Team LumberHack

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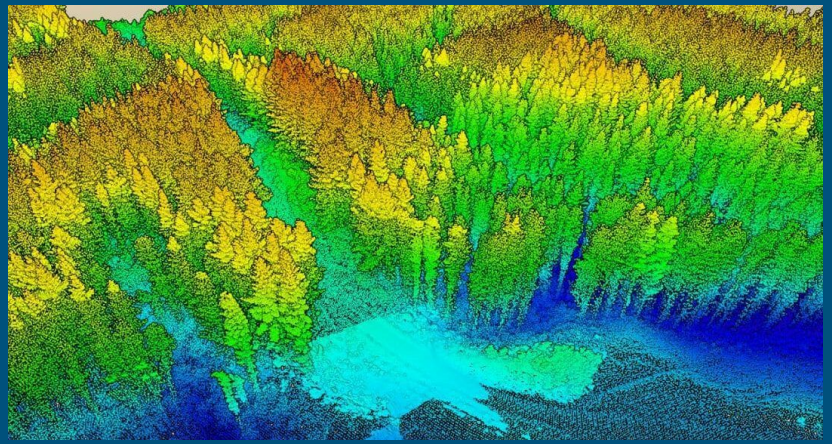
Client: Andrew J. Sanchez Meador, Ph.D

Mentor: Melissa D. Rose

Introduction

- Climate change
- Forests are denser than ever before
- Large scale restoration projects



Point cloud of a dense forest

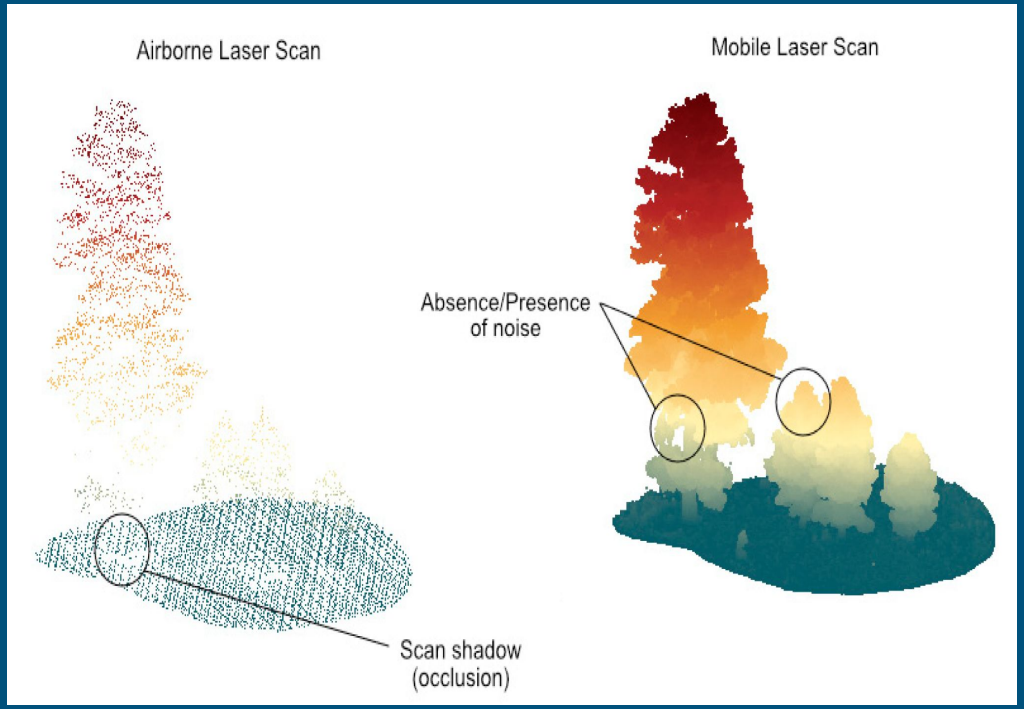
Our Client

- Forest Ecology Researcher
- What is LiDAR?
  - Light Detection and Ranging
  - Airborne and Mobile
  - Create point clouds for modeling data
- LiDAR assists in restoration efforts

Dr. Andrew J. Sanchez Meador

Problem Statement

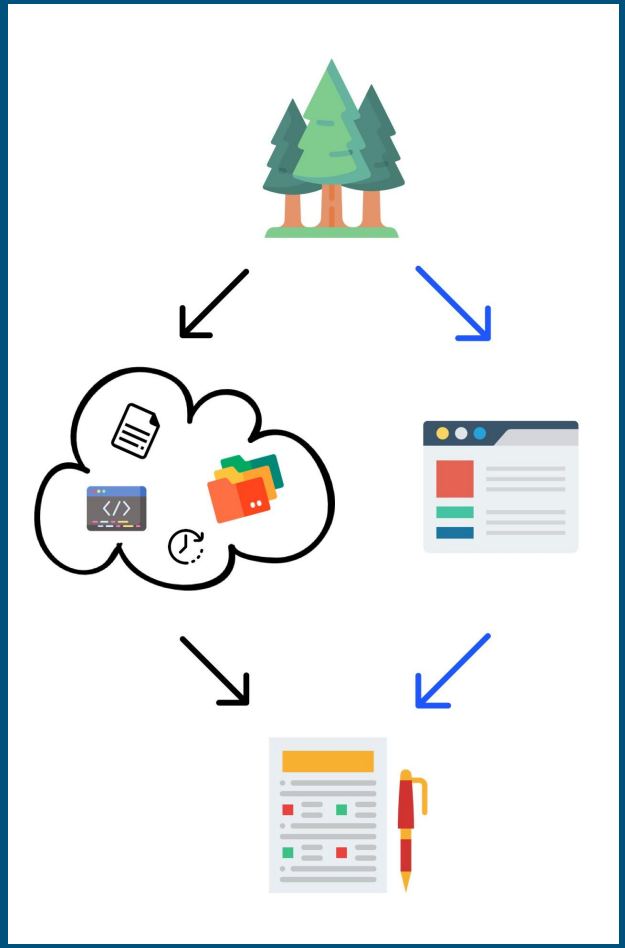
- Current tools are not mobile laser scanning (MLS) focused
- Lack of automation / steep learning curve with current software
- Visualizing and generating useful statistics is difficult with current methods



Solution Overview

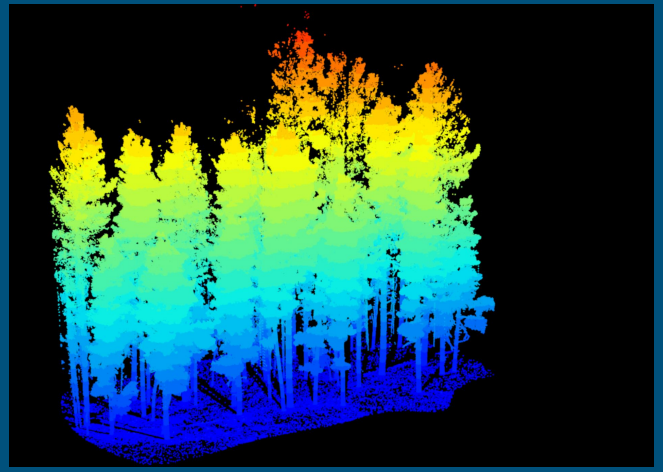
An application that runs in the browser and offers a user-friendly interface for lidar processing

- Mobile lidar focused
- No juggling multiple software libraries
- Performs all major lidar workflow steps in one place



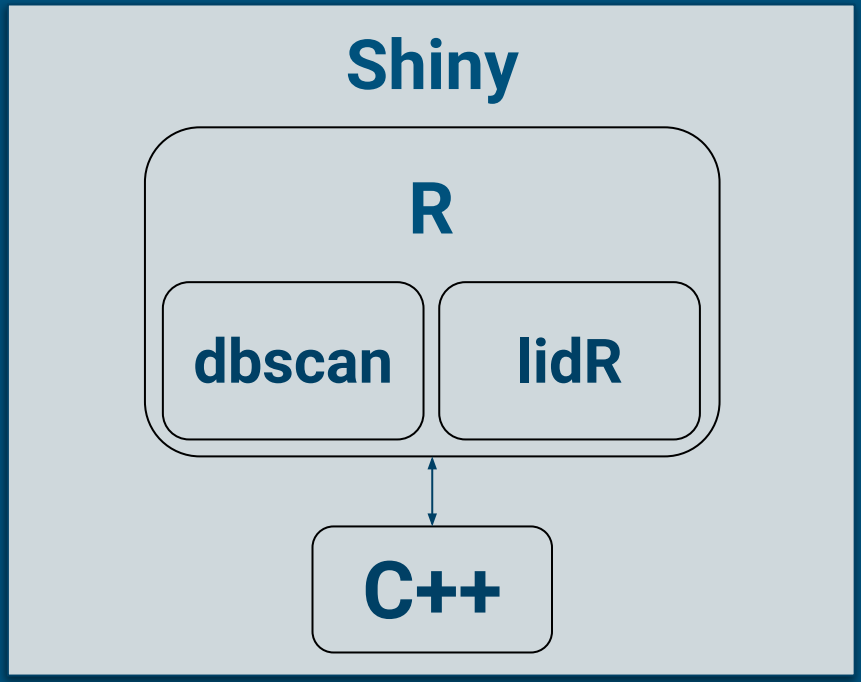
Requirements/Specifications

- R Shiny for user interface
- Data upload
- Clean and normalize data
- Classify points
- Segment trees
- RANSAC Cylinder fit at 1.37 m for tree boles
- Display results with error reporting

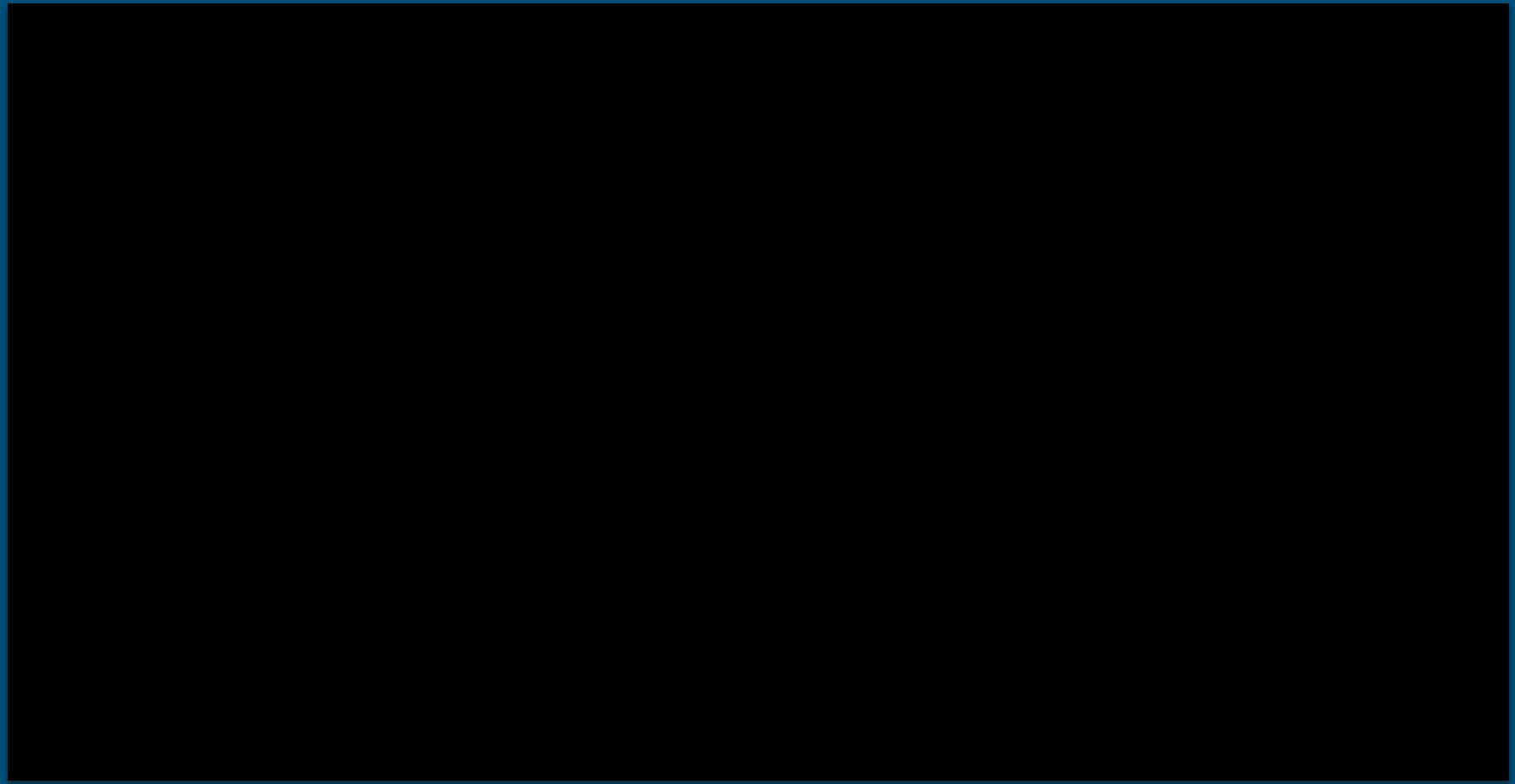


Architecture and Implementation Overview

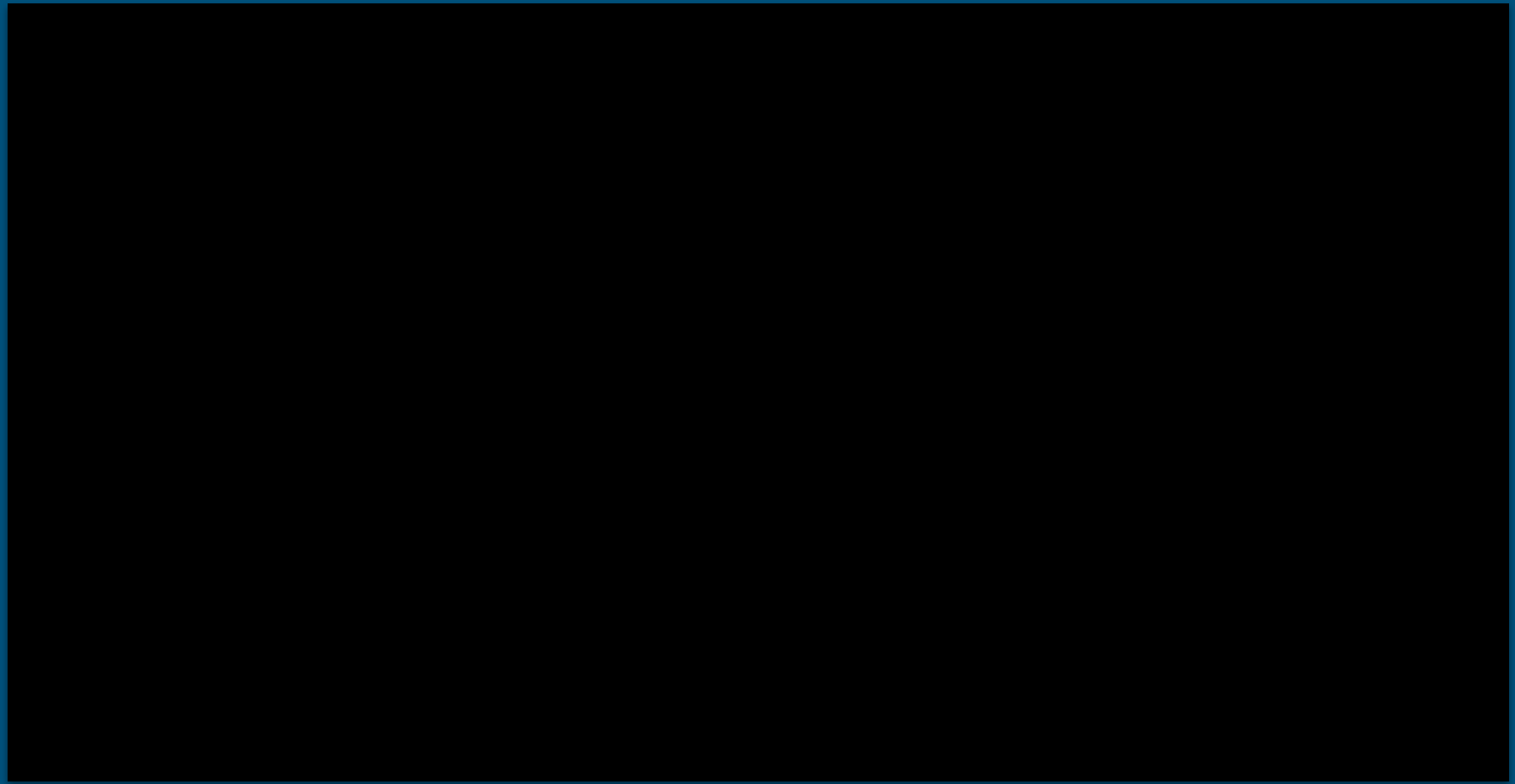
- R shiny user interface
- R manages data and supporting packages
- C++ handles fast processing of data



Prototype: Data Upload and Cleaning



Prototype Plotting Point Cloud



Prototype Tree Segmentation

Challenges and Resolutions

- Windows and Mac compatibility

- R package dependencies

- Point classification

UNIT TESTING PLAN

6 modules

FILE UPLOADING

1) .las or.laz file types
2) Total size of file doesn't exceed10GB

DATA CLEANING

1) File cleaned
2) User receives message pop up

DATA PLOTTING

1) Ground classified
2) Height normalized
3) Noise classified
4) Points filtered
5) Point cloud plotted

DRAW SLICE OF TREE

1) Plot of slice will be created when button is pressed

CIRCLE SHAPE FITTING

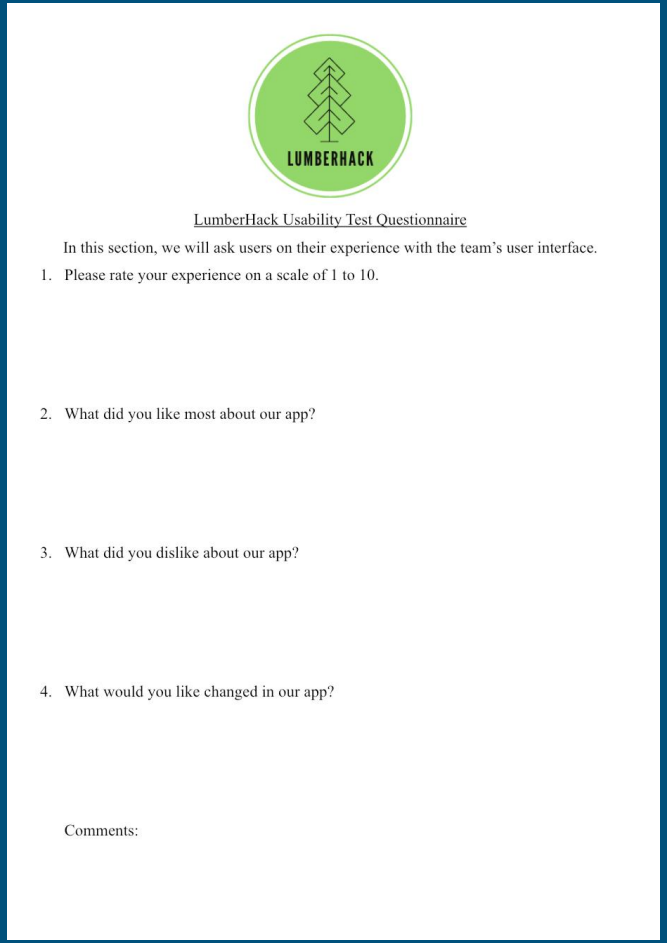
1) CSV file gets returned correctly with best overall count and circle fit(x,y,r)

DATA SUMMARY TABLE

1) Info about individual trees can be displayed in a 2D table

Usability Testing Plan

- Observe end users from Forestry department with the user interface
  - Group 1 - First impressions of app
  - Group 2 - Improved first impressions of app
- Users fill out a questionnaire at end of testing session
  - Rate their experience on a scale of 1 to 10
  - Open-ended questions i.e. what they liked/disliked, what they would like changed, etc.



LUMBERHACK

LumberHack Usability Test Questionnaire

In this section, we will ask users on their experience with the team's user interface.

1. Please rate your experience on a scale of 1 to 10.

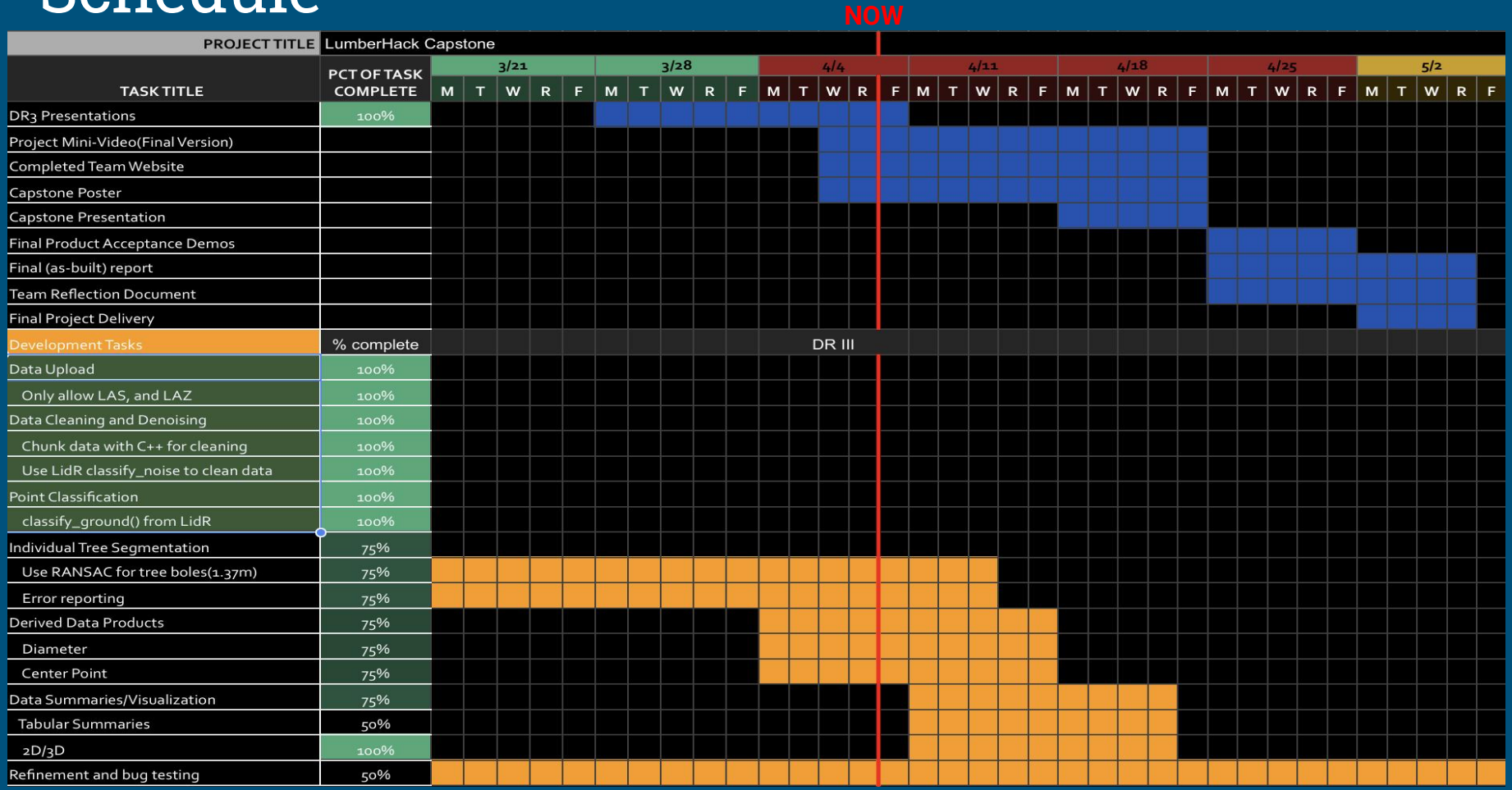
2. What did you like most about our app?

3. What did you dislike about our app?

4. What would you like changed in our app?

Comments:

Schedule


NOW
PROJECT TITLE
LumberHack Capstone
TASK TITLE
PCT OF TASK COMPLETE
3/21
3/28
4/4
4/11
4/18
4/25
5/2
M T W R F M T W R F M T W R F M T W R F M T W R F M T W R F M T W R F
DR3 Presentations 100%
Project Mini-Video(Final Version)
Completed Team Website
Capstone Poster
Capstone Presentation
Final Product Acceptance Demos
Final (as-built) report
Team Reflection Document
Final Project Delivery
Development Tasks
% complete
DR III
Data Upload 100%
Only allow LAS, and LAZ 100%
Data Cleaning and Denoising 100%
Chunk data with C++ for cleaning 100%
Use LidR classify_noise to clean data 100%
Point Classification 100%
classify_ground() from LidR 100%
Individual Tree Segmentation 75%
Use RANSAC for tree boles(1.37m) 75%
Error reporting 75%
Derived Data Products 75%
Diameter 75%
Center Point 75%
Data Summaries/Visualization 75%
Tabular Summaries 50%
2D/3D 100%
Refinement and bug testing 50%

Conclusion

Our project aims to:

- Streamline data collection
- Enable non-technical ecologists an easy way to extract information
- Provide ecologists with more time to evaluate and plan forest treatment

The team will continue to focus on finishing:

- Circle shape fitting
- Table summary
- Refining and testing our app

Based on successful development of this prototype, our client is very excited about our fully developed Shiny app for forestry researchers and ecosystem health.