The Knotorious Five

October 3rd - October 9th

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 spent a significant amount of time writing the preliminary report. We also presented our preliminary presentation to our advisor and our peers on two separate occasions. Some preliminary work was done to research an AI model and attempt prototyping practice of a similar model that can be applied to our project. The team also split into two sections to tackle force sensor resistor prototyping and AI model prototyping/training.

Team Goals:

- In the upcoming week, the team plans to continue to develop our solutions and explore potential models and digitalization of the FSR circuit.

Individual Accomplishments:

- Lucy: This week I completed assigned sections of the preliminary report about suture and prototype testing. This involved researching and learning about AI model testing and validation phases as well as evaluating model accuracy through F1-scores.
- Presley: This week I completed my assigned sections of the preliminary report, focused on the displacement method of determining when the last suture knot is sufficiently tight. I also presented the preliminary presentation with my team twice, once to our advisor and once to our peers.
- Maddie: This week I completed my assigned sections of the preliminary report and presented twice, once to our advisor and once to our peers. I also began creating a coding outline for a possible AI model using Python. I learned how to prime the images in terms of cropping, pixelization, etc. I also learned how to display an image in a Jupyter Notebook and began training a model to recognize loose vs. tight square knots (of rope for now).
- Sadie: This week, I completed my assigned section of the preliminary report, which focused on the design of visual knot characteristics. I also updated the design matrix to reflect our slightly revised design parameters. To complete the methods and materials section of the report, I explored PyTorch: the machine learning framework we plan to use, in order to better understand the steps required to train a machine learning model.
- Kate: This week, I completed my assigned section of the preliminary report. I focused on writing the introduction, including the background information and PDS. I presented at the peer preliminary presentations this past week.

Individual Struggles:

- Lucy: No struggles for the week
- Presley: No current struggles for this week.
- Maddie: I am working through the logic behind AI image prediction models and understanding the difference between various packages that are applicable to the modeling process.
- Sadie: I am beginning to learn about how to train a machine learning model, which comes with a steep learning curve.
- Kate: I have no current struggles at the moment

Individual Goals:

- Lucy: My goal is to complete MTS testing on our current suture materials and then assist the team developing the force sensor prototype.
- Presley: My goal for the upcoming week is to work on the force sensor prototype with a few other members of the team.

- Maddie: My goal for the upcoming week is to complete this image prediction model using scikit in Python and use the provided testing and validation sets to verify its success.
- Sadie: My goal for the upcoming week is to assist with MTS testing on the provided suture materials and begin assembling the dataset for image-based training.
- Kate: My goal is to work on taking the input of the force sensor prototype and turning it into a meaningful output (force) that will be turned into real-time feedback. I would also like to complete MTS testing this week.

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
	Practice Image Prediction Model	Goal 10/17
10/17 - 10/23 Week 7		
10/24 - 10/30 Week 8		
10/31 - 11/7 Week 9		
11/8 - 11/14 Week 10		
11/15 - 11/21 Week 11		
11/22 - 11/28 Week 12		
11/29 - 12/5 Week 13		
12/6 - 12/12 Week 14		
12/13 - 12/18 Week 15		
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