The Knotorious Five

February 5 - February 13

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
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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 took better, more specific pictures of knots. We then created a larger dataset of augmented images to perform K-Fold validation. We communicated with Dr. Peter Adamczyk to schedule a Raspberry Pi meeting. Lastly, the team determined required Raspberry Pi materials and sent them to the client.

Team Goals:

- Next week, the team hopes to be finished with training the new model and begin prototyping with our Raspberry Pi components.

Individual Accomplishments:

- Lucy: This week, I increased our original data set by tightening additional sutures and capturing more knot images. I uploaded approximately 100 new images including tight

and loose knots. I communicated with the client to coordinate ordering the Raspberry Pi materials and emailed Dr. Adamczyk to schedule a meeting with the team.

- Presley: This week, I went to Wendt commons with Kate and discussed Raspberry Pi options in stock on campus. After discussions with the team, we decided to order a Raspberry Pi kit online as well as the HQ camera, and we sent the order form to our client. The team worked on expanding our current data set by taking more photos of knots (in addition to image augmentation). I also researched how to setup the Raspberry Pi and get our model onto the board.
- Maddie: This week, I created a code snippet to automatically crop the new knot images by both object detection and center cropping. Both of these methods were acceptable, but for ease of cropping, I chose to utilize the center cropping method to intake images with the knot at the center and crop with a resolution of 500x500 to the knot. I completed cropping the entirety of our dataset with this function. I also helped the team determine which Raspberry Pi materials to order.
- Kate: This week, I went to the MakerSpace to see what options they have for electronics and if there are any experts on staff. They have office hours we can go to for help with the project, but they have minimal experience with Raspberry Pi cameras. The team decided against getting a Raspberry Pi from the MakerSpace and instead ordered a kit with multiple components that is more cost-effective. I researched how to load the OS onto the Raspberry Pi microprocessor.
- Sadie: This week, I reviewed the image resolutions in our dataset and collaborated with Maddie to develop a plan for standardizing the images to ensure more consistent training data. I also captured additional photos of knots to incorporate into the dataset before initiating a new round of augmentation. Additionally, I researched alternative Raspberry Pi camera options that may be more cost-effective, given that we do not require the high resolution provided by the HQ camera. Finally, I compiled purchasing links for necessary materials and updated the expense sheet accordingly.

Individual Struggles:

- Lucy: No struggles this week.
- Presley: No struggles this week.
- Maddie: No struggles this week.
- Kate: No struggles this week.
- Sadie: No struggles this week.

Individual Goals:

- Lucy: Next week, I plan to remain in communication with the client for material shipping updates. I also plan to conduct more research on our specific Raspberry Pi hardware and camera, including case studies and previous examples of implementing similar feedback systems.

- Presley: Next week, I hope to work on training the new model and getting that implemented onto the Raspberry Pi.
- Maddie: Next week I hope to help take a few new images of tight knots to even out the class distribution, apply augmentation techniques to those images, and train the new model.
- Kate: Next week, I want to make a schematic of the Hardware so we have a set plan of action when the Hardware components arrive.
- Sadie: Next week, I will augment the dataset via Roboflow in preparation for retaining the model. I will also begin k-fold cross validation to extract a more reliable estimate of testing performance.

Project Timeline:

Week	Description	Date	Status
1/22 - 1/29 Week 1	Team Meeting 1	1/26	Complete
	Advisor Meeting 1	1/23	Canceled
1/30 - 2/5 Week 1	Team Meeting 2	2/4	Complete
	Advisor Meeting 2	1/30	Complete
2/6 - 2/12 Week 3	Preliminary Presentations	2/6	Scheduled
	Team Meeting 3	2/9	Completed
	Advisor Meeting 3	2/13	Scheduled
	Order Raspberry Pi Camera and Board	2/13	In progress
2/13 - 2/19 Week 4	Images Augmented	2/16	Not Started
	K-Fold Cross Validation	2/18	Not Started
	Model Trained	2/20	Not Started
2/20 - 2/26 Week 5	Preliminary Deliverables	2/25	Not Started
2/27 - 3/6	Submit Patent to	3/6	Not Started

Week 6	WARF or IDR		
3/7 - 3/13 Week 7			
3/13 - 3/19 Week 8			
3/20 - 3/26 Week 9	**Show and Tell**	**3/20**	Not Started
3/27 - 4/2 Week 10	Select Design Award	4/1	Not Started
	Executive Summary (Draft)	4/1	Not Started
4/2 - 4/8 Week 11			
4/9 - 4/15 Week 13			
4/16 - 4/22 Week 14	**Executive Summary**	4/17	Not Started

4/23 - 4/29 Week 15	Final Pressentations	4/24	Not Started
4/30 - 5/5 Week 16			
Winter Break			

Expenses

Item	Description	Manufacturer	Mft Pt#	Vendor	Vendor 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
Raspberry Pi Kit	Contains: Raspberry Pi 5 8GB, 27W power supply, active cooler, 64 GB SD card, card reader, 4K Mico HD out cables, and case	Vemico	B0D2WYFS23			2/8/2026	1	$173.99	$173.99	Link
Arducam IMX477 Pi HQ Camera	HQ Camera + CS 6mm lens	Arducam	B024002			2/8/2026	1	$67.99	$67.99	Link
									TOTAL: $249.57	