

Title: Radiographic Radiomics Phantom Progress

Report 2

Date: 9/10 - 9/17

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	
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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

This week the team arranged a meeting with the client Dr. Jennie Crosby for Friday the 18th to discuss product design details and specifications. We filled out as much of the PDS document as possible without client input. We individually continued to research relevant literature, including a new paper and an existing product provided by Dr. Crosby.

Difficulties / Advice Requests

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

What materials are in your current phantom that are working well?

Current Design

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

Materials and Expenses

Item	Description	Manufac- turer	Mft Pt#	Vendor	Vendor Cat#	Date	#	Cost Each	Total	Link
Category 1										
N/A									\$0.00	
									\$0.00	
Category 2										

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

Goals

Major Team Goals for the Next Week (09/14-09/20)

1. Update the PDS after the client meeting
2. Continue literature study
3. Start modeling preliminary design in SolidWorks

Next Week's Individual Goals (09/17-09/24)

- Pierson Trapskin: Start building preliminary models in Solidworks for our design matrix and for client input.
- Ava Hodgson: Continue looking into competing designs to determine the best materials for accuracy, look into how to implement a variety of textures and densities to fulfill client needs.
- Presley Stellflue: Finalize research on dimensions for the different removable/nonremovable parts of the phantom. Continue research and document editing.
- Matthew Casas: Continue researching existing radiomics phantom designs and begin brainstorming potential design concepts based on findings from individual research and client feedback.
- Sonja Pionek: Conduct more research on potential design elements following client meeting. Begin brainstorming potential full designs and ways to compare/rank designs to one another.
- Allie Ma: Conduct more research on phantom production procedures, standards, and specifications. Complete the Miscellaneous section of PDS and provide annotations to the standards I've found. Reinstall Anaconda and download PyRadiomics Python package.

PDS: Will be added once completed this weekend.

Timeline

[illegible]

Meetings																
Client			X													
Advisor	X	X														
Website																
Update	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:

The week started with a basic question: how does a CT scan tell different materials apart? The answer is that a CT scanner measures how much each material blocks X-rays, and reports that as a Hounsfield Unit (HU) — water is 0, air is about -1000, and denser things like bone read much higher. HU roughly tracks how dense a material is, which is why phantom inserts are usually built and labeled by density. It's not a perfect match, though two materials at the same density can still read slightly different HU values depending on what they're made of, and this shows up most with bone. For our purposes, building inserts to match density should be good enough, unless we specifically need the HU readings themselves to match real tissue exactly.

Ava Hodgson:

I created some individual research notes on competing designs as well as initial patents used for similar products made before (Can be found under 'Ava Hodgson', then 'Research Notes' then 'Competing Designs'). I made some basic notes (labelled 'Notes') during my readings in the article and its findings/advice and then created a few personal notes (labelled 'Our

Design') for how to add their features/characteristics to the prototyping and testing of our design. There are many opportunities to differentiate our design by creating a removeable core and ensuring inserts have a variety of densities/textures to serve a variety of purposes, all while being economically effective within our budget.

Presley Stellflue: Individual research on background and scope of project.

Sonja Pionek: Conducted individual research notes on the background of the project and began brainstorming elements that could be included in some of our potential product designs.

Matthew Casas: Conducted individual research on existing radiomics phantom designs, focusing on modular designs, materials, and methods for creating reproducible textures. Reviewed the open-source CT texture phantom paper provided by the client and researched potential design considerations that could be applied to our phantom.

Allie Ma: Perused articles and standards to understand phantom development and began filling in PDS information.

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	2
Allie Ma	9/11-9/17	Began filling PDS information. Researched on standards for phantom development.	1.5	1.5	1.5