Arthrex

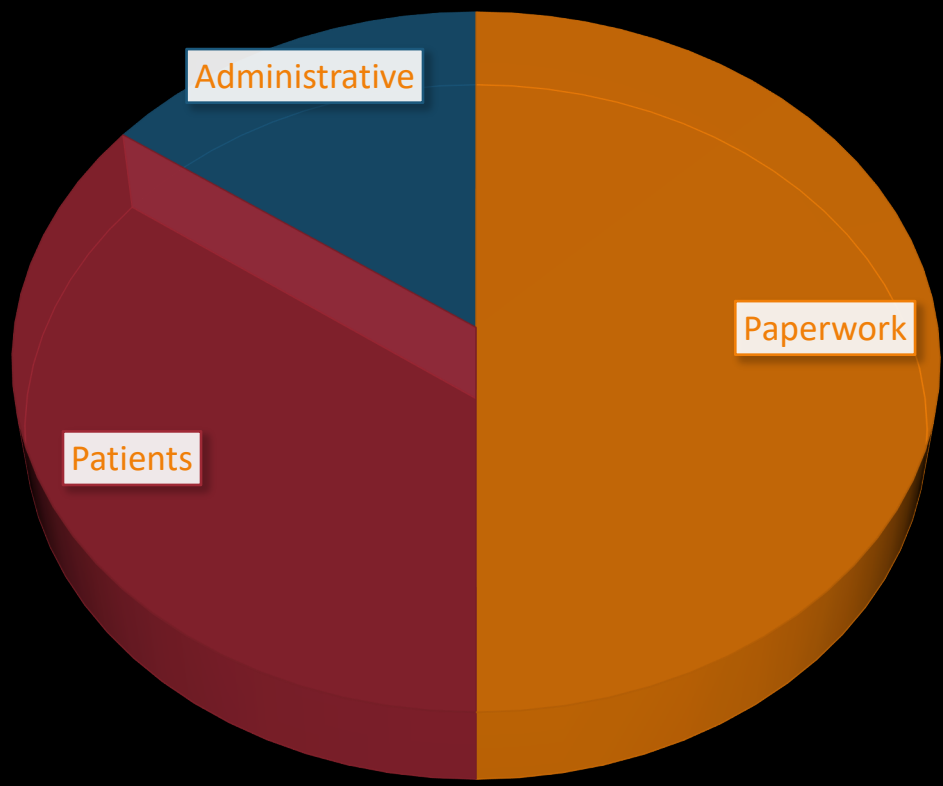
Brian
Sid
David
Ram
Andrew

ASSIST MD

Addressing the Issue

- Problem
  - Doctors spend too much time on paperwork
  - Paperwork compromises time spent with patients

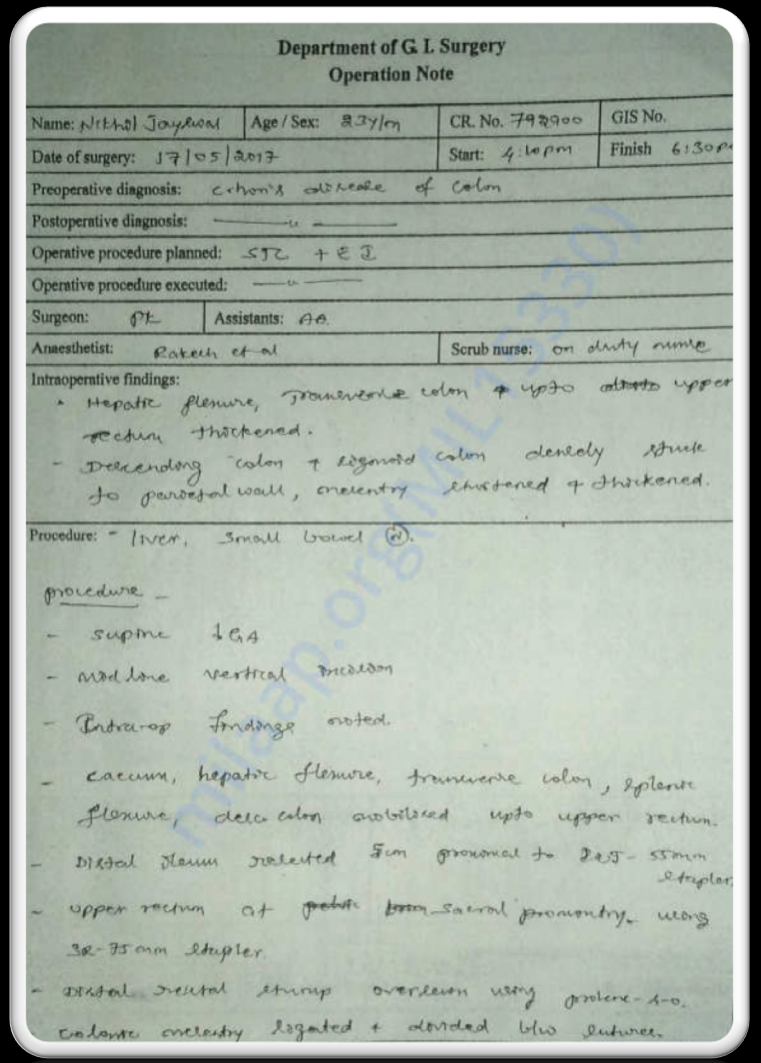
Data based on:
Forbes
New York Times
Health.edu
TheSurgicalLab.com



Current Problem with Doctor Paperwork

- Messy handwriting is dangerous
- 7,000+ deaths a year from misinterpretation

Data based on:
New York Times
TheSurgicalLab.com



Department of G. I. Surgery
Operation Note

Name: Nikhil Jayswal	Age / Sex: 23y/m	CR. No. 792900	GIS No.
Date of surgery: 17/05/2017		Start: 4:10pm	Finish 6:30pm

Preoperative diagnosis: Crohn's disease of colon

Postoperative diagnosis: —"—

Operative procedure planned: SJC + EI

Operative procedure executed: —"—

Surgeon: PK | Assistants: AA

Anaesthetist: Rakesh et al | Scrub nurse: on duty nurse

Intraoperative findings:
- Hepatic flexure, Transverse colon + upto upper rectum thickened.
- Descending colon + sigmoid colon densely stuck to parietal wall, mesentry shortened + thickened.

Procedure: - liver, small bowel (N).

procedure -
- supine ↓GA
- mid line vertical incision
- Intra-op findings noted.
- caecum, hepatic flexure, transverse colon, splenic flexure, desc colon mobilised upto upper rectum.
- Distal ileum resected 5cm proximal to IIJ - 55mm stapler
- upper rectum at sacral promontory using 3R-75mm stapler
- Distal rectal stump overseen using prolene-4-0. colonic mesentry ligated + divided b/w sutures.

milaap.org(ML13330)

Integrating a Solution

Automate Operative Report!

Result

- More time with patients and family
- Not as rushed
- No more Messy handwriting

Operative Report

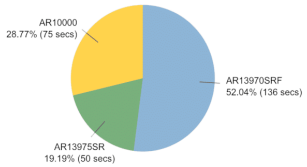
Surgery Information:

Patient Name: David Roster
Doctor Name: Brian Humphreys
Hospital Name: Valley Cottage
Procedure Name: Appendectomy
Time and Date of Surgery: March 3, 2019 4:00 pm

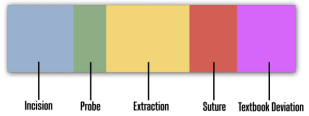
Surgery Event and Instrument Information:

Instruments Used: AR-13975SR AR-13970SRF AR-10000

Most Used Instrument: AR-13970SRF Least Used Instrument: AR-13975SR



Instrument Usage Pie Chart



Sequence of Events Graph

Surgery Narrative:

The surgeon performed an appendectomy. The surgeon started the procedure by performing an incision for 90 seconds using AR-13970SRF. Second, the surgeon did probing for 37 seconds using AR-10000. Third, the surgeon performed an extraction for 38 seconds using AR-10000 and AR13975SR. Fourth, the surgeon did a suture for 12 seconds using AR-13970SRF and AR-13975SR. Finally, an unexpected event occurred and the surgeon had to deviate from the textbook outline for the procedure. The incision, probing, extraction, and suture took more time to complete than the average time for each procedure in previous surgeries. Overall, the surgery was successful.

- *"Generating operative reports is the holy grail of medical tech industry"*

-Bruce Kennedy (VP of Tech at Arthrex)

ASSIST MD IS SHOOTING FOR THE STARS!

Assist MD wishes to automate Operative Reports

So this sounds pretty cool…

Let’s learn about surgery and the technologies used!

How is automating Operative Reports possible???

Textbook surgical knowledge

- All procedures can be described in a step by step sequence of events
- All surgical events/steps are preformed using a specific set of instruments

Computer vision

- Detect instruments on surgical table with camera (these are instruments not in use)
- Extrapolate instruments that are in use

Sequence Mapping

Input

Output

Probing

Input

Output

Extraction

Input

Output

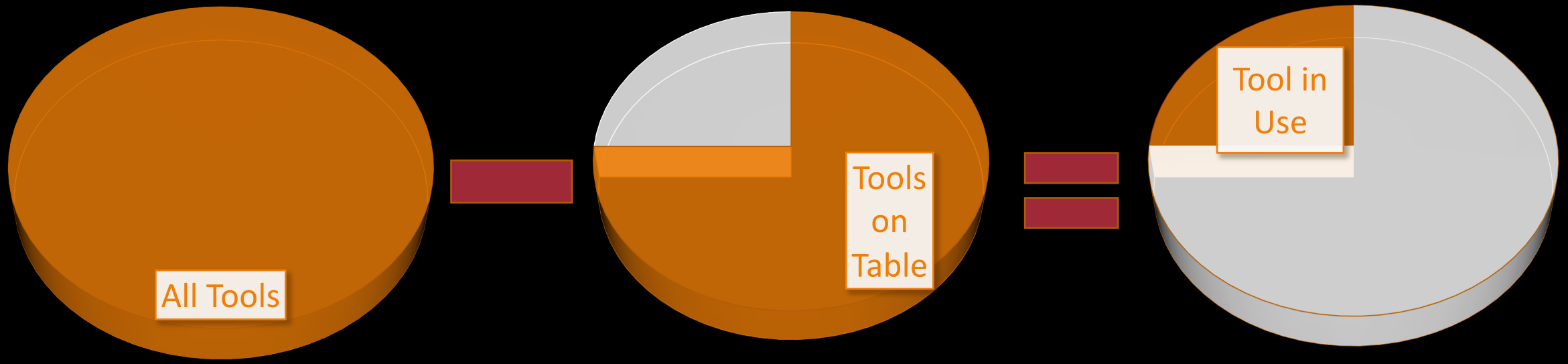
Incision

Input

Output

Suturing

Instrument Elimination



Detection Software

Trained using YOLO v2
An opensource classifier

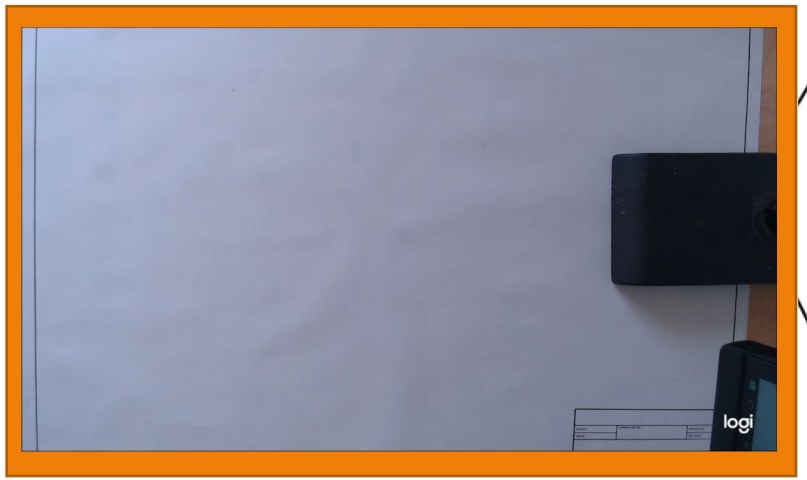
Deployed in DARKFLOW

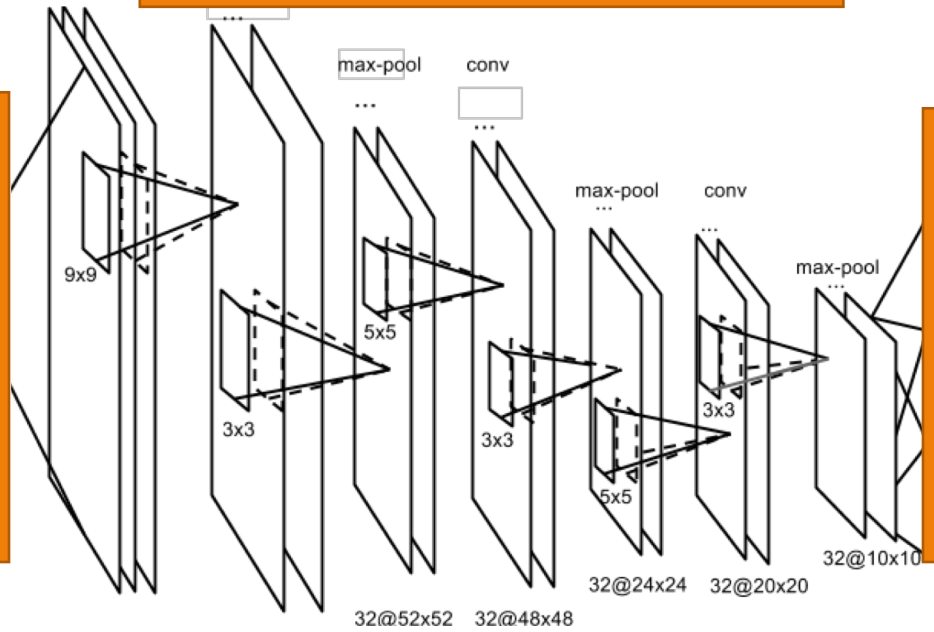
- A TENSORFLOW wrapper for darknet models.
- Runs in Python

Simply pipe the STDOUT to our app.

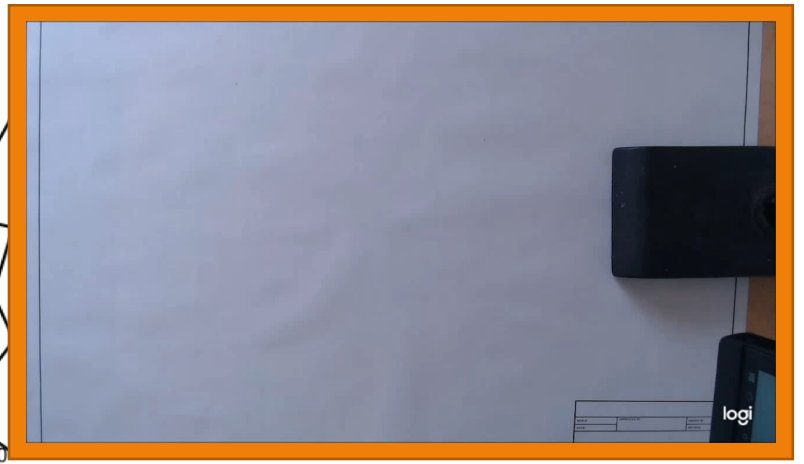
Input video stream

State of the Art Convolutional Neural Network





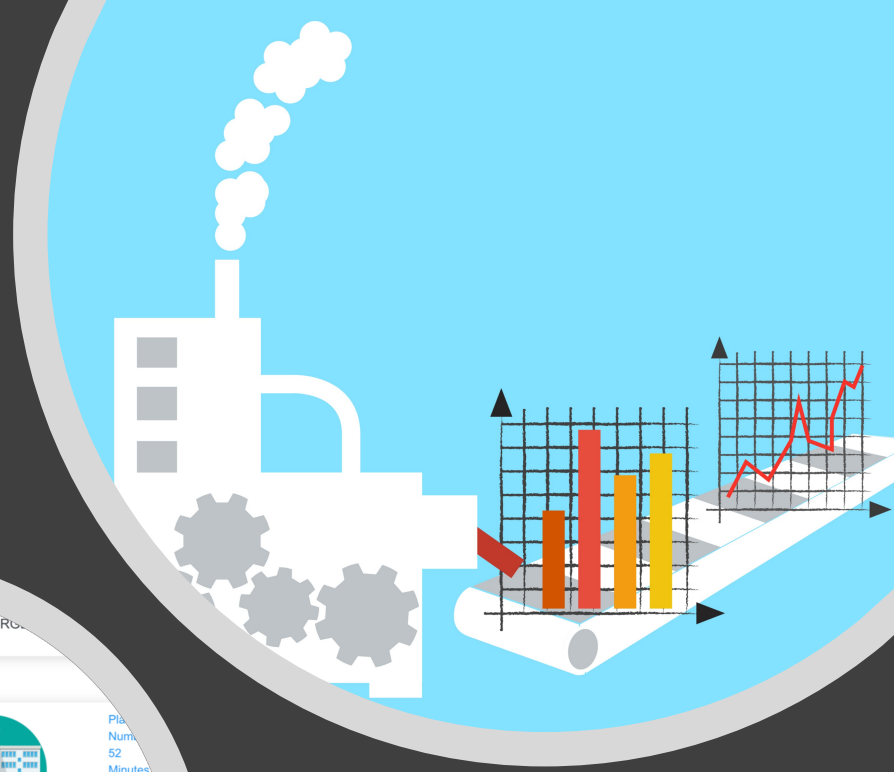
Output instrument detection



Instrument Detection

Building on the concepts

- We take the live surgery data
- We clean and process analytics
- We organize statistics into a friendly interface on our website



Video Stream

Content Manager

SQL Database

Web Interface

Performance Evaluation

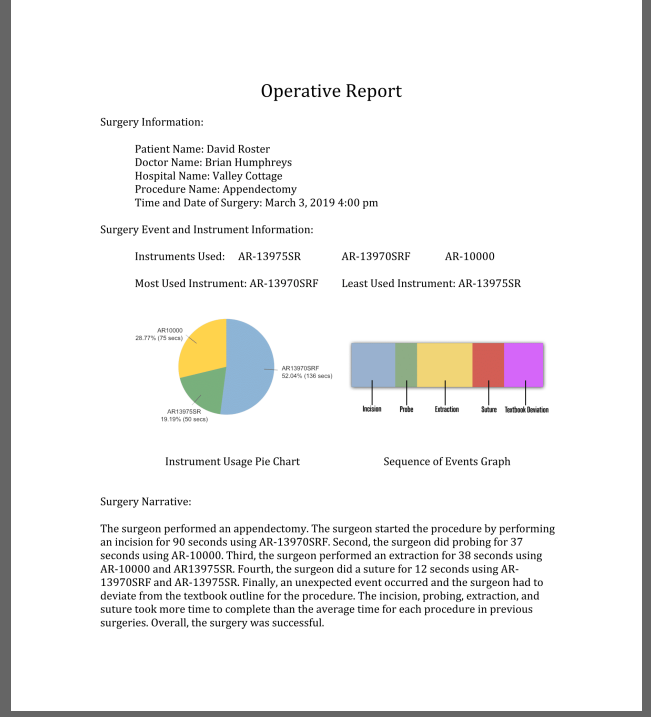
Predictive Analysis

Data Cache Server

Post Surgical Report

Data Analytics

- Filter out low confidence frames
- Log duration each instrument was used
- Map sequence of instruments to medical events
- Construct narrative for Operative Report



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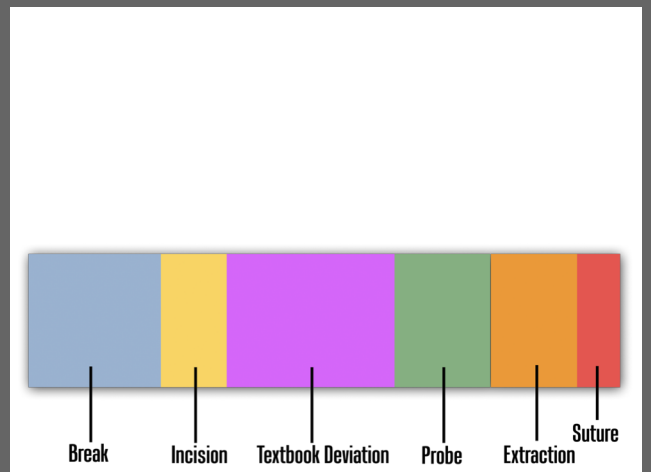
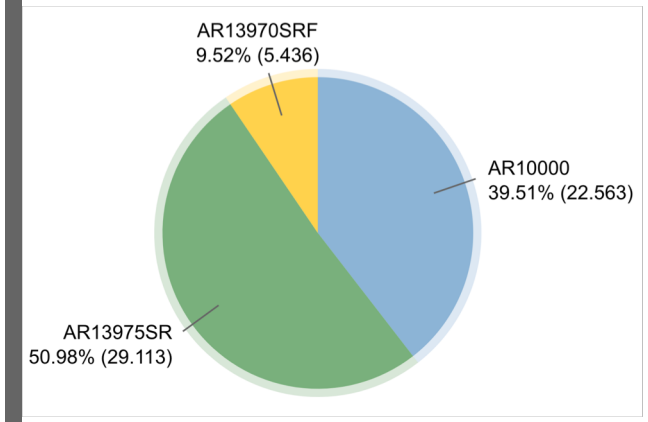
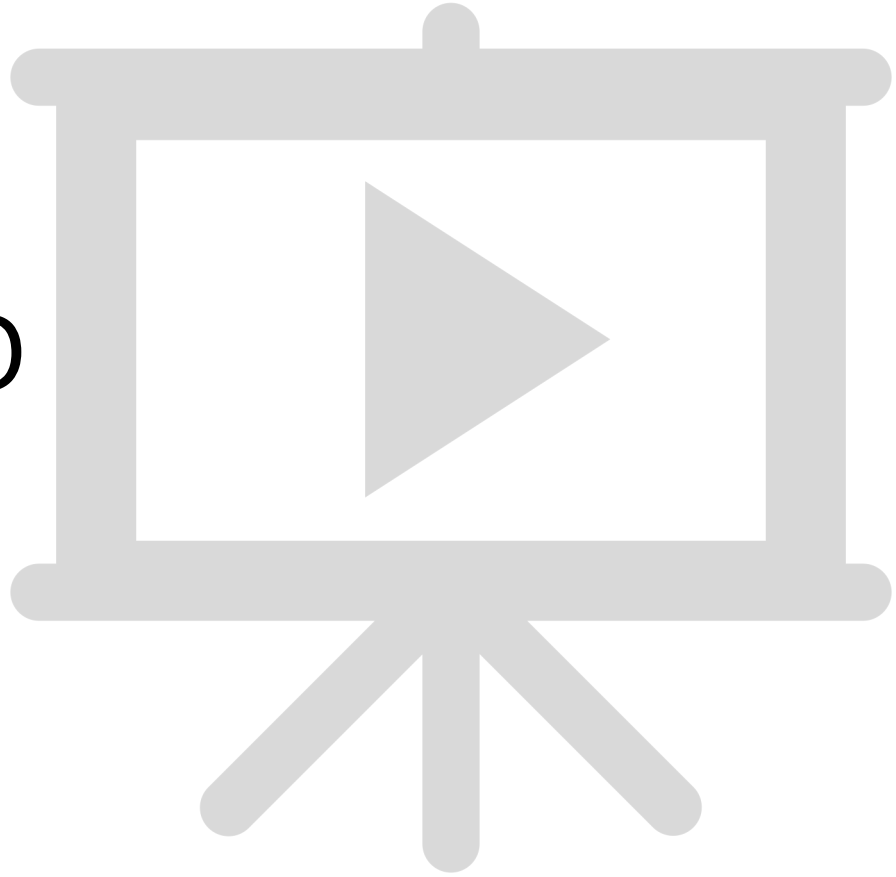


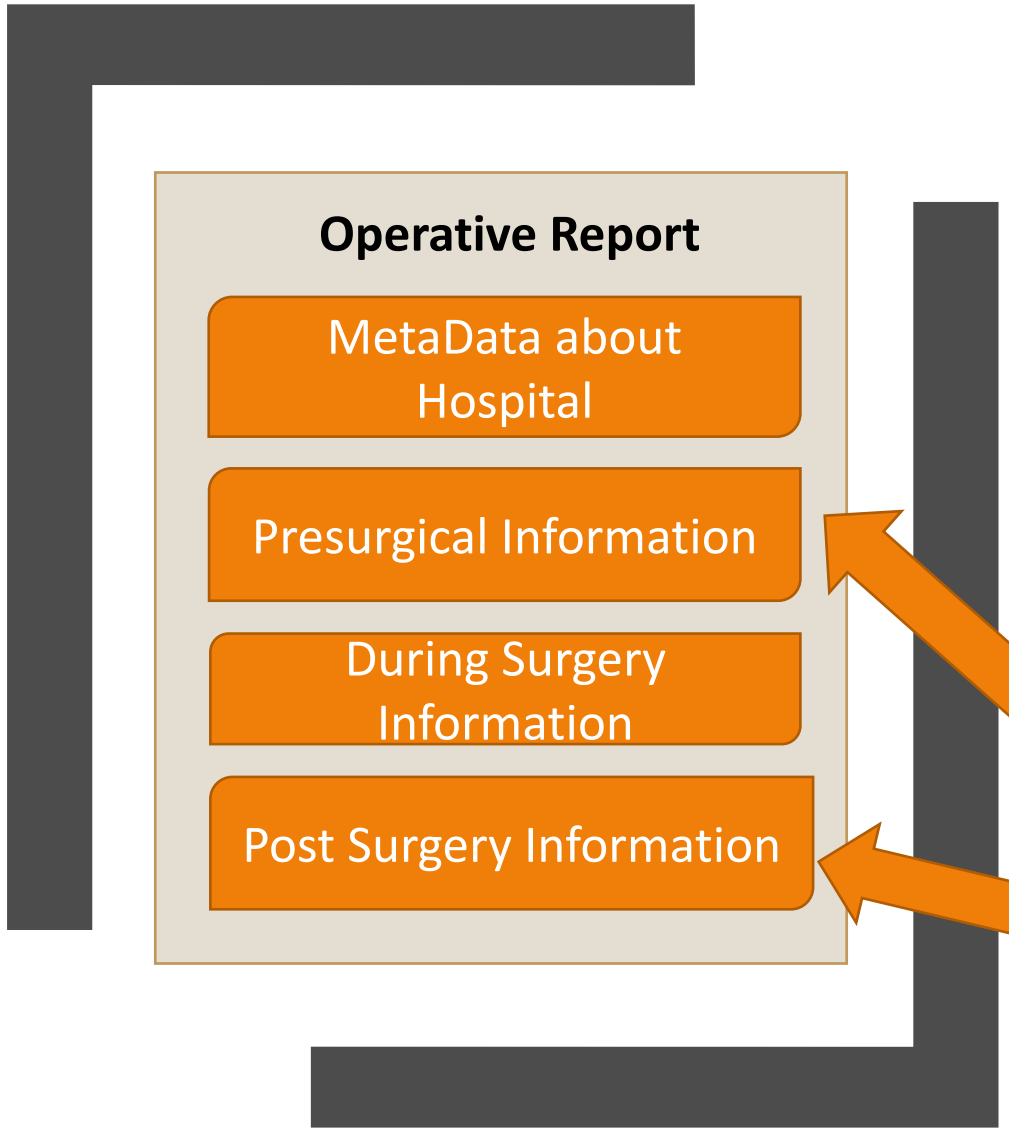


Now let’s demo the project …



We did a lot of work over these last two quarters

Our vison for the future



Vision

- What we currently do!
- What we envision we can do!
  - Smart room that logs events before surgery happens
  - Smart watch with biometrics scanning that logs patients recovery

Thank you audience for your time, you've been great!!

Thank you to Arthrex for partnering with UCSB Capstone and providing assistance throughout the journey to our group.

And a special thanks to Professor Krintz and Professor Bultan for the hard work they put into Capstone and dealing with us hooligans!

And did I mention the judges look great today (: