The Knotorious Five

November 7th - November 13th

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 tied more tight and loose square knots and took more photos with phone cameras to train the machine learning models. We created a website that interfaces with the Teachable Machine model, which is an open source software that is used for many image recognition models.

Team Goals:

- In the upcoming week, the team plans to evaluate and compare the efficacy of the two models and integrate them into an app or website.

Individual Accomplishments:

- Lucy: This week, I met with the team to tie more knots, took photos at an improved angle and created new folders to organize the rest of the team's photos.

- Presley: This week, I tied tight and loose square knots on a skin pad and took photos of each knot for the machine learning model.
- Maddie: This week, I tied and took images of loose and tight square knots. I retrained both models (Teachable Machine and Python) with the new images. I also created a website that interfaces with the teachable Machine model.
- Sadie: This week, I picked up additional suturing material from the client and began suturing for a second round of database images. Maddie and I planned which sutures should be tied tightly versus loosely to ensure a relatively even distribution of each. I photographed and cropped images of the new knots, then reviewed the original batch of photos to remove any taken from an overhead angle, where it was difficult to distinguish between tight and loose sutures.
- Kate: This week, I tied new suture knots for new training images for image training the model. I took pictures of the suture knots and cropped the images so they are ready to be used for training.

Individual Struggles:

- Lucy: I am having difficulties determining what angles/suture types are needed to successfully train the model.
- Presley: I struggled slightly to get high-quality photos of the knots with my phone camera.
- Maddie: I am trying to determine what technology to use for capturing the suturing process and how to turn that into an app or system that all trainees have access to.
- Sadie: I am struggling to determine the most effective interface for the analysis: whether it should be an app, website, or standalone training module. I will work with the team and client to weigh convenience against quality and accuracy.
- Kate: I have no current struggles.

Individual Goals:

- Lucy: Depending on the success of the current model, I plan to begin setting up testing protocols and discussing with the team on appropriate next steps.
- Presley: Next week, I would like to work with the team to decide upon a website or app interface and continue the progress of the model training.
- Maddie: My goal for the next week is to create a website that is not run through my own terminal and can be accessed by other devices. I also want to find a way to integrate the Python model into an app.
- Sadie: Next week, I hope to make significant progress on model training and explore whether an app or website would be a viable platform for capturing the images.
- Kate: I would like to decide and create what user interface platform (website or app) we will move forward with for capturing images.

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 Week 6	Advisor Meeting 3	Scheduled for 10/10
	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 - 11/6 Week 9	**Show and Tell**	**Due 10/31**
	Team Meeting 7	Scheduled for 10/31
11/7 - 11/14 Week 10	Advisor Meeting 5	Scheduled for 11/07
	Team Meeting 8	Scheduled for 11/07
	Team Meeting 9	Scheduled for 11/12
11/14 - 11/20 Week 11	Advisor Meeting 6	Scheduled for 11/14
	Team Meeting 10	Scheduled for 11/14
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 11	Scheduled for 12/6
12/13 - 12/18 Week 15	Advisor Meeting 8	Scheduled for 12/13
	Team Meeting 12	Scheduled for 12/13
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