The Knotorious Five

March 27 - April 9

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 (khiller@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 completed the executive summary draft. We also performed k-fold cross validation on four sets of data to determine the best for our new model. After k-fold, we determined the original images performed the best and trained a ML model on those images. The team also continued writing and implementing code for the full raspberry pi workflow.

Team Goals:

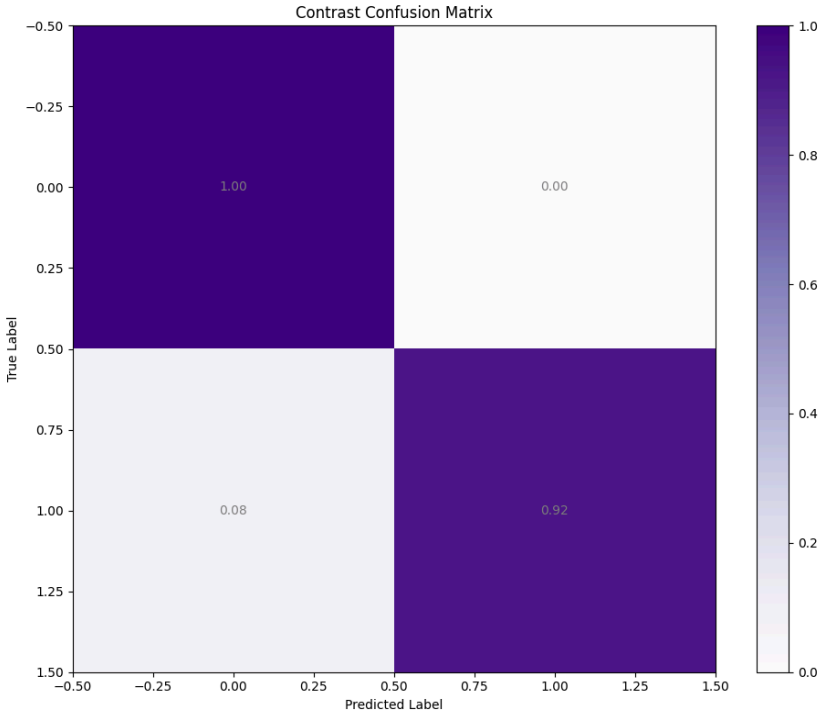
Next week, the team hopes to have the pi full workflow running with the new model.

Individual Accomplishments:

- Lucy: This week, I worked on drafting and editing the executive summary for the Design Excellence award. Also, I attended our team meeting to finalize the LED display and discuss device housing options.

- Presley: This week, I met with the team to work on the overall workflow with the LEDs and button incorporated. I also worked on writing the executive summary for the Design Excellence Award.
- Maddie: This week, I performed k-fold cross validation using binary no background, background removed with color, contrasted with background, and original (normal) image sets. We did this to determine which training set would perform the best in a model. The accuracies were as follows: binary (53%), colored no background (62%), unedited (74%), and contrasted images (57%). I then trained a model on the original image dataset to obtain a model accuracy of 92-96%. Model specific details are shown below:

	precision	recall	f1-score	support
0	0.92	1.00	0.96	12
1	1.00	0.92	0.96	13
accuracy			0.96	25
macro avg	0.96	0.96	0.96	25
weighted avg	0.96	0.96	0.96	25



- Sadie: This week, I sorted through the normal, binary, and contrasted images to remove any incorrect classifications or pictures that were preprocessed weirdly so Maddie can re-run k fold. I also worked with the team to set up LEDs and implement the full

workflow code on the Pi. Aside from project work, I was focused on the executive summary.

- Kate: This week, I met with the team to start setting up the LEDs and button for the Pi. We set up the hardware, but we are still working on setting up the GPIO pins. I also worked on writing the executive summary for the Design Excellence Award.

Individual Struggles:

- Lucy: None.
- Presley: None.
- Maddie: None.
- Sadie: N/A
- Kate: No struggles this week

Individual Goals:

- Lucy: I would like to finish our final prototype and begin testing for final deliverables.
- Presley: I would like to finish the overall workflow of our project and begin the journal and final presentation.
- Maddie: Next week, my goal is to complete the full workflow testing and get the GPiO pins to work properly. I also plan to perform in depth model image training analysis.
- Sadie: This Friday, I am planning to meet with the team to finish implementing the entire workflow code (press button, take picture, model classifies picture, LED output) and conduct latency testing. After this is completed, I will shift my focus to final deliverables.
- Kate: This Friday, I would like to finish setting up the prototype workflow with the team. I would also like to complete final testing and start working on final deliverables.

Project Timeline:

Week	Description	Date	Status
1/22 - 1/29 Week 1	Team Meeting 1	1/26	Completed
	Advisor Meeting 1	1/23	Canceled
1/30 - 2/5 Week 1	Team Meeting 2	2/4	Completed
	Advisor Meeting 2	1/30	Completed
2/6 - 2/12 Week 3	Preliminary Presentations	2/6	Completed
	Team Meeting 3	2/9	Completed
	Advisor Meeting 3	2/13	Completed

	Order Raspberry Pi Camera and Board	2/13	Completed
2/13 - 2/19 Week 4	Images Augmented	2/16	Completed
	K-Fold Cross Validation	2/18	Completed
	Receive Materials	2/18	Completed
	Model Trained	2/20	Completed
	Team Meeting 4	2/18	Completed
	Advisor Meeting 4	2/20	Completed
2/20 - 2/26 Week 5	Preliminary Deliverables	2/25	Completed
	Upload Model onto Pi	2/20	Done
	Team Meeting 5	2/23	Completed
	Advisor Meeting 5	2/27	Complete
2/27 - 3/6 Week 6	Submit Patent to WARF or IDR	3/6	TBD
	Team Meeting 6	3/4	Complete
	Advisor Meeting 6	3/6	Complete
3/7 - 3/12 Week 7	Team Meeting 7	3/13	Complete
	Advisor Meeting 7	3/13	Complete
	Get the Pi camera running	3/8	Complete
3/13 - 3/19 Week 8	Team Meeting 8	3/18	Complete
	Advisor Meeting 9	3/13	Complete
	Implement Pi camera and images into user system	3/13	Complete
~~3/20 - 3/26~~	**Show and Tell**	**3/20**	Complete

Week 9	Advisor Meeting 10	3/25	Complete
3/27 - 4/9 Week 10	Select Design Award	4/1	Complete
	Executive Summary (Draft)	4/1	Complete
	Advisor Meeting 11	4/8	Complete
4/10 - 4/16 Week 13			
4/17 - 4/23 Week 14	**Executive Summary**	4/17	In Progress
	Advisor Meeting 12	4/17	Scheduled
4/24 - 4/30 Week 15	Final Pressentations	4/24	Not Started
	Final Journal Due	4/29	Not Started
	Client Evaluation	4/29	Not Started
	Email Report and Notebook to Client	4/29	Not Started
	Advisor Meeting 13	4/24	Scheduled
4/31 - 5/6 Week 16	Advisor Meeting 14	5/6	Scheduled
VET CONFERENCE JUNE 4 & 5			

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	