Assist-MD - Vision Statement

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What tasks will Assist-MD be able to perform?
- Videos that can play back specific events that took place during surgery based on specific keywords by autonomously break down surgical procedures into fundamental sub-procedures and tagging them (i.e. “Assist-MD, play back the 30 minute time frame of <patient’s name>’s shoulder surgery when joint caps were installed”)
- Data collected from the surgery would be analyzed in conjunction with real-time biometric data and compiled to study how the patient reacted to each action the surgeon took and be studied at a later date
- Post-surgery, Assist MD will compile highlighted events that took place (perhaps in PowerPoint slides) to be reviewed by a medical board

What tasks will Assist-MD not be able to perform?
- Identify Medical personnel, as this is not HIPPA compliant and violates some rules
- Give feedback on the how well or bad the surgery went
- Will not measure biometrics. It will only analyze existing biometrics
- Identifying the medical scene
- No spoken commands. Most likely will find videos based off of keywords.

Why is this technology Important?
Assist MD will not only assist in making medical jobs easier and reducing the amount of paperwork but will give doctors the ability to make advancements in their respective fields. The insights Assist MD will provide patient health and biological responses to surgical procedures which will allow for faster improvement in a doctor’s surgery performance.

What problems are Assist-MD going to solve?
- Event-specific video playback and biometric correspondence will allow for better and more time efficient performance evaluation by giving medical personnel detailed information on how patients reacted to specific events (i.e. how did the patient's heart rate respond when muscles near some nerve were cut)
- Event-logging will create more useful documentation and indexing of surgical procedures, techniques, and traditional practices
- Denser data about a given surgery (perhaps an experimental surgery) will give doctors more insight on how to better approach the next procedure, allowing them to more quickly improve their performance and therefore heal more patients, faster
- Medical personnel portfolios compiled (i.e “Doctor <doctors name> has performed 12,254 surgeries, 1,553 heart surgeries, 334 heart stent installments, has cauterized 2,560 arteries, sutured 20,120 wounds, and has made 509 resuscitations)

How are these problems addressed today?
Traditionally, the medical community today creates a predefined outline for how the surgery will be conducted and what techniques will be used. A post-surgical report is constructed by the
medical staff afterward on how closely the procedure mimicked textbook cases. This is all done through paperwork or voice annotation which is manually indexed and filed along with the surgical report.

**Milestones Outlined**

The first milestone will be to get an end to end web app going. Perhaps a picture can be sent from the front end and AWS captures the request and sends back an answer as to what the object is. The next milestone will be to analyze a constant stream of data coming from a webcam. After that, we could then build a time series of when instruments were utilized.

Sub-procedure could then be recognized using pattern recognition between the procedure and textbook procedures. After some, or all of this information is analyzed, we can finally build out the data presentations. For this, we think it best that a web dashboard is built to view this compiled data and event time series, organized much like patient files would be organized. The final piece here would be to compile surgical reports and PowerPoint summaries.

**Challenges**

Probably one of the most challenging tasks in this project will be to identify and tag events on specific parts of a video feed. It will be hard to extrapolate certain actions and events without knowing the exact medical scene.

**Technologies Utilized**

Sagemaker will be used for all computer vision and pattern recognition algorithms, with docker applications stringing the outputs together to compile the data. Biometric data will be simulated using a smartwatch. Videos of instruments on treys will be fed into an agent that orchestrates throughput to SageMaker. We are also hoping to get access to a camera feed from an actual operating room. Time series charts and other data collected will be presented on a live frontend website, built using React-Native that leverages scripts to allow for the option to download summaries as PowerPoints or PDFs. Requests will be sent to AWS using axios, a Javascript library. PowerPoint will be used in the automatic compilation of surgical data from the website and be made downloadable.