

Title: Radiographic Radiomics Phantom Progress Report 4

Date: 9/25 - 10/1

Client: Dr. Jennie Crosby

Advisor: Yang Lu

Team:

Last Name	First Name	Role	E-mail	Phone	Office Room/Building
Trapskin	Pierson	Leader	Pierson Trapskin	(608) 335-7986	
Hodgson	Ava	Communicator	Ava Hodgson	(289) 968-7479	
Stellflue	Presley	BSAC	Presley Stellflue	(847) 224-7803	
Pionek	Sonja	BWIG	Sonja Pionek	(608) 622-2590	
Casas	Matthew	BWIG	Matthew Casas	(262) 290-8734	
Ma	Allie	BPAG	Allie Ma	(781) 990-8825	

Problem Statement

The goal of this project is to design and construct a radiomics benchmarking phantom for radiographic imaging systems that includes multiple clinically relevant textures, accommodates both small- and large-anatomy imaging protocols via a removable core or

interchangeable sizing, and uses materials stable enough for repeated use over multiple years.

Brief Status Update

The team met with Dr. Jennie Crosby to discuss project specifications, better understand the project scope, and receive consultation on team phantom designs. Client meeting notes can be found in the "Project Information >> Team Activities >> Client Meetings" folder. The design matrix is complete, and the preliminary presentation is being completed. A mini version of the preferred design has been 3D printed.

Difficulties / Advice Requests

Would you like to use the electron density method or physical texture method?

Is there any site for us to make a price estimate for acrylic 3D printing if we were to use your lab's printer?

What is the small size air gap the CBCT would be able to detect?

Current Design

The phantom features a removable core, allowing the same shell to represent both large and small anatomy by swapping in modular phantom texture inserts. Phantom materials and textures are still undecided, but shall mimic either the physical texture or electron density of anatomical tissues.

Materials and Expenses

[illegible]

									\$0.00	
Category 2										
N/A									\$0.00	
									\$0.00	
								TOTAL :	\$0.00	

Goals

Major Team Goals for the Next Week (10/2-10/8)

1. Begin preliminary report
2. Continue literature studies. Be ready for discussions to ensure all team members are on the same page.
3. Have a polished budget to send to our client based on an estimate of material choices.

Next Week's Individual Goals (10/2-10/8)

- Pierson Trapskin: Help finalize a budget so our client can finish applying for a grant. Begin designing and different textures in CAD.
- Ava Hodgson: Develop detailed finalized budget for a grant application, begin prototyping initial textural inserts & test them in a CT scanner.
- Presley Stellflue: Create a list of materials to have a more finalized budget. Utilize the amenities in the design and innovation labs for prototyping resources.
- Matthew Casas: Continue individual research on phantom materials and texture designs and begin contributing to the preliminary report.
- Sonja Pionek: Conduct more formal research on materials and costs to determine the best option to finalize the budget for our client.
- Allie Ma: Present to our advisors. Conduct more literature research on materials & testing and collaborate with Ethan on finalizing phantom testing procedures.

PDS: Completed first draft. Requires further refining and detailed specifications.

Timeline

Task	Sep				October					November				December	
	4	11	18	25	2	9	16	23	30	6	13	20	27	4	11
Project R&D															
Empathize	X	X	X	X											
Background...			X	X	X										
Prototyping															
Testings															
Deliverables															
Progress Reports	NA	X	X	X	X										
Prelim presentation					X										
PDS			X												
Design Matrix				X											
Preliminary report															
Decide on final design															
Final Poster															
Meetings															
Client			X	X											
Advisor	X	X		X	X										
Website															
Update	X	X	X	X	X										

Filled boxes = projected timeline

X = task was worked on or completed

Detailed accomplishments

Previous week's goals and accomplishments by individual

Pierson Trapskin:

This week I continued the materials research for the phantom's texture-based insert approach, narrowing the candidate fabrication routes identified in last week's source survey, and produced the first physical prototype of the design: a small-scale PLA print representing every piece of the phantom together, body and removable core alike. The print confirmed the core can be seated and removed from the shell as designed, moving the removable-core concept from a written description into a handled, testable object. Next up is checking fit and tolerance on the print and deciding which texture-insert fabrication route to pursue now that the core mechanism itself is physically validated.

Ava Hodgson: This week I continued to research the biological and physiological aspects of this project to help determine what materials, textures and average densities will show up best to attain the features needed in CT scans. I also helped to outline a detail budget for another grant application. I finished my slides and created key points for the Preliminary Design presentation.

Presley Stellflue: This week I continued to research common size and dimensioned phantoms similar to ours to get a better understanding of what processes and materials were used to create a phantom of a similar size. I have also done some research about what tools and machines would be available at the university for fabrication of possible materials.

Sonja Pionek: This week, I continued to build on my research on CT scanners and phantoms. I also did research on biology and physiology, specifically the head and abdomen to get a better understanding of what the scanner is analyzing at a fundamental level. I also did a browse of potential materials we could use for our phantom and to get a better gauge on costs. I also wrote justifications for each component in our Design Matrix to determine the grading received by each component. Additionally, I completed my slides and practiced for our Preliminary Design Presentation.

Matthew Casas: Completed individual research on CT phantom designs, texture patterns, and radiomic features. Finished slides and prepared for the Preliminary Design Presentation. Uploaded the progress report and preliminary presentation slideshow to Canvas and the team website.

Allie Ma: Researched phantom production procedures to better gauge pricing of materials and testing methodologies. I have also begun CNC training in the case our team chooses to mill the phantom design instead of casting or 3D printing.

Activities

Name	Date	Activity	Time (h)	Week Total (h)	Sem. Total (h)
Pierson Trapskin	9/14 and 9/15	Individual research on existing designs and materials.	2	2	4
Pierson Trapskin	9/16	Notebook update and progress report 2.	1	3	5
Presley Stellflue	9/16	Research on possible materials and dimensions. Began drafting PDS	3	3	4
Ava Hodgson	9/14-9/16	Research on competing designs, pre-existing patents, and standards used to create previous competing designs	5	5	5
Ava Hodgson	9/17	Adding to draft of PDS	1	6	6
Matthew Casas	9/17	Added progress report to website. Individual research on existing radiomics phantom designs and potential materials/textures.	2	2	4
Allie Ma	9/11-9/17	Began filling PDS information. Researched on standards for phantom development.	1.5	1.5	1.5
Presley Stellflue	9/17-23	Worked on and edited PDS, completed individual research, and created a SolidWorks model for a design idea.	7	7	11

Pierson Trapskin	9/18	Developed an appropriate CAD model for both full size and small scale model size of our front-running design. Researched appropriate sizing based of competing design and client recommendations.	6	6	10
Allie Ma	9/18	Finished editing PDS. Uploaded PDS under "Project Information >> Team Activities >> Design Process". Any further updates to the PDS will be uploaded in that folder too.	1	1	2.5
Allie Ma	9/18-9/24	Wrote up design matrix template. Began editing design matrix grades and reasoning. Annotated key literature provided by client.	3	4	5.5
Ava Hodgson	9/21	Individual research on biological components of CT scans, possible materials and/or texture ideas for phantom	2	2	8
Ava Hodgson	9/18-9/23	Developed CAD design as preliminary design idea for presentation, uploaded to design matrix	6	8	14

Matthew Casas	9/18-9/24	Individual research on 3D-printed materials for CT phantoms and the effects of texture patterns on radiomic features. I also added the progress report to the website.	2	2	6
Ava Hodgson	9/29-10/01	Individual research on CT physics, attenuation & the possibility of 3D printing tissue like materials to gain better understanding of the machine the phantom will be used on.	4	4	18
Pierson Trapskin	9/29	3D printed our model making use of the Design and Innovations Lab at Wendt.	1	1	11
Ava Hodgson	9/29-9/30	Created slides and notes for Preliminary Design presentation for the Background and Competing Designs.	2	2	20
Pierson Trapskin	9/30	Continued research and brainstorming on materials and costs. Specifically on what materials could help eliminate airgaps and grey matter from scans.	3	4	15
Presley Stellflue	9/29-10/1	Worked on preliminary presentation and edited slides. Conducted individual research on fabrication processes of phantoms and gathered information on competing designs.	4	4	15

Matthew Casas	9/28-10/1	Completed individual research on CT phantom designs and radiomic texture features. Created slides and prepared for the Preliminary Design Presentation. Uploaded the progress report and preliminary presentation slideshow to Canvas and the team website.	4	4	10
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