

The Knotorious Five

October 31st - November 6th

Client: Dr. Margene Anderson, Dr. Sara Colopy, Dr. Paul Merkatoris

Advisor: Professor Wally Block

Team Members:

Madison Michels (mmichels2@wisc.edu), Leader

Lucy Hockerman (lhockerman@wisc.edu), Communicator

Presley Hansen (pmhansen3@wisc.edu), BWIG

Sadie Rowe (skrowe2@wisc.edu), BPAG

Kate Hiller (khillier@wisc.edu), BSAC

Problem Statement:

In veterinary training, mastering the skill of applying appropriate suture tension is essential for successful wound closure and patient recovery. However, novice practitioners often struggle to judge the correct amount of force needed, leading to either insufficient tension or excessive tension, which can cause plastic deformation of the suture material or tissue damage. Currently, the evaluation of suture technique relies heavily upon subjective instructor feedback, lacking objective, real-time metrics to guide learners. This gap hinders consistent skill development and increases the risk of procedural errors. There is a critical need for a real-time suture tension measurement and feedback system to help students learn to apply optimal tension, prevent material or tissue compromise, and improve surgical outcomes through data-driven training.

Brief Status Update:

This week, the team presented our designs at show and tell where a few suggestions were provided. First, we were told of a suturing club on campus that might be able to help create knots or test our device. Additionally, we discovered a software within Matlab that creates a website for the data our force sensing resistor would collect to be able to show to the user. Lastly, we were given professors and classes that relate heavily to our project and can guide us through the image training process.

Team Goals:

- In the upcoming week, the team plans to meet with the client to confirm the knot classifications and begin training the model on those images. Using these images, we will train the classification model. After obtaining different accuracy scores and information on the model, we can bring it to professors to help us refine and evaluate our model.

Individual Accomplishments:

- Lucy: This week, I finished sorting the unclassified images into tight and loose folders. I communicated with the client to find a time to meet and verify the knot classifications. Additionally, I spent time researching and testing out various ways to automatically upload photos from a camera. The best technique found was to connect an iPhone to screen sharing systems on a laptop and take screenshots off a live feed.
- Presley: This week I attended show and tell and met with the team to discuss a plan of action. I researched ways to connect live feed from a phone to a computer so screenshots can be taken and automatically applied to the AI model.
- Maddie: This week I attended show and tell and sorted images into tight and loose folders. I also created confusion matrices and calculated F1, precision, accuracy, and recall scores for the ResNet and VGG models.
- Sadie: This week, I organized the classified images in preparation for client review. I met with the client to review images and better understand what adjustments need to be made to the existing set of images prior to training. I also coordinated pickup of additional suture materials to expand the dataset.
- Kate: This week, I attended show and tell and a client meeting. From the meeting, I learned that we need to photograph new suture images differently (from the side) and reclassify our current images. I started looking into how to build an app using Swift that could integrate our AI model.

Individual Struggles:

- Lucy: I am struggling to find simple and inexpensive methods that can upload high-quality images of knots into our model.
- Presley: I am struggling to determine if the magnification from a phone will be clear enough for the AI model to determine if the knot is tight enough.
- Maddie: I am struggling to understand how we will get pictures from the camera to the model.
- Sadie: I am struggling to determine the best method to input images for analysis
- Kate: I am struggling with figuring out the best method of uploading the image of the suture to the software and providing quick feedback.

Individual Goals:

- Lucy: Next week, I hope to decide on the best camera option/method for our initial prototype and meet with a professor for model design advice. Also, tie more knots to complete our dataset.

- Presley: Next week, I hope to help the others with rebuilding the data set as necessary and exploring more ways to build an app or finding a method to get photos to the computer AI model in real time.
- Maddie: Next week I hope to meet with a professor to gain insights on our model design and find a testing method for the model.
- Sadie: Next week, I plan to rebuild the dataset based on our client meeting, and ensure all images are ready for use.
- Kate: Next week, I hope to tie sutures with the new suture material we will receive on 11/7 and photograph them to be used in the dataset for training/testing/validation. I also want to explore the website vs. app upload of an image to the AI model.

Project Timeline:

Week	Description	Status
9/5 - 9/11 Week 1	Initial research	Complete
	Client Meeting 1	Complete
	Team Meeting 1	Complete 9/12
	Advisor Meeting 1	Advisor did not attend
9/12 - 9/18 Week 2	Product Design Specifications	Due 9/16
	Team Meeting 2	Complete 9/18
9/19 - 9/25 Week 3	Design Matrix	Due 9/25
	Team Meeting 3	Complete 9/22 Complete 9/24
	Advisor Meeting 2	Complete 9/19
	Meeting with Dr. Numinkar	Complete 9/24
9/26 - 10/2 Week 4	Client Meeting 3	Complete 9/26
	Team Meeting 4	Complete 9/29 and 10/1
	Preliminary Presentation Review	Complete 10/1
10/3 - 10/9 Week 5	Preliminary Presentation	Complete 10/3 at 12:35 PM
	Preliminary Report	Due 10/8
10/10 - 10/16	Advisor Meeting 3	Scheduled for 10/10

Week 6	Team Meeting 5	Scheduled for 10/10
10/17 - 10/23 Week 7	Advisor Meeting 3	Scheduled for 10/17
	Team Meeting 5	Scheduled for 10/17
	Force Sensor Resistor Value Testing and Research	Goal by 10/17
	Calibrate Sensor	Goal by 10/17
	Determine Output Force Equation	Goal by 10/17
	MTS Testing	Goal by 10/17
10/24 - 10/30 Week 8	Advisor Meeting 4	Scheduled for 10/24
	Team Meeting 6	Scheduled for 10/24
	Add Visual Queue to Circuit	Goal by 10/24
	RoboFlow Model	Goal by 10/24
	MTS Data Analysis	Goal by 10/24
	Python Model	Goal by 10/24
10/31 - 11/7 Week 9	Show and Tell	Due 10/31
	Team Meeting 7	Scheduled for 10/31
11/8 - 11/14 Week 10	Advisor Meeting 5	Scheduled for 11/08
	Team Meeting 8	Scheduled for 11/08
11/15 - 11/21 Week 11	Advisor Meeting 6	Scheduled for 11/15
	Team Meeting 9	Scheduled for 11/15
Thanksgiving Break 11/22 - 11/28		
11/29 - 12/5 Week 13	Final Presentation	Due 12/05
12/6 - 12/12 Week 14	Final Report	Due 12/10
	Advisor Meeting 7	Scheduled for 12/6

	Team Meeting 10	Scheduled for 12/6
12/13 - 12/18 Week 15	Advisor Meeting 8	Scheduled for 12/13
	Team Meeting 11	Scheduled for 12/13
Winter Break		

Expenses

Item	Description	Manufacturer	Mft Pt#	Vendor	Vend or Cat#	Date	QTY	Cost Each	Total	Link
Force Sensor Resistor	Force sensor that outputs resistance in a voltage divider circuit (2 in pack)	Haosie?	N/A	Amazon Prime	N/A	10/1	1	\$7.59	\$7.59	Link