Imperial College London

3 December 2023

Week 5 Updated

Ahmad Agus Widodo, PhD student

Imperial College London

Research Objective

Flood Risk Management by assessing and monitoring the condition of flood embankment assets.

- Predicting embankment deterioration by utilising LiDAR and other related parameters.
- Developing a machine learning model to establish an approach for autonomous classification and address the physical mechanisms of embankment conditions and their deterioration.

Imperial College London

Research Area

Embankment system along Thames River and Hamber River

- Thames River : lies along and is crossing the city of London.
- Hamber River : Hull city is facing flooding because the city lies below sea level along Hamber River.

Imperial College London

Literature Review

LiDAR: Robust multi-task machine learning network for prepossessing LiDAR point cloud. [1]

- Denoising : minimising useless and deviated information.
- Objective Segmentation : eliminating unnecessary background or object that should be excluded.
- Completion of point cloud : achieving to produce higher quality of dense point cloud data.
- Multi-task machine learning : utilising various machine learning and deep learning methods.

Imperial College London

Literature Review

Levee: implemented as part of mitigation actions to reduce flooding entering neighborhoods. [2]

- Geology and geomorphology
- Records past maintenance and structural records
- Frequency of floods and other loading (stress level)
- Vegetation condition

Literature Review

Climate Condition: possible effects vary around the world [2]

- River / sea Water Level
- Wave height and direction
- Wind condition
- Rainfall and dryness intensity
- Storm frequency / intensity
- Salinity concentration

Imperial College London

Tools and Software

Python

- Pandas
- Geopandas
- Matplotlib
- Segment-lidar
- pylidar

Open Result

- CloudCompare
- Diplaz

GIS (ArcMap)

Imperial College London

Data

- LiDAR Point Cloud : generated from https://environment.data.gov.uk/survey

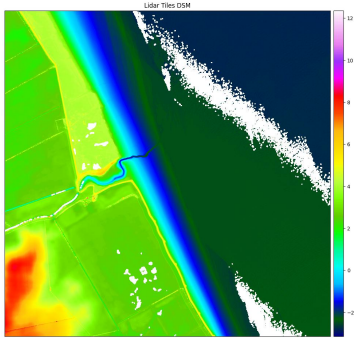

Figure 1: Data Types (.tif / , laz)

Figure 2: ML / DL operations

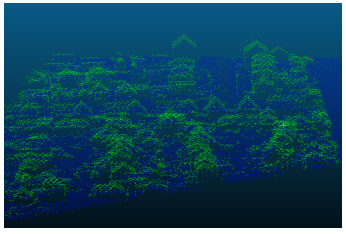

Figure 3: Result, open using Cloud Compare

Imperial College London

Expectation

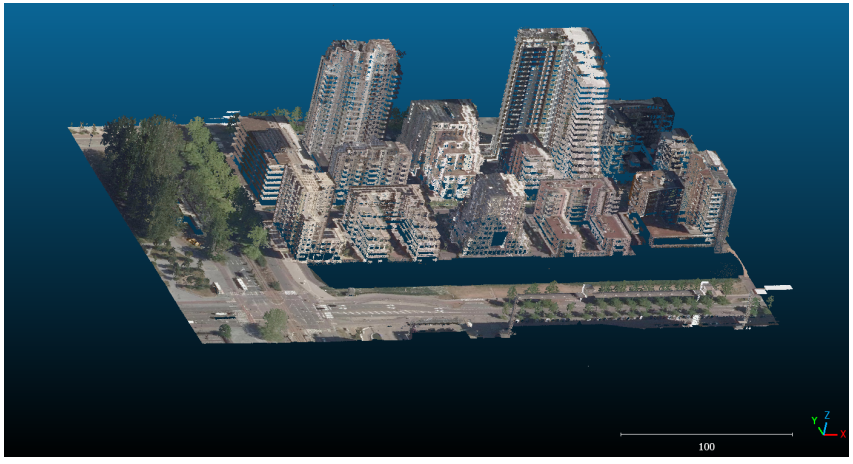

Figure 4: Another Data (Expected Outcome)

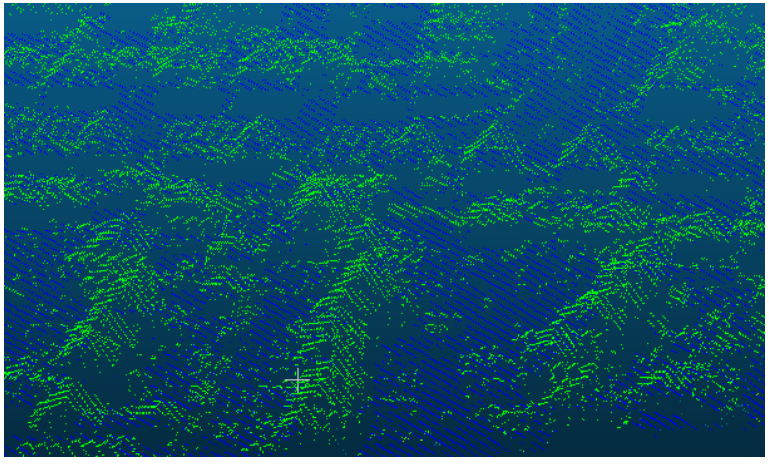

Figure 5: LiDAR Data from Environment Agency (Right Now)

Imperial College London

Data

- Climate Data (time series) : generated from https://environment.data.gov.uk/hydrology/explore

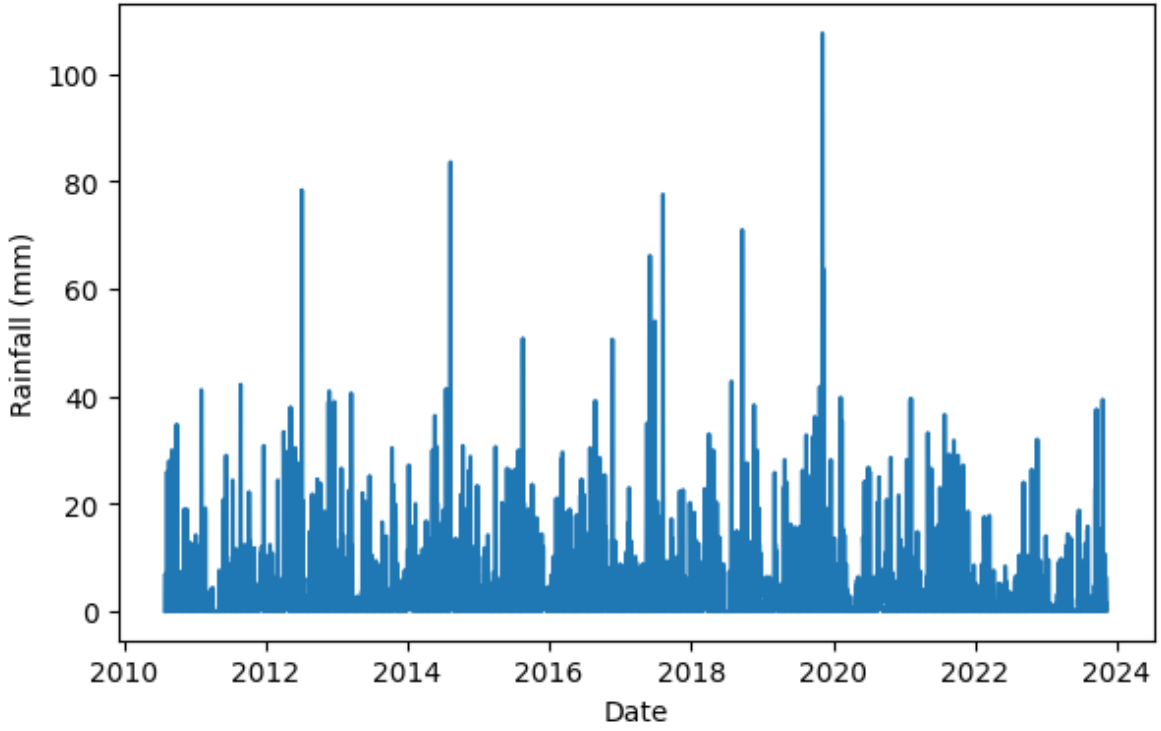

Figure 6: Rainfall Data Series

Imperial College London

Timeline

- Working Milestone during PhD

TASK ID	TASK TITLE	START DATE	DUE DATE	DURATION IN DAYS
1	Literature Review	1/11/23	30/11/23	29
1.1	Open the data			
1.1.1	Start working on ML/DL			
1.2	Exploring LiDAR Data	1/12/23	31/1/24	61
1.3	Writing First Project Model			
1.4	Exploring Other Parameters	1/2/24	31/5/24	120
1.5	Finalisasing LiDAR Data Outcome			
1.6	ESA	1/6/24	31/8/24	91
2	Committee Meeting	1/9/24	31/10/24	60
2.1	Perform Experiment on Main Projec	1/12/24	30/11/25	364
2.2	Paper 1, Conference			
2.3	Perform Experiment on Main Projec	1/12/25	30/11/26	364
2.4	Paper 2, Conference			
3	Write Paper 3	1/12/26	31/10/27	334
3.1	Write Final Thesis			
3.2	Defense			
3.2.1	Viva			

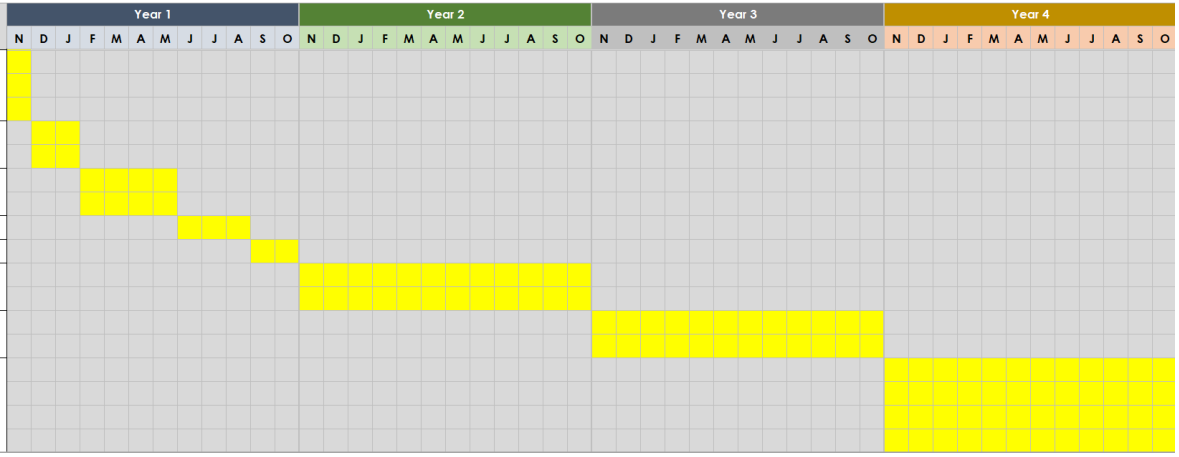

Figure 7: Milestone

Imperial College London

Reference

[1] Luda Zhao et al. "Robust multi-task learning network for complex LiDAR point cloud data preprocessing". In: *Expert Systems with Applications* 237 (2024), p. 121552.

[2] M Sharp et al. *The international levee handbook*. 2013.