

Interview Presentation

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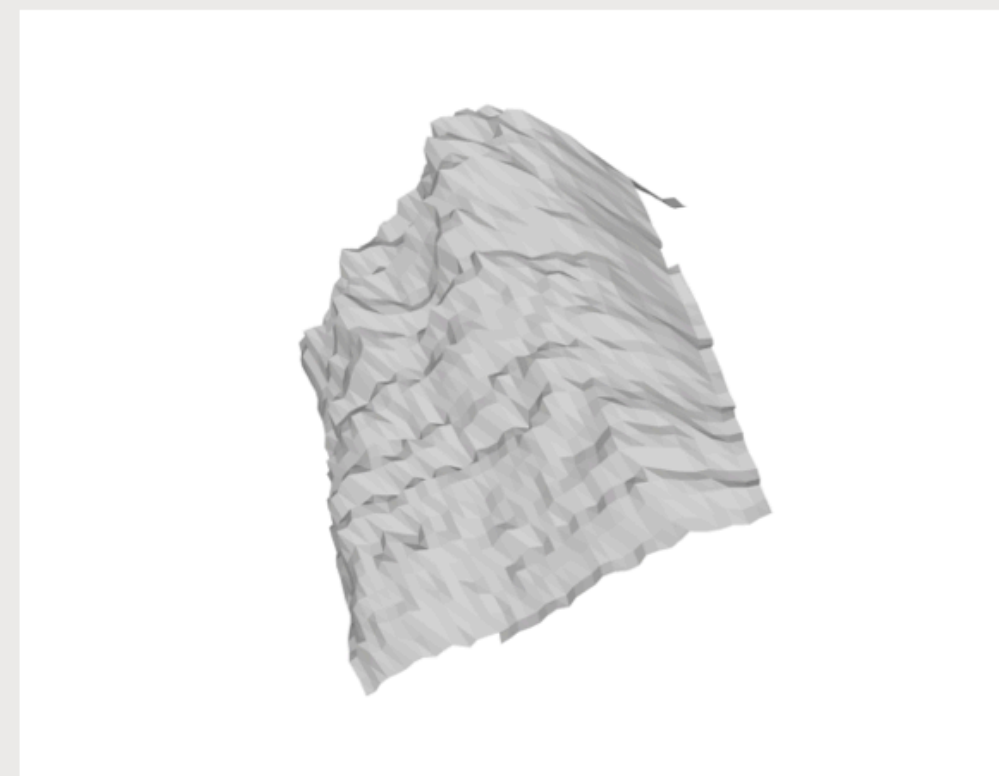
a little background

2nd year student at IIT Delhi - Abu Dhabi

Co-Secretary of Aerospace and Robotics Club

Interests : Space, Rocketry, Aviation, Robotics, Automation

Its flat!?



3D Topographic Map Reconstruction

Convert Flat 2D satellite images into 3D Representations

Course Project

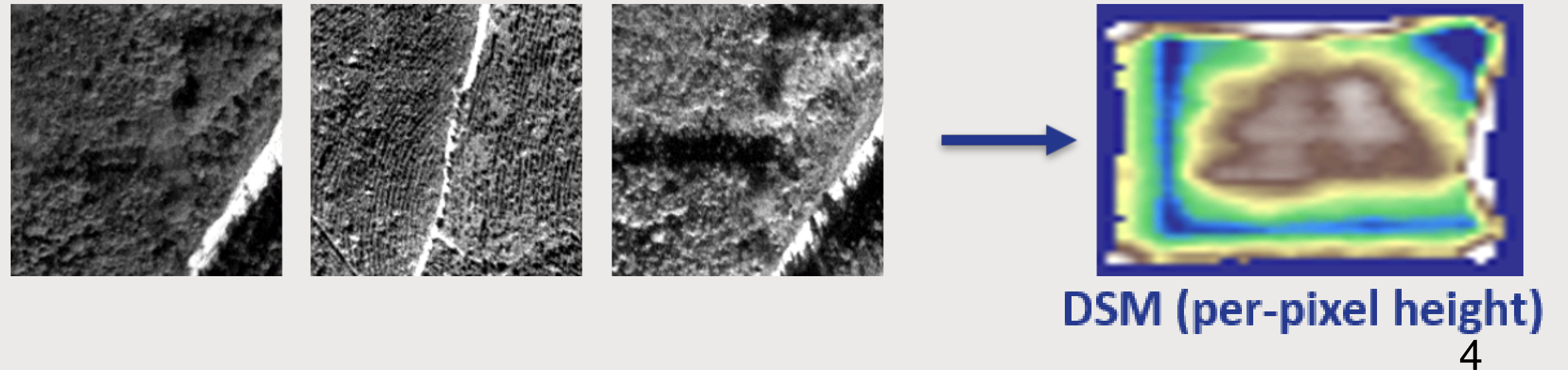
Prof. Monika Aggarwal, IIT Delhi

Purpose

Turns multiple satellite images along with their RPC's to DSM's with the help of a deep learning neural network. Useful for mapping, disaster response , monitoring infrastructure on a large scale. Trained on WHU-TLC

Limitations

1. Could only train to 5 epochs
2. Fails where there is nothing to match



Digital Twin of Lab Experiments

Research Project

Under Prof. Rachit Khare

Progress

Currently working on Heat Transfer Experiments, mostly preliminary work so far

Role

A 6 person team consisting of CS, Energy and Chemical Engineers coming together under this project to build twins of laboratory equipment. ML Models, Solvers, figuring out the unique situation and sensor data

Expected Outcome

A twin of the heat transfer rig that matches measured data and can simulate and optimise new experiments, plus a reusable lab-equipment-to-twin pipeline the team extends to catalysis and reactor systems.

ARTBOT : 2D Plotter

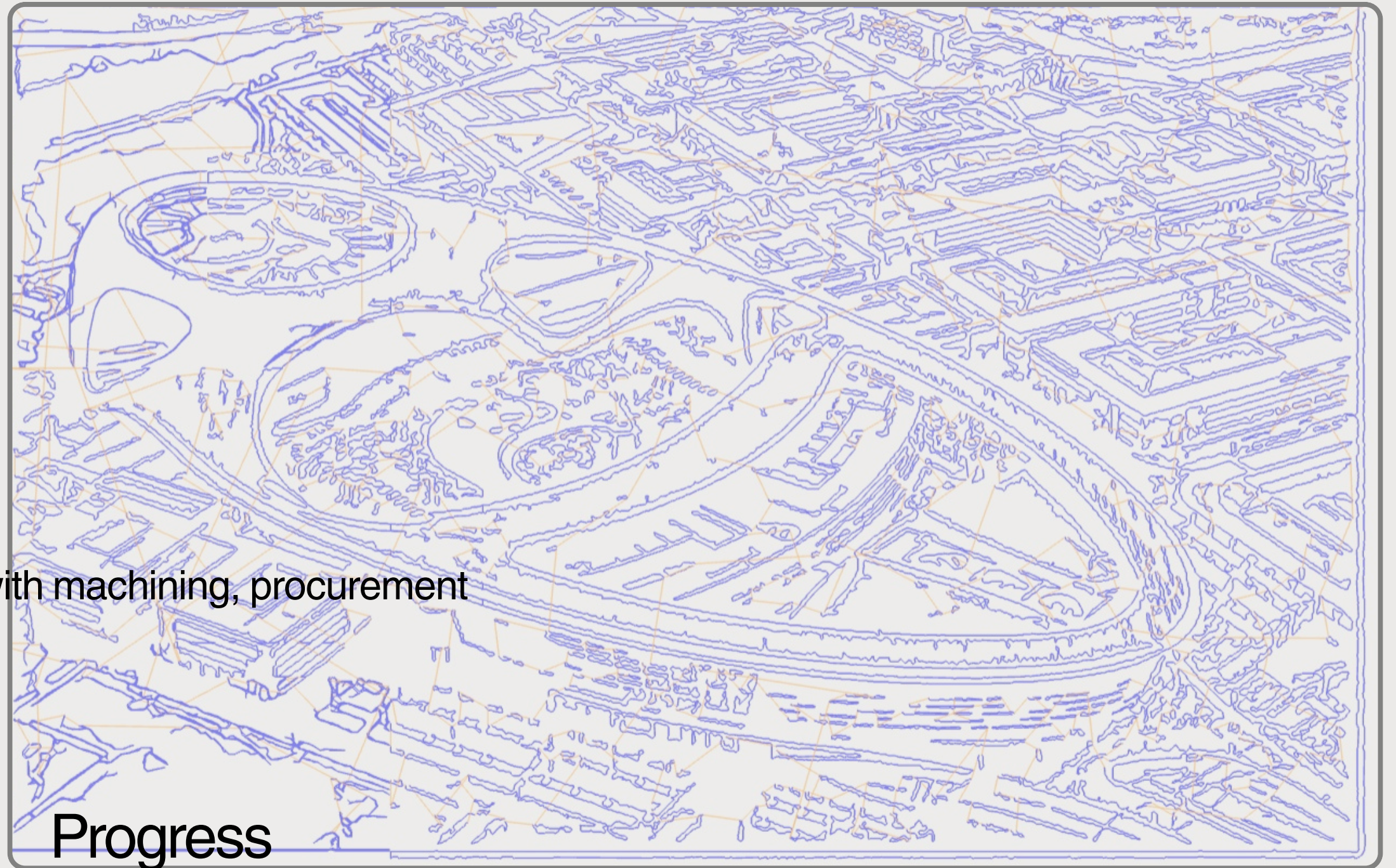
Under Active Construction

Role

Convert any given Image to G-Code, Assisting with machining, procurement of parts, Arduino, Motor Control

Approach

Made use of image-negatives, just as they do in the filming industry, to bring out different features of the image that can then be further processed



Progress

Under active construction, delays due to uncontrollable situations.
Estimated completion within 3 weeks.

How it relates to SpaceR/Uni.lu

3D Topology Reconstruction : Autonomous Global Mission Planning (NeverGiveUp)

Lunar Rover (stereo distance estimation)

Digital Twin : Quite versatile, can be used to simulate entire labs, simulations, optimize outputs etc; relates to OmniLRS

ARTBOT: Apart from the gcode ; the arduino, motors the machining etc

Project

TwilightR

The Problem??

Polar lighting on the moon results in a cascade of shadows, many pitch black :

→ This is difficult for existing systems

→ Glare and the darkness coupled with the texture make detection tricky

Research shows that most existing models fail to deliver any reliable results surrounding this area. Source : LuMon; Sekmen et al.



Existing Data Sets



SPICE-HL3

Gives us stereo images, precise rover poses, however there were some issues :
Rovers moving away from light may lost track
No ground-truth depth

Other Datasets

DATASET	DESCRIPTION
POLAR Stereo	Lab setting with terrain and polar style lighting
POLAR Traverse	Polar Sequences moving across a testing bench
CHERI	Dark, polar lighting benchmark for lunar rovers
LuSNAR	Lunar Stereo with Semantics

Addition to Global Mission Planning

Build on the 3D Topographic Reconstruction Pipeline

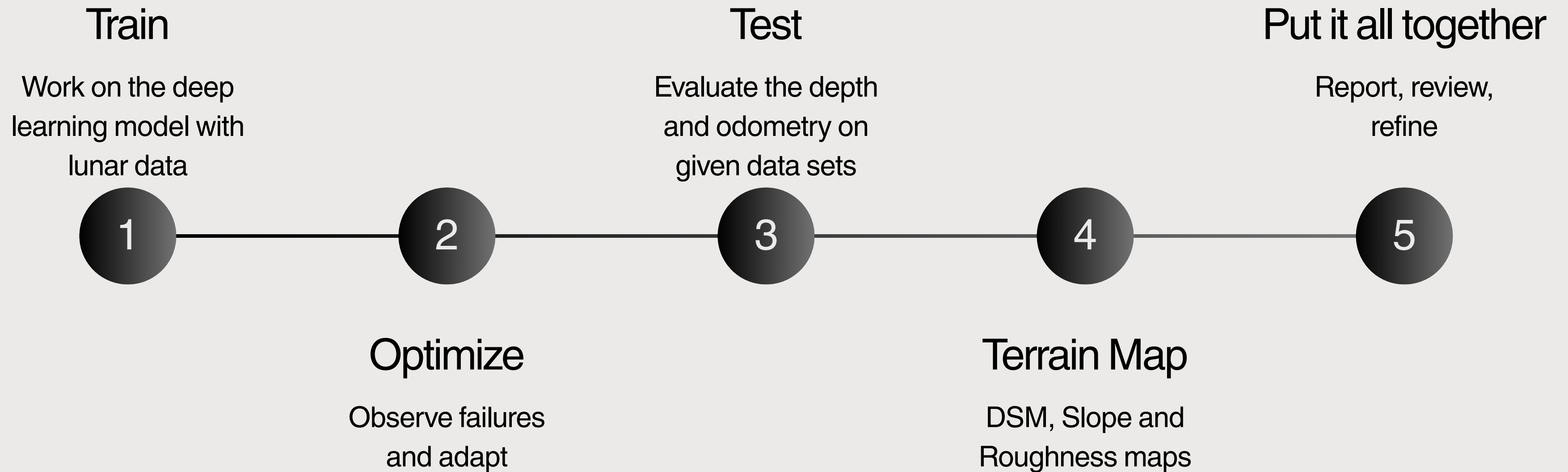
Making use of previous work, modifying it to fit this situation/ using the DSM outputs and test how they fare against the lunar landscape.

Train/ Expand to work on the Moon's rough terrain

Design slope, gradient and roughness maps that would assist in bringing out different features of the landscape that we can then implement to make more accurate models of the Moons unmapped terrain.

Could assist with NeverGiveUp

Approach



Testing Methodology

DATASET	Given	Role
SPICE-HL3	Rover poses, motion capture	Adapt it for stereo applications
Polar Stereo & Traverse (NASA)	LiDAR Scans of lunar like terrain	Check accuracy of predicted/calculated depth
StereoLunar, LuSNAR(synthetic)	Dense depth,LiDAR, Stereo-image pairs	Pretraining data sets

Timeline

Weeks	Work
1 to 2	Run a pretrained stereo network for each direction (SPICE-HL3, POLAR)
3 to 4	Mapping failures, further optimizing given models, plotting errors etc
5 to 6	Modify Radiometric stretch and self refinement for this application
7 to 9	Depth, odometry, slope and roughness maps; all this work together
10 to 12	Wrap up; Optimizing, refining, producing results/writeup

Risks?

Possible Outcomes

- There could be too few reliable points away from the light and hence tracking/progress in that direction could be skewed
- Errors could buildup/reinforce themselves which would work counter-productively if it were to occur
- Adapting/fine-tuning could not be as effective as thought of
- We could gain a clear view of where stereo fails and solutions surrounding it
- Slope maps that can be further reused in the pipeline or adapted somewhere else
- If it works out, accurate depth that holds even when observing away from the light

End