3D Road Network Visualization

Prof. Ahmed Eldawy

Kapish Garg
Gyan Prakash
Tina Mirzaei
Zhuocheng Shang
Xinlong Yi

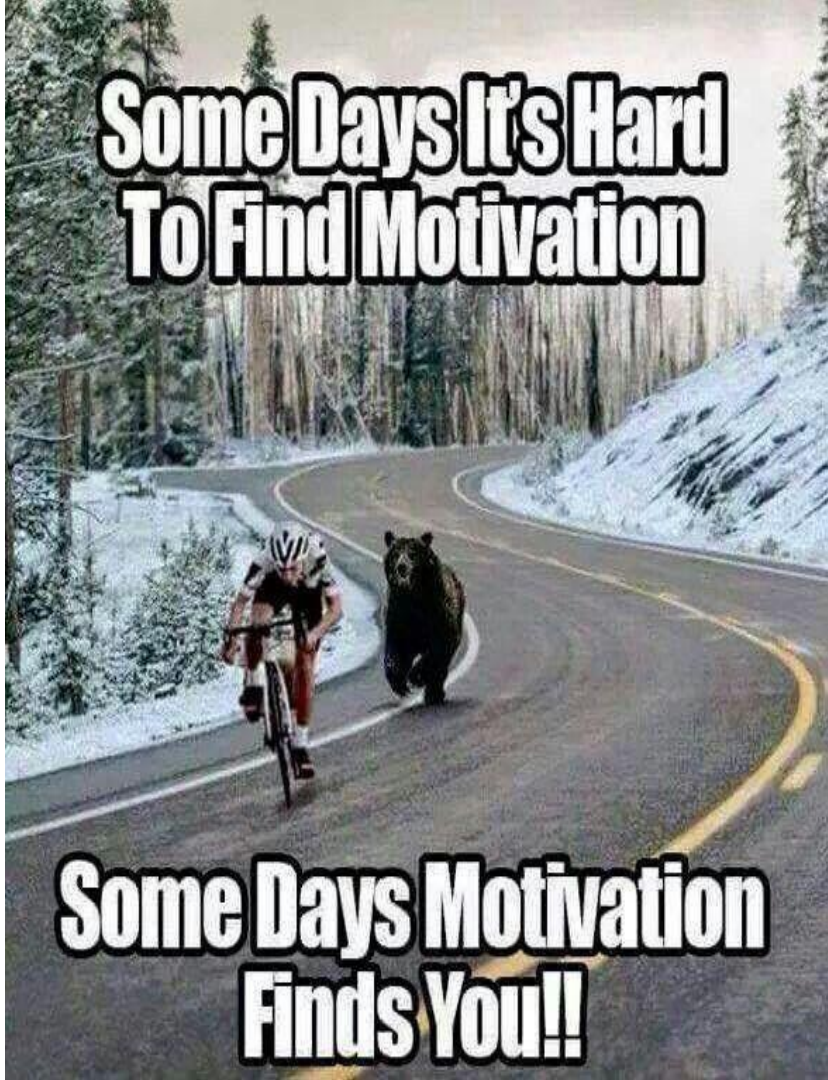
Outline


Motivation
Introduction
Data Preparation
Data Visualization
Future Work

Motivation

Datas stored as 2D road network.

- There is an abundant amount of 2D road network maps
- Only few tools and methods to convert data into 3D models.



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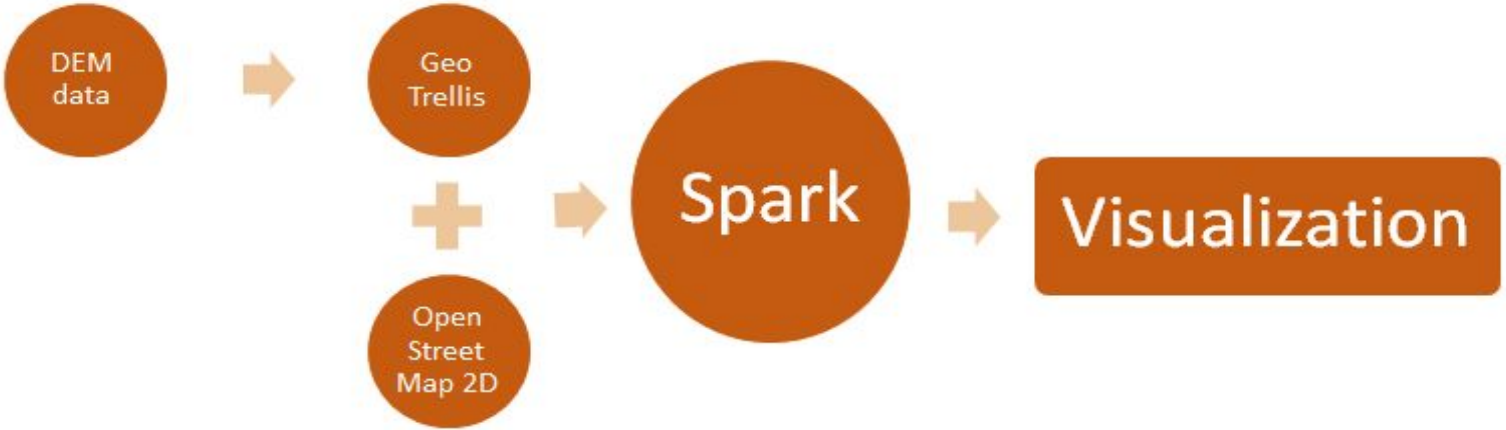
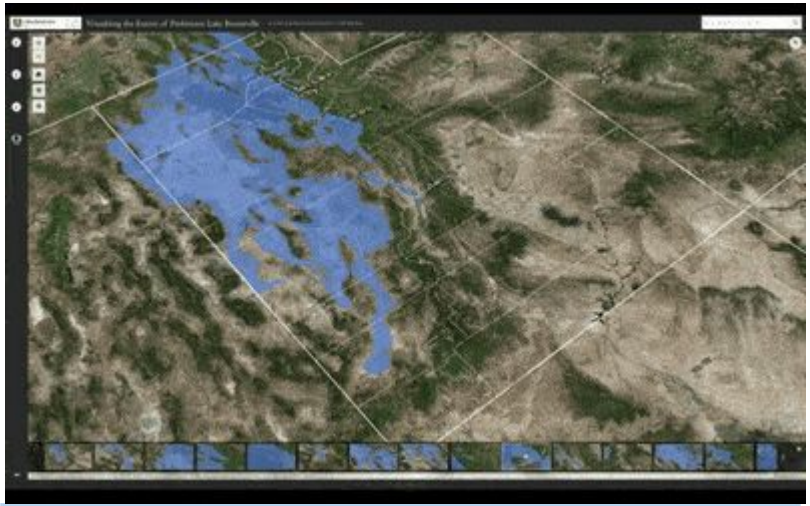
Introduction



Introduction

Applications:

- Converting 2D road data to 3D road network efficiently
- Navigating from one place (of origin) to another (destination)
- Increasing the efficiency of using and maintaining city infrastructure
- Monitoring the environmental and social conditions of urban life
- Using road networks in gaming



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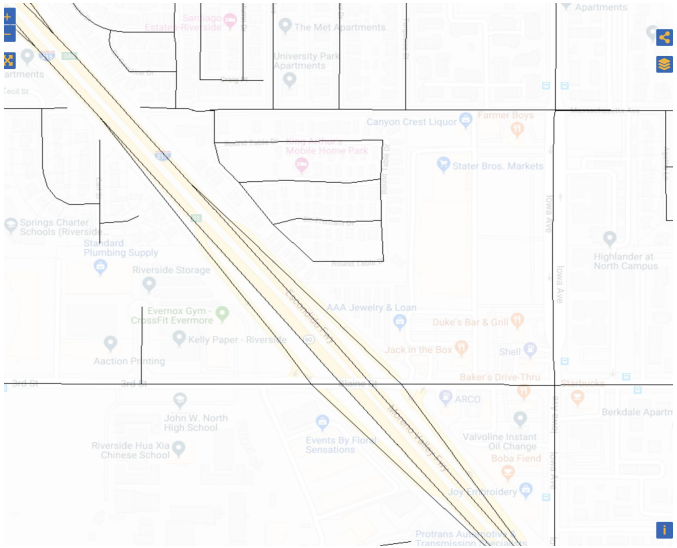
Data Preparation

Data Abstraction

- Open street road map - 2D
  [longitude, latitude]

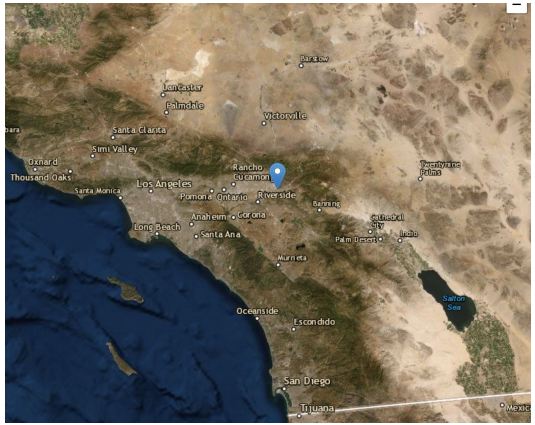


Geojson

Features :
- Properties:
  - attr 0 : segment id
  - attr 1 : start point id
  - attr 2 : endpoint id
  - attr 3 : road id
  - attr 4 : other features

Geometry:
- type: LineString
- coordinates: segment location (start,end)

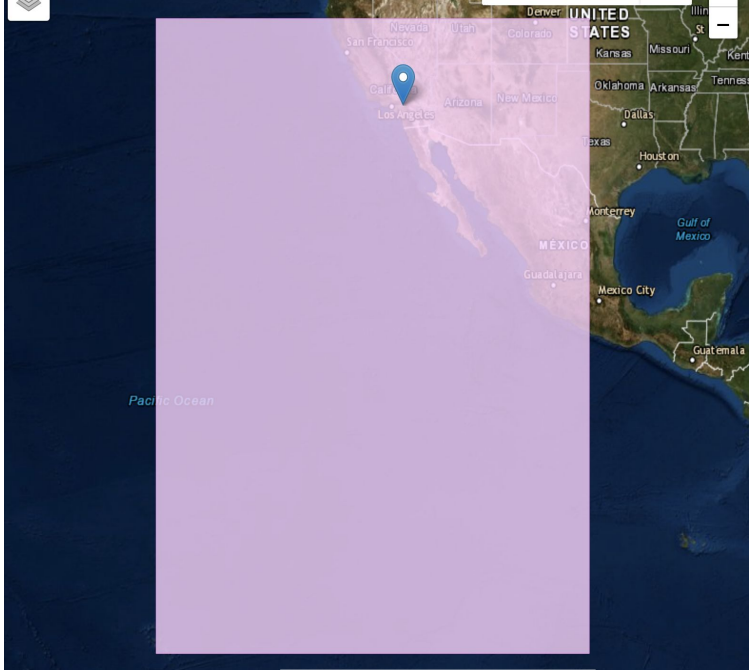
- How DEM looks like - 3D
  [longitude, latitude, altitude]

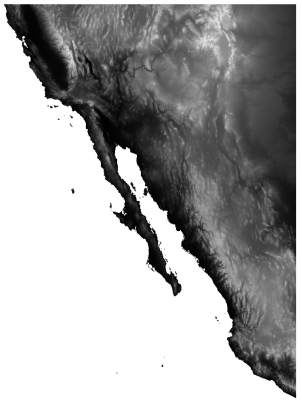


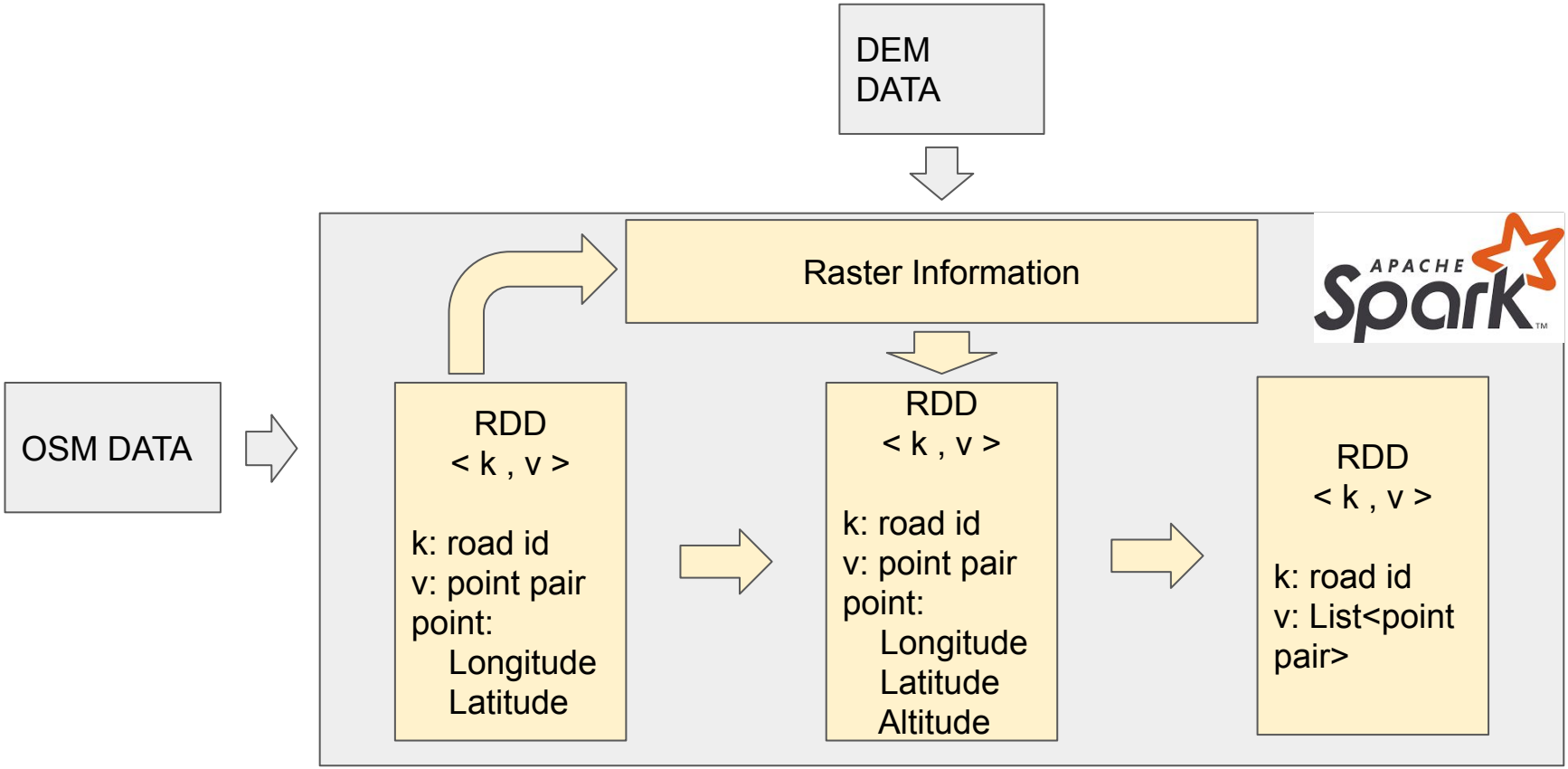
Data Preparation

Data Cleaning

- The DEM data divides world map into 32 blocks.
- Also filter out irrelevant altitudes such as oceans.
- Need to map the block with corresponding longitude and latitude.



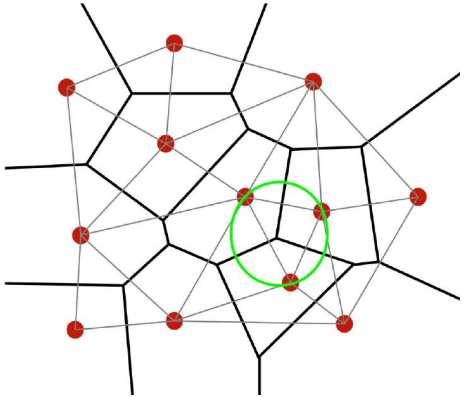


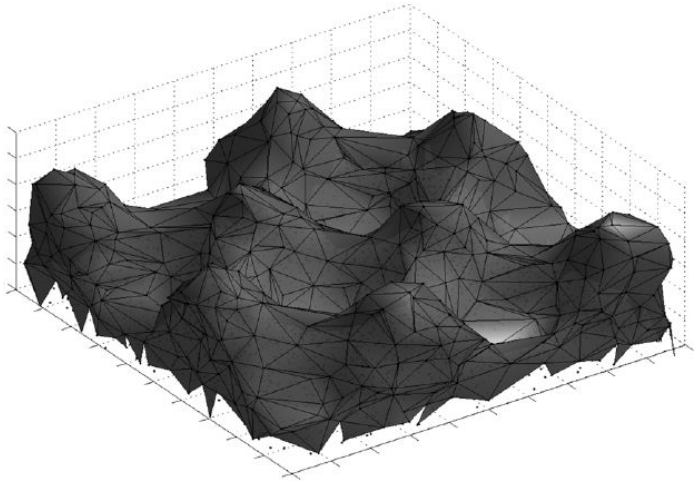

DEM
DATA
Raster Information
APACHE
Spark
OSM DATA
RDD
< k , v >
k: road id
v: point pair
point:
Longitude
Latitude
RDD
< k , v >
k: road id
v: point pair
point:
Longitude
Latitude
Altitude
RDD
< k , v >
k: road id
v: List<point
pair>

Data Preparation

Data Integration

- What if road-network points does not included in DEM?
- Use Delaunay Triangle to estimate the surface.
- Use estimated surface to get the approximation of the missing data.





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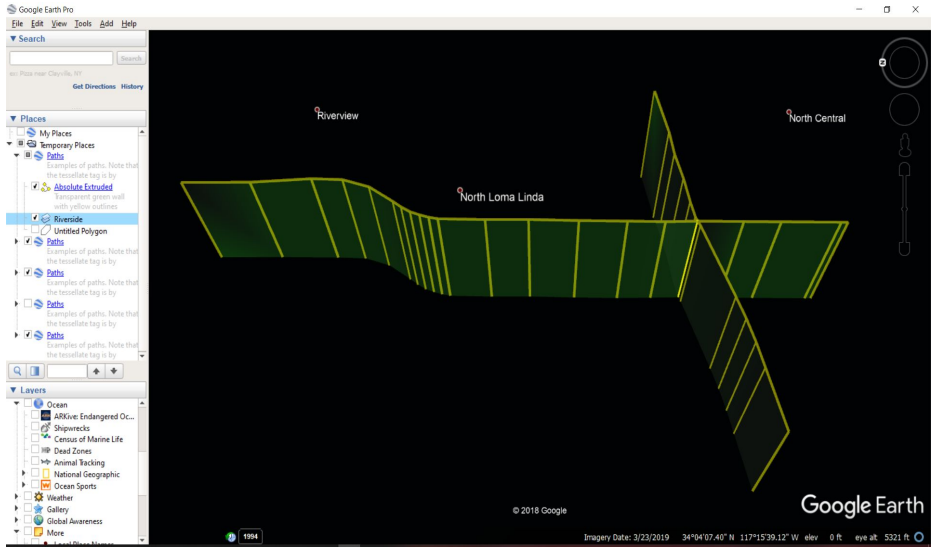
Data Visualization

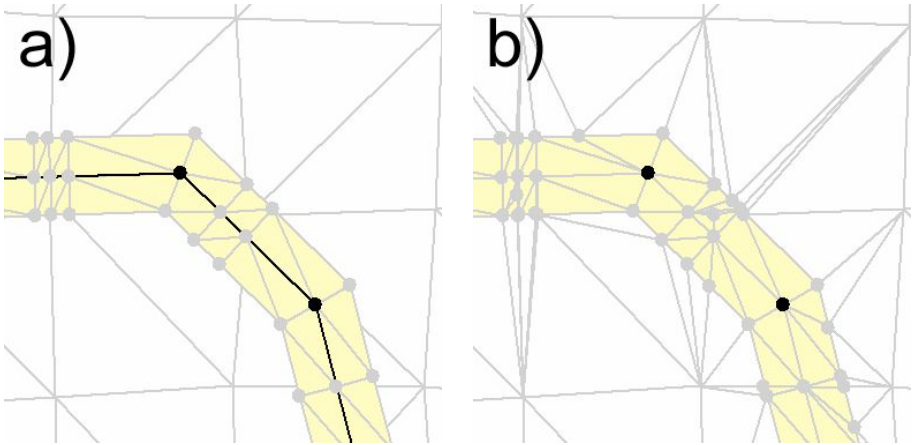
Google Earth

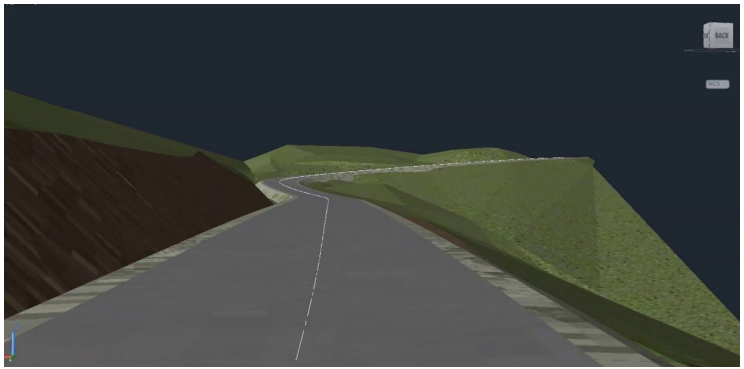
- The final output data contains x, y, and z coordinates. Which can be read in a KML file and visualized using **Google earth**



Simulating Road surface and it’s curvature

- Using Three.js, we can independently simulate the Roads. Showing their horizontal Slopes along with the elevation.
- The slope of the road can be calculated using delaunay triangulation.





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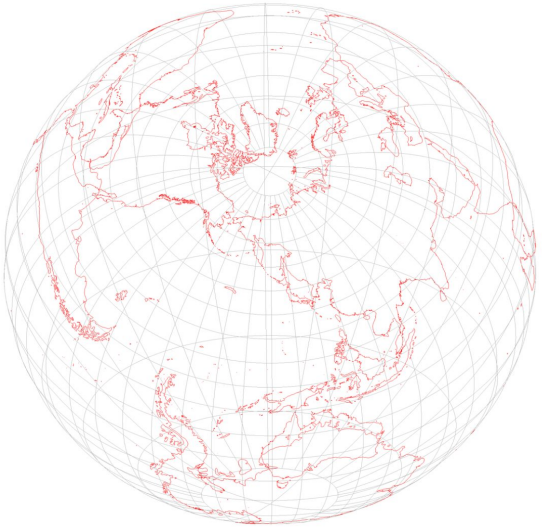
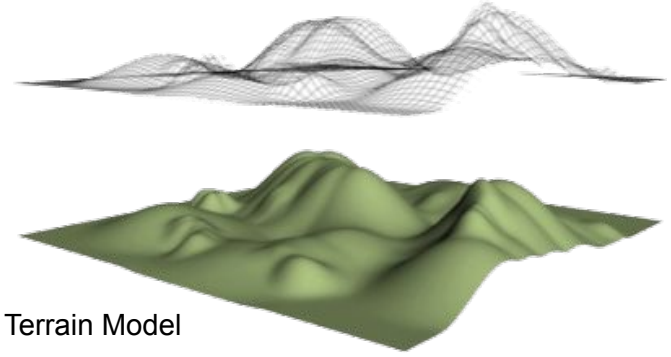
- Using Digital Terrain Model (DTM)

  A DTM is a vector data set composed of regularly spaced points and natural features such as ridges and breaklines.

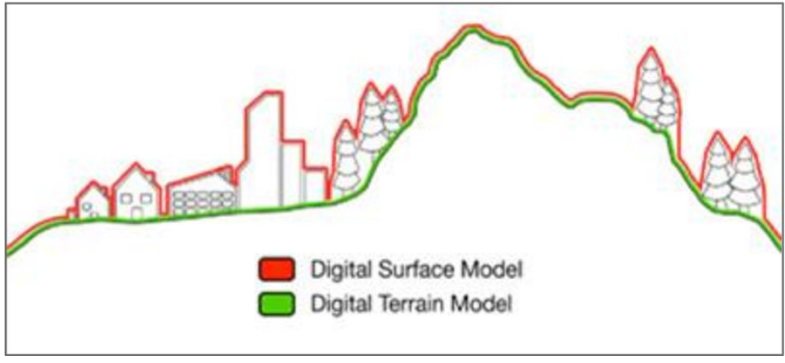
  A DTM augments a DEM by including linear features of the bare-earth terrain.

- Digital Surface Model (DSM)





Digital Terrain Model




thank you