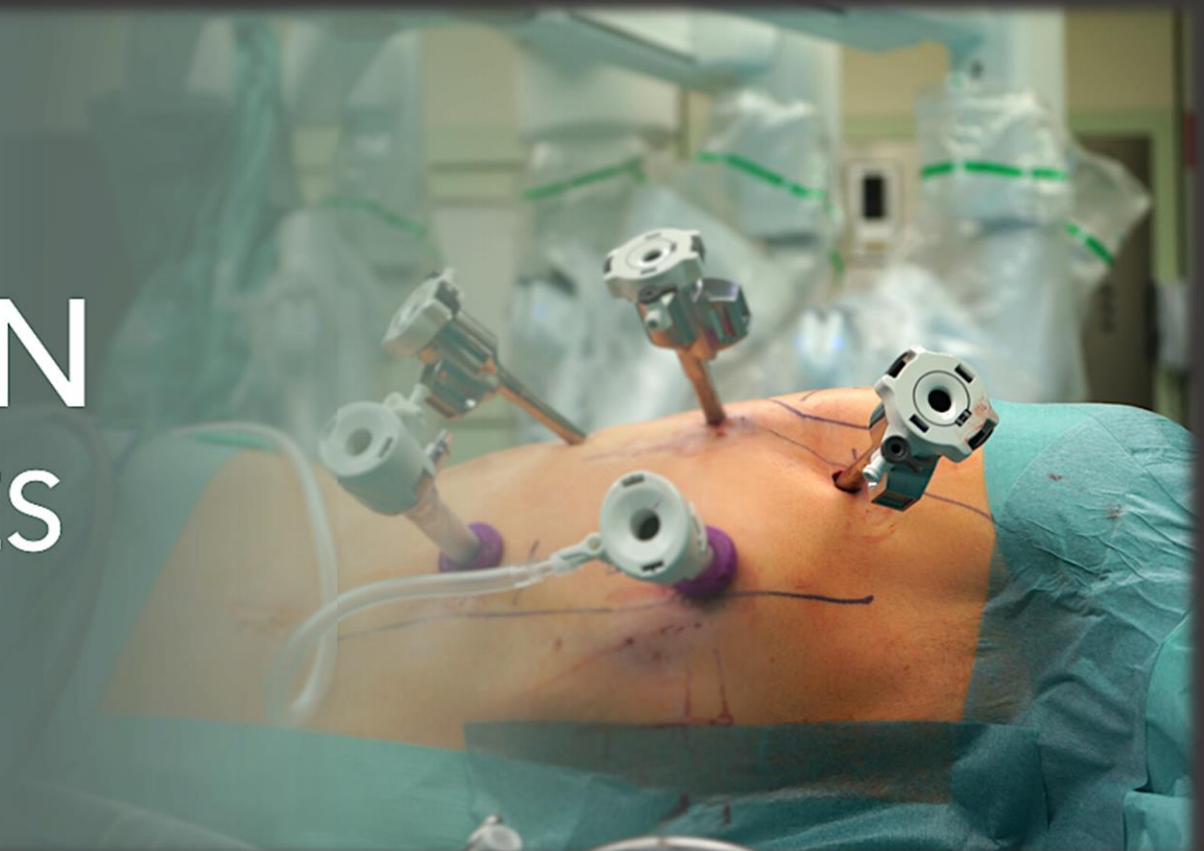
Metrics

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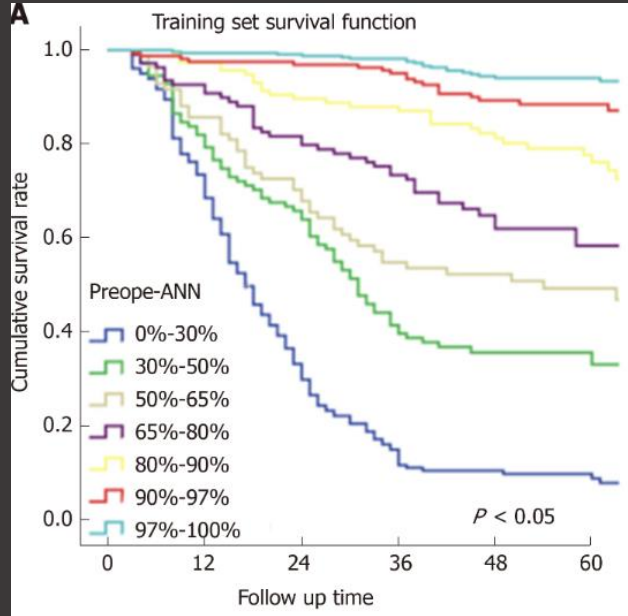
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Perspective

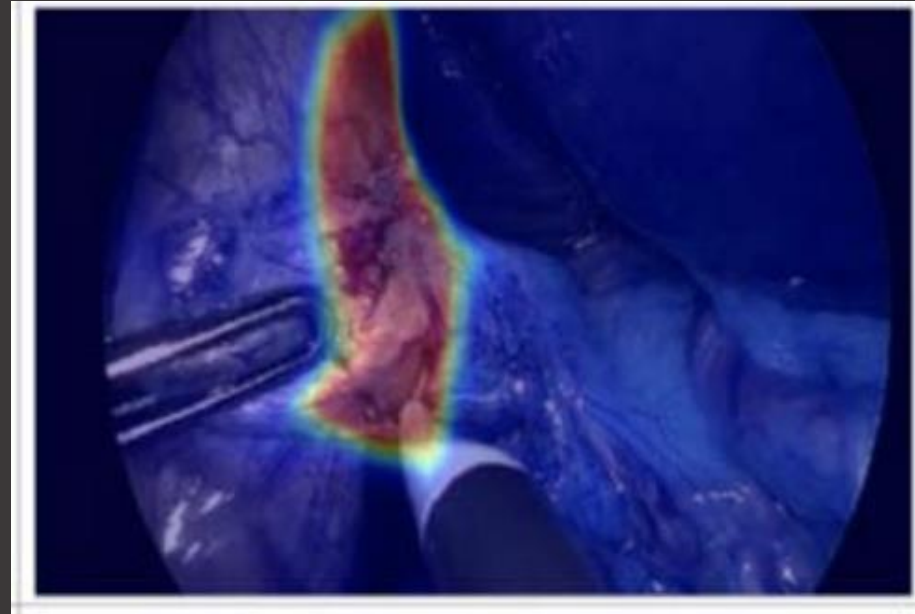
> 21 MILLION
MIS PROCEDURES



Perspective



Kudo et al. 2021.



Madani et al. 2022.

EMR System

The image shows a screenshot of an EMR system interface. On the left, there is a silhouette of a person. To the right, there is a form titled 'Personal Information' with fields for Name, Gender (Male/Female), Date of Birth, Marital Status (Single/Widowed/Married/Divorced), Blood Type, Nationality, Occupation, Telephone No., Email Address, and Address. Below the form, there are buttons for Home, Back, Next, and Done. On the left side of the form, there are tabs for Personal Information, Social Information, Diagnosis, Treatment, Medical History, Calendar/ Appointment, and Insurance.

Ren et al. 2021.

Preoperative

Intraoperative

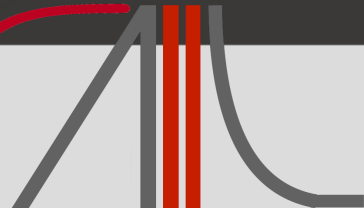
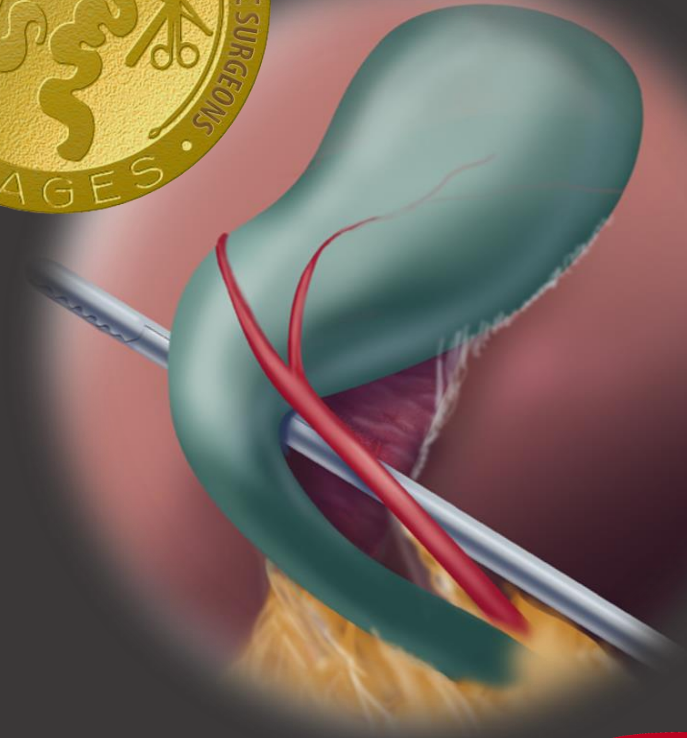
Postoperative

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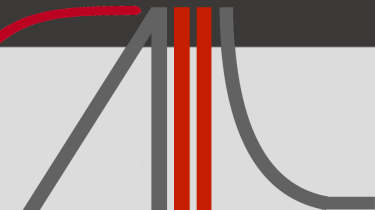
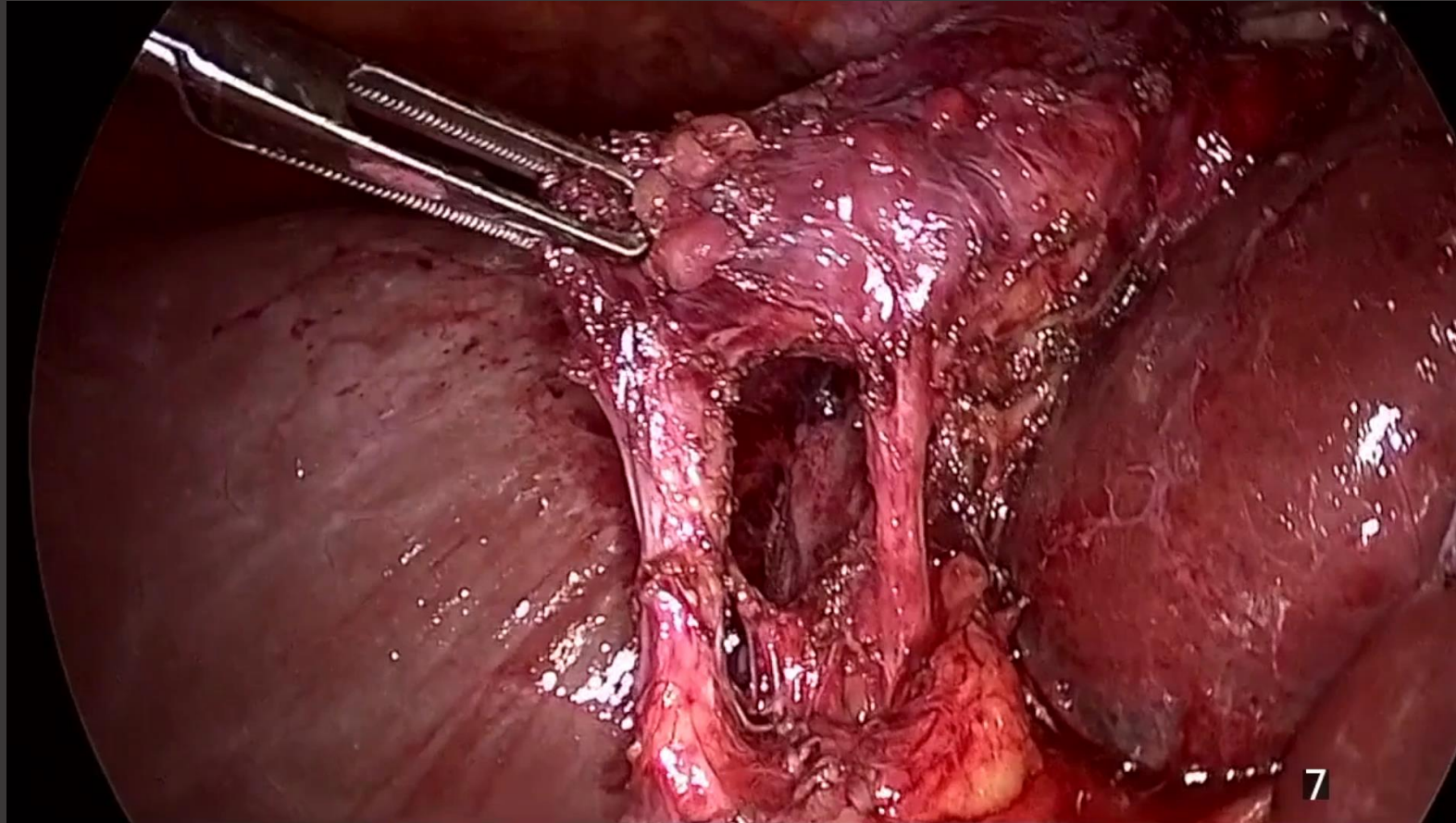
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The Critical View of Safety Challenge

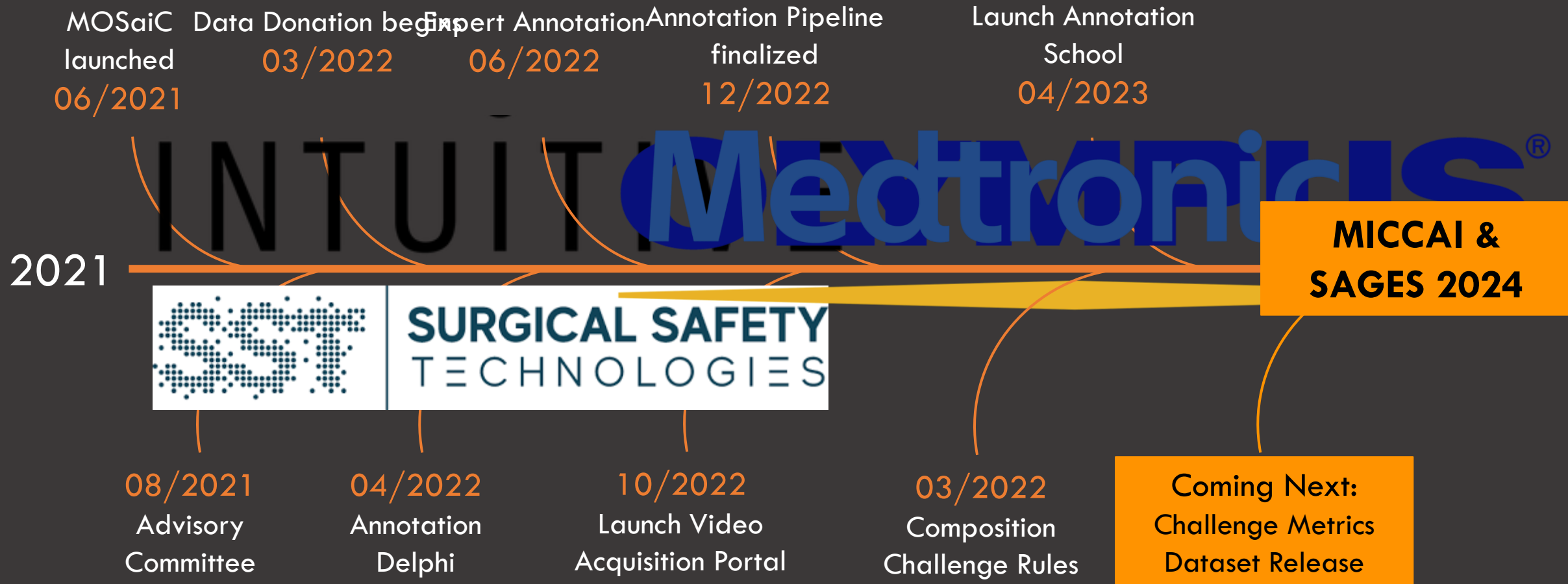
- 500.000 lap Chole cases annually
- 0.5 -1.5% Common Bile Duct Injuries
- Critical View of Safety = universally recognized safety measure
- The SAGES Safe Cholecystectomy Program



The Critical View of Safety Challenge



Timeline

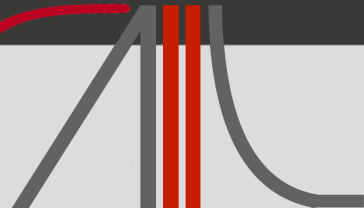


The Critical View of Safety Challenge



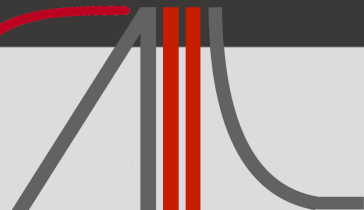
www.cvschallenge.org

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Data Donation

- Quantity
 - Accuracy of AI
- Diversity
 - Generalizability of AI
- Distribution
 - Close to real-world
 - Should be reasonable (no extreme distributions)



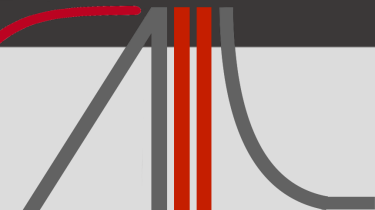
Data Donation



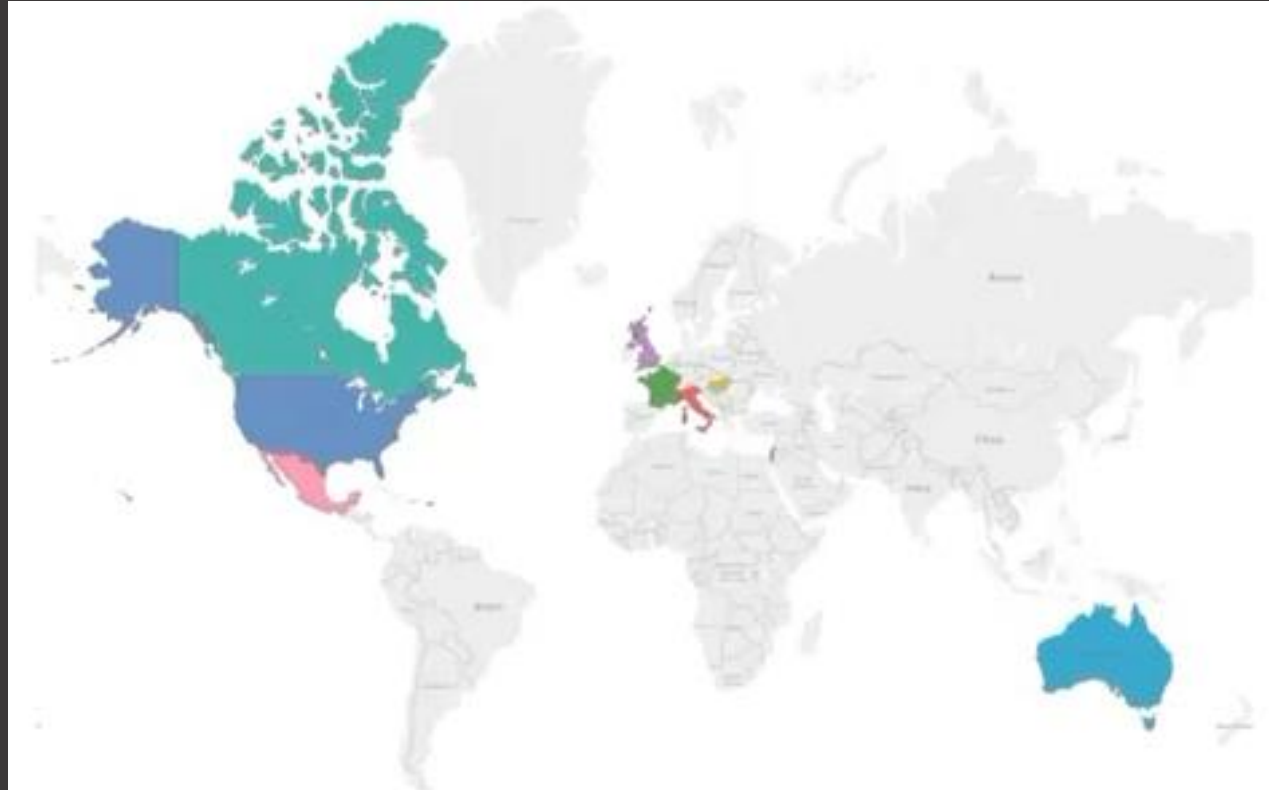
SAGES Video Acquisition Portal

powered by SST

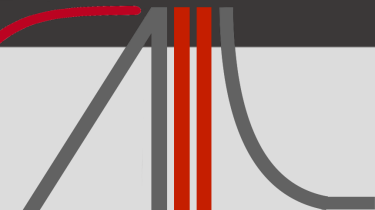
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The Critical View of Safety Challenge

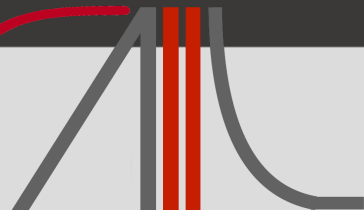
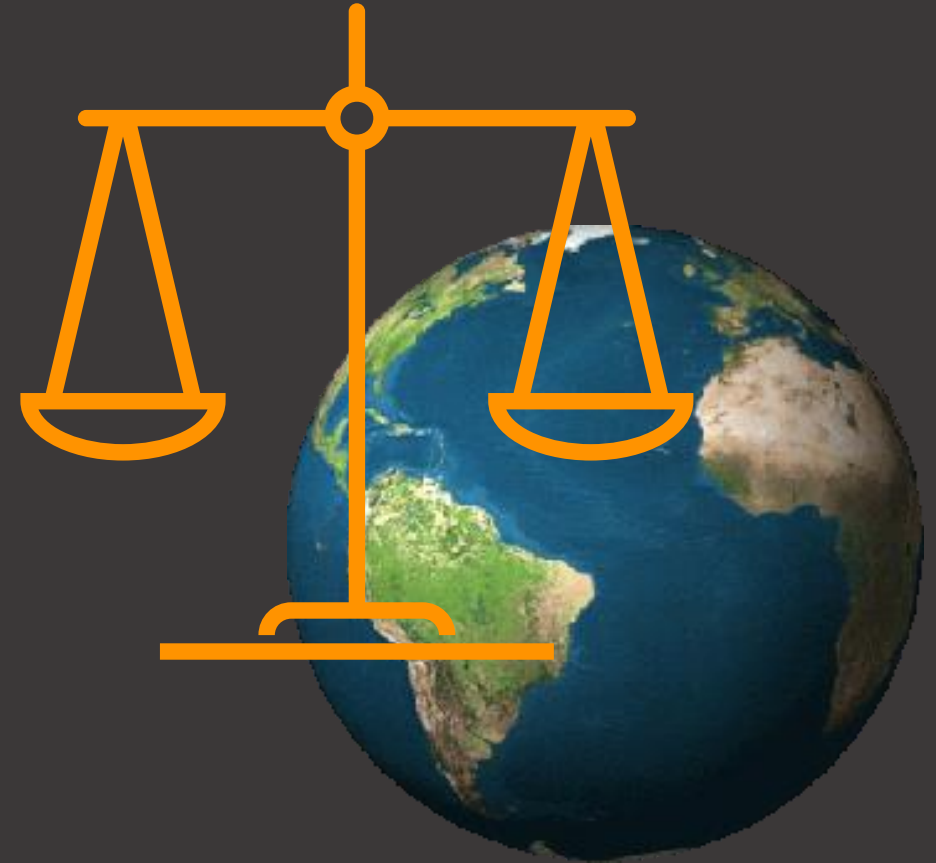


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Other Considerations

- Legal
 - Data Donation
 - De-identification
 - Regional Differences
- Ethical
 - Inclusivity
 - Fairness

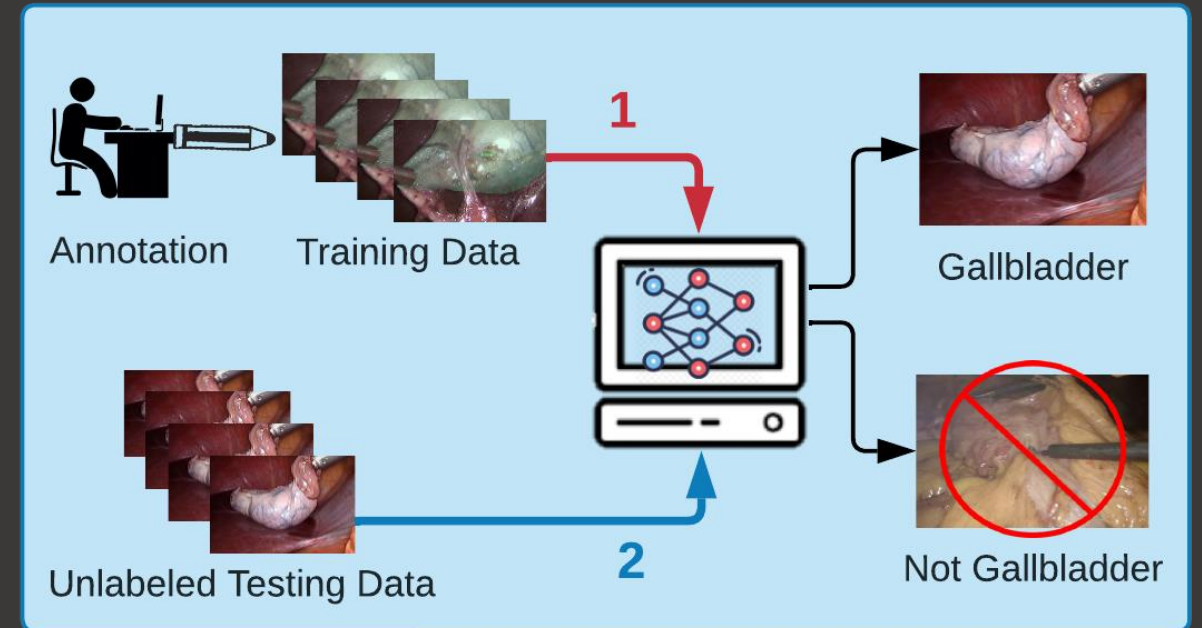


Annotation

- Annotations should be
 - Consistent
 - Objective
 - Universally reproducible
 - Clinically valuable
 - Machine readable

Good Surgeon \neq Good Dataset

Clinical perception \neq Machine perception



Supervised Machine Learning

Annotation in MOSaiC

Annotation Trial
By: Jean-Paul Mazellier
Supervised

In this group, you will have opportunity to test the interface and get used to the annotation. This video will not be used for the challenge. Consider it as a playground.

Annotation School
By: Jean-Paul Mazellier
Supervised

After reviewing the Annotation School Video and CVS Annotation Protocol (found in Instructions Tab) please complete the Annotation (Video, Frame and Annotation Difficulty) of these 60 Videos as your Annotation School. The administrators will review your annotations and grant you access to the full dataset.

Instructions
By: Jean-Paul Mazellier
Supervised

Here you can find MOSaiC video tutorial.

VIDEOS (5) | BOOKMARKED VIDEOS (0)

Curriculum_03.mp4

Curriculum_05.mp4

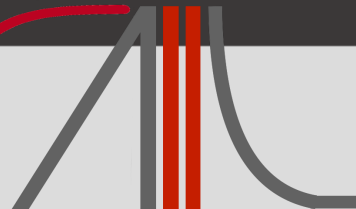
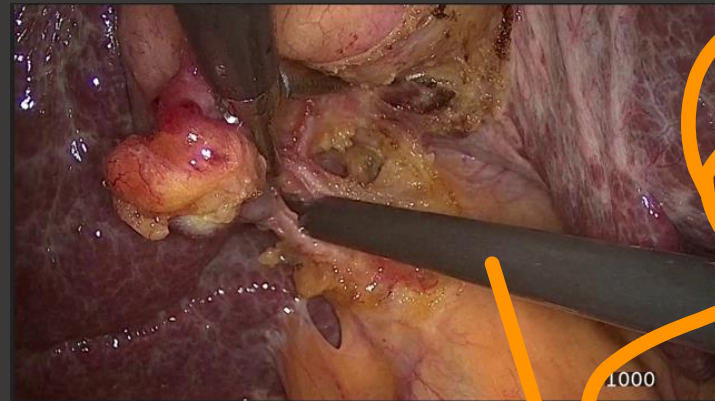
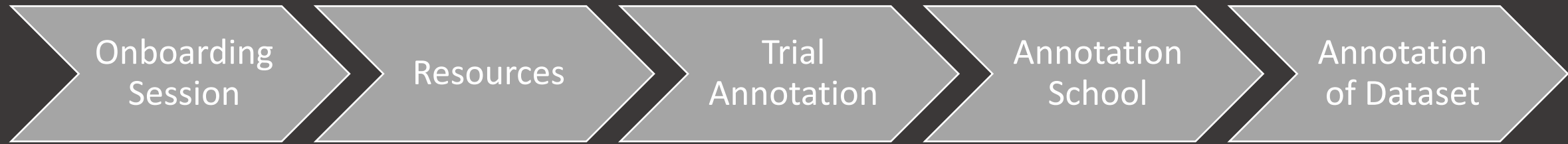
Curriculum_01.mp4

Software Experience, Trial & Error

Proficiency based Progression

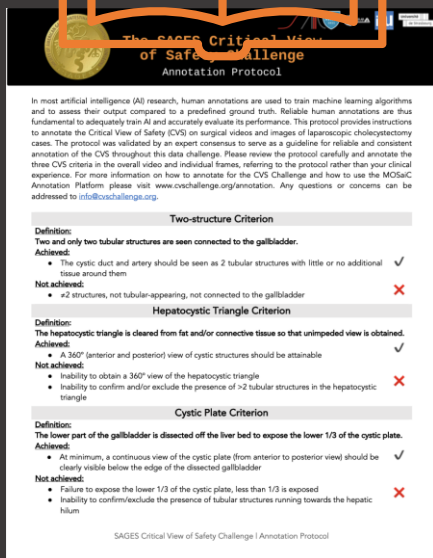
Annotation Protocol & Video

Annotation



Resources

Protocol



Video



Live Assistance



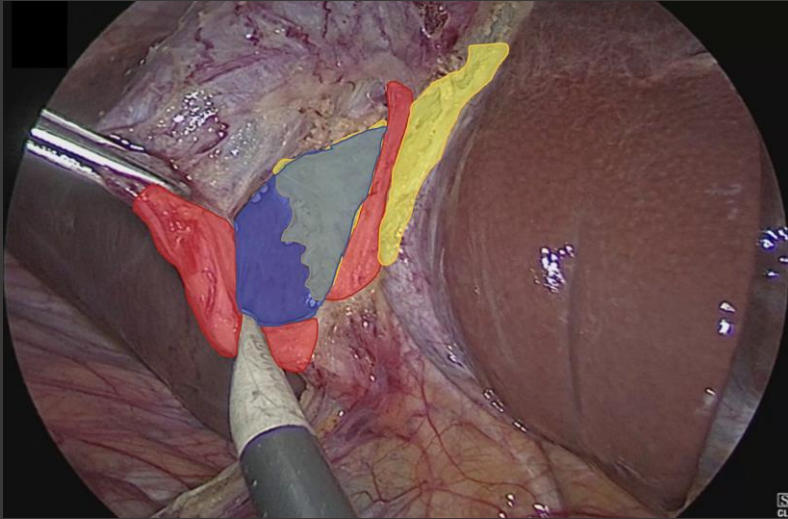
info@
cvschallenge.org

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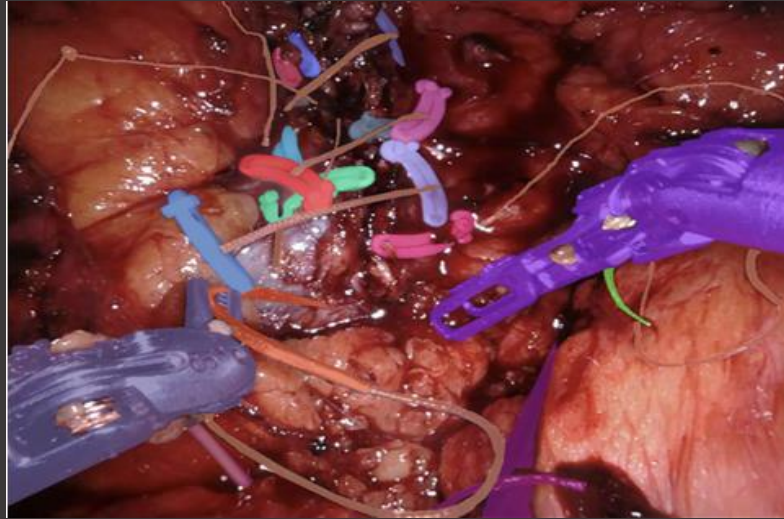
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Perspective

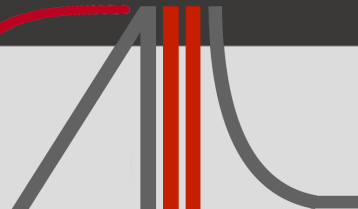
Other Applications



Other Procedures



Real Time Deployment





Thank you!

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