

Intraoperative Fiducial Tracking in TORS

CIS II Project #15

Mini Check Point Presentation

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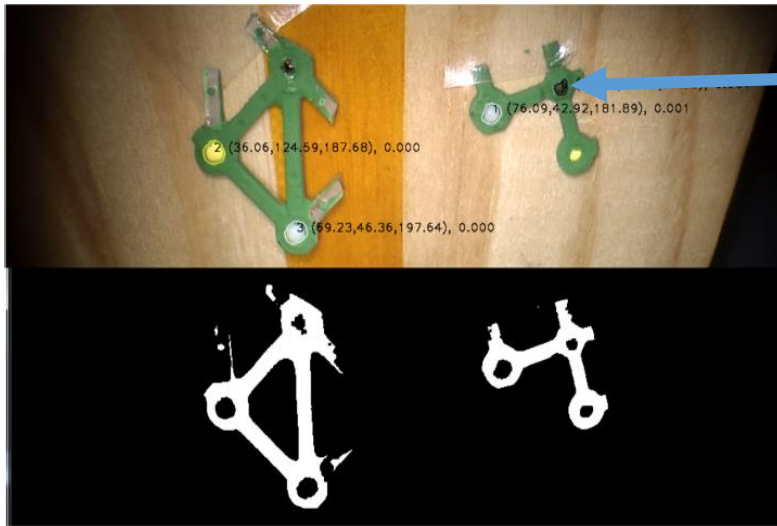
05/01/14



Project Overview

- Project Goal:

The goal of this project is to design and implement an intraoperative fiducial tracking algorithm in TORS that can accurately track the fiducial under the endoscope.

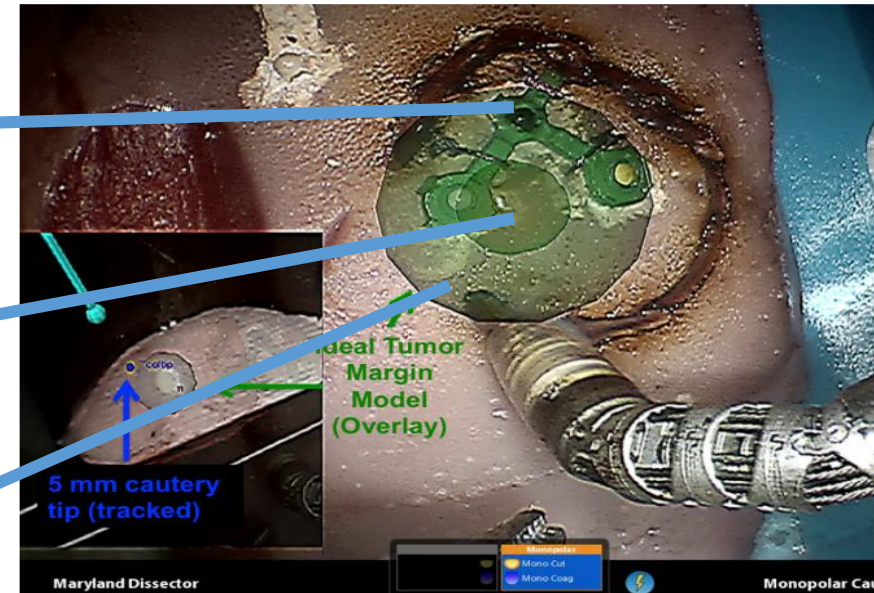


Images courtesy of Wen P. liu

Fiducial

Ideal virtual tumor estimated according to the position of the fiducial

Ideal virtual tumor margin



Project Overview (Continue)

- Project Background :
 - TORS: TransOral Robotic Surgery
 - The base of tongue tumors has become a significant health care concern. Because most base of tongue tumors are buried deep in the musculature of the tongue, when doing the transoral surgery, expert surgeons always rely on experience to remain correctly oriented with respect to critical anatomy.
 - Such practice leaves considerable room for improvement and has brought TORS. It is a minimally invasive surgical intervention for resection of base of tongue tumors.



<http://www.ohsu.edu/xd/health/services/comprehensive-robotics-program/surgical-services/transoral-robotic-surgery-tors.cfm>

Project Deliverables

- **Minimum (Planned 4/10):** → Might be delayed to 4/15 **Done 4/22**
Implementation of fiducial segmentation of the recorded endoscopic images **Done 4/14**
Implementation of fiducial tracking of the recorded stereo video **Done 4/22**
- **Expected (Planned 4/22):** **In Progress**
Real-time fiducial tracking ~~under the robot endoscopic camera~~ **Done 4/25**
Optimization of the implementation to confirm better result than the already existed tracking method
Still working on this
- **Maximum (Planned 4/29):** → Might be delayed to around 5/3 **Would delay or drop**
A more accurate tracking under intraoperative scenario **might not do this**
~~Video recording for the intraoperative fiducial tracking process~~ **won't do this**
~~A new fiducial for better and more accurate tracking~~ **won't do this**

Project Deliverables (Continue)

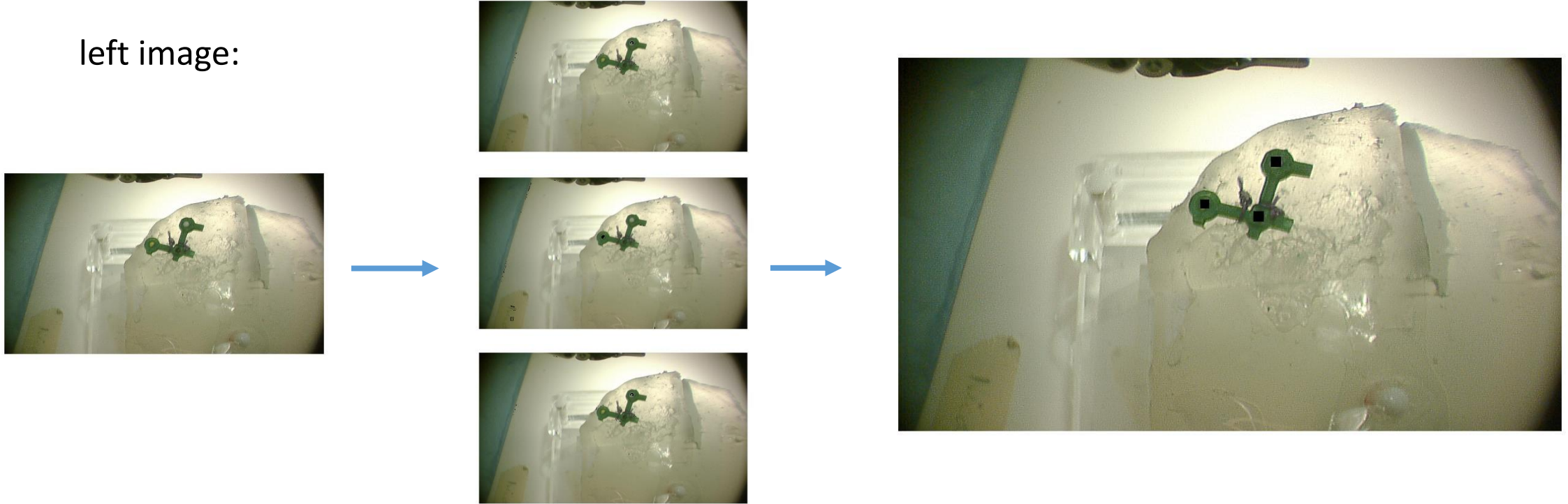
- A big change about the deliverables:
 - will not do within C++ and CISST, but instead use Matlab only
- due to time management and underestimating the difficulties of the project
- which means most work before around March 20 is useless



Project Deliverables (Continue)

- Fiducial detection of the recorded endoscopic images

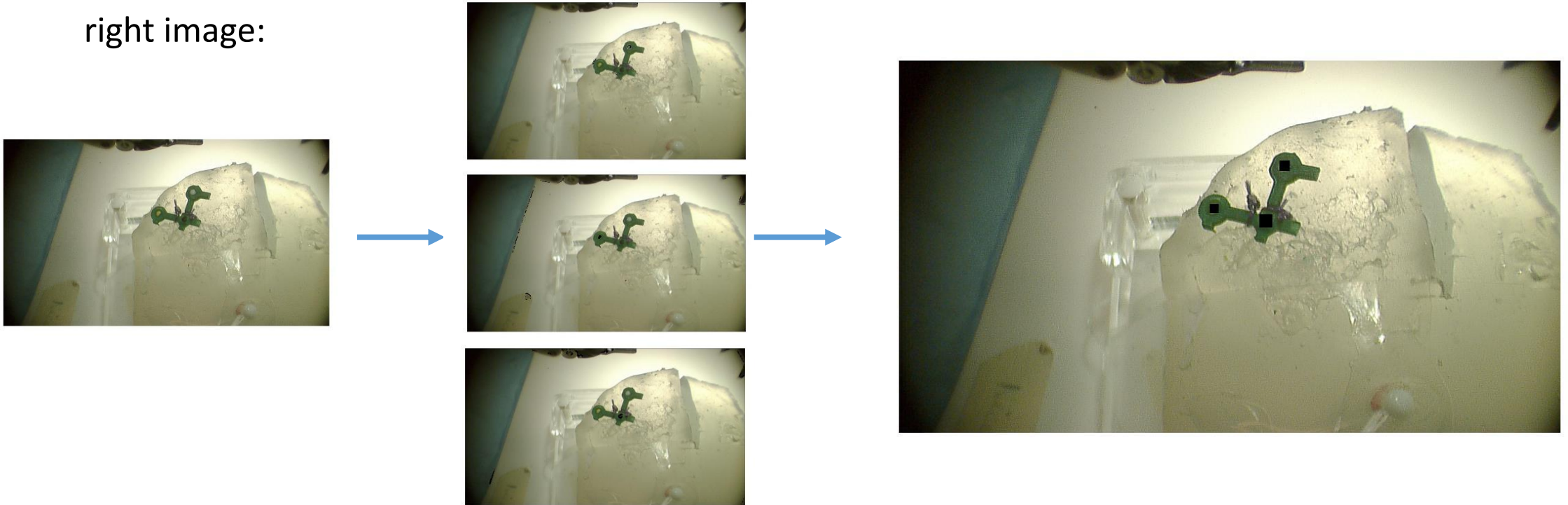
left image:



Project Deliverables (Continue)

- Fiducial detection of the recorded endoscopic images

right image:



Project Deliverables (Continue)

- Fiducial detection of the recorded endoscopic images



Then use binocular vision can reconstruct the tumor in the endoscopic scene

Project Deliverables (Continue)

- Fiducial detection of the recorded endoscopic images

- Some Problems:

The threshold of color chosen is not robust enough, so it doesn't work for the video

The fiducial group selection algorithm is not robust enough and would result in false fiducial detection in the video

Project Deliverables (Continue)

- Fiducial detection of the recorded endoscopic images
- Some false examples when applied to the video:



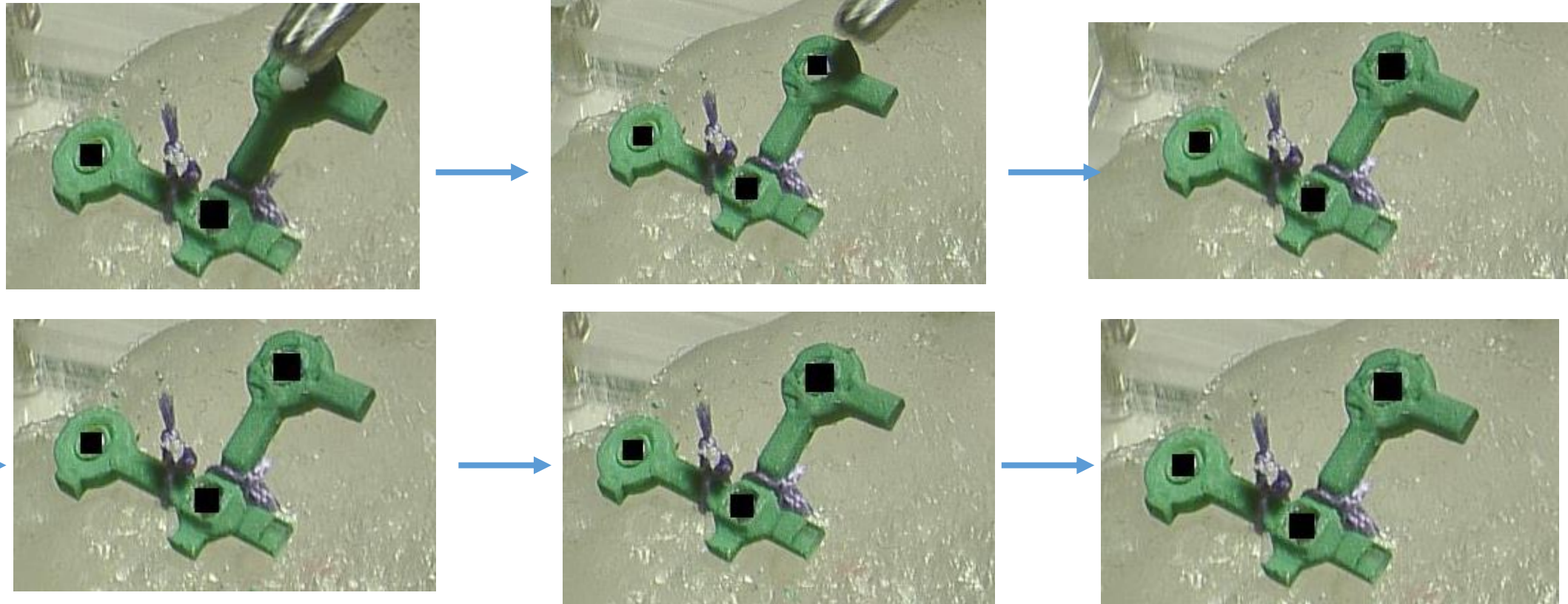
Project Deliverables (Continue)

- Fiducial detection of the recorded video
- modified the threshold function: absolute value → relative value
- modified the fiducial group selecting algorithm → more strict requirements
- using Kalman Filter



Project Deliverables (Continue)

- Fiducial detection of the recorded video



Frame
52-57

Project Deliverables (Continue)

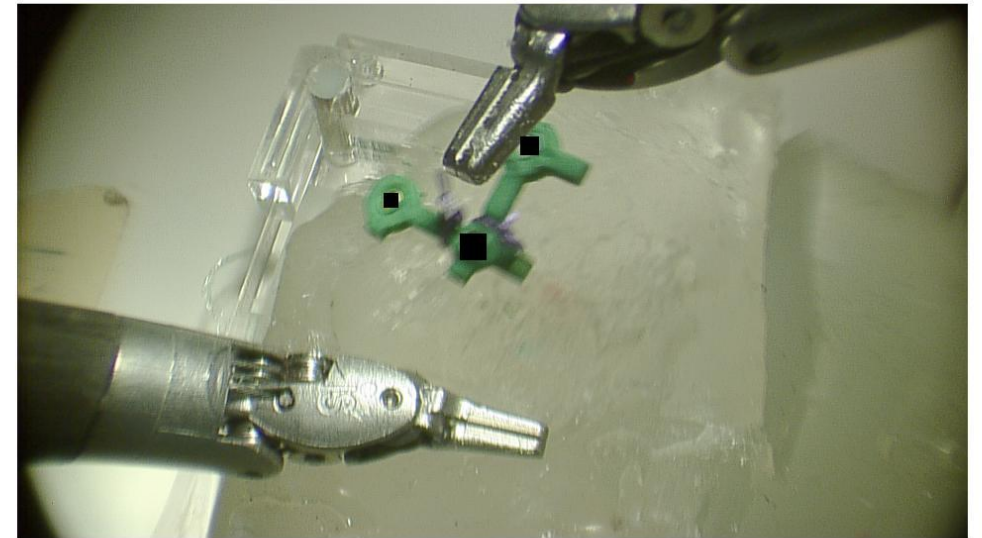
- Fiducial detection of the recorded video



Images were blurred, Frame 61-63

Project Deliverables (Continue)

- Fiducial detection of the recorded video
- some wrong examples, which still being worked on mainly because of illumination and occlusion, and the discontinuity adds difficulties for the Kalman filter



me 47-48

Project Deliverables (Continue)

- Fiducial detection of the recorded video
- some more wrong examples:
mainly because of illumination and occlusion



Frame 46-47

Project Deliverables (Continue)

- Fiducial detection of the recorded video
- some more wrong examples, which still being worked on mainly because of illumination and occlusion



Frame 50-51

Project Key Dates

- Feb. 20: Complete Software Installation: Visual Studio 9.0, CMake, SVN, cisst saw library, OpenCV **done**
- Feb. 21: Begin algorithm design **done**
- Feb. 22: Begin software and cisst study **begun and required part done**
- Feb. 23: Begin new fiducial design (optional, might do it after testing the implementation on the robot) **begun and dropped**
- March. 1: Print the new fiducial (optional) **dropped**
- March. 7: Algorithm study and design complete **done (modifying some parameters)**
- March. 10: Begin algorithm implementation (coding) with C++ **begun and paused**
- April. 10: (Minimum deliverable) Complete algorithm implementation **done**
- April. 12: Begin testing on the robot **dropped**
- April. 22: (Expected deliverable) Optimization and begin testing on the robot **first half in progress, second half dropped**
- April. 29: (Maximum deliverable) Optimization under intraoperative scene **haven't begun yet**
- May. 9: Post session and project report



Project Management

- Weekly meeting with Wen through the completion of the project.
Every Monday afternoon. With occasional exceptions.
Meet more frequently recently.
Keep contacting by emails.
- ~~Bi-weekly~~ Scheduled meeting with Anton after the beginning of implementation.



Thank You

