WASP Project Course 2025

Enhanced texturing of real world 3D models

Background

Maxar uses its automated multi view stereo algorithms inside a state-of-the-art high-performance computing environment, with direct access to the world's most trusted commercial satellite imagery. This powerful combination creates unparalleled geospatial capabilities and enables the production of the Globe in 3D at an extremely rapid rate. The Globe in 3D provides decision-makers and analysts with the entire world in highly accurate, immersive 3D models for telecommunications, emergency response and defense and intelligence. Currently ~90 MSqkm of the earth's landmass is covered with 50cm 3D models.
The 3D model constitutes of a textured 3D TIN mesh based on 50 cm satellite images, that you can extract 3D vectors from, see Fig 1.

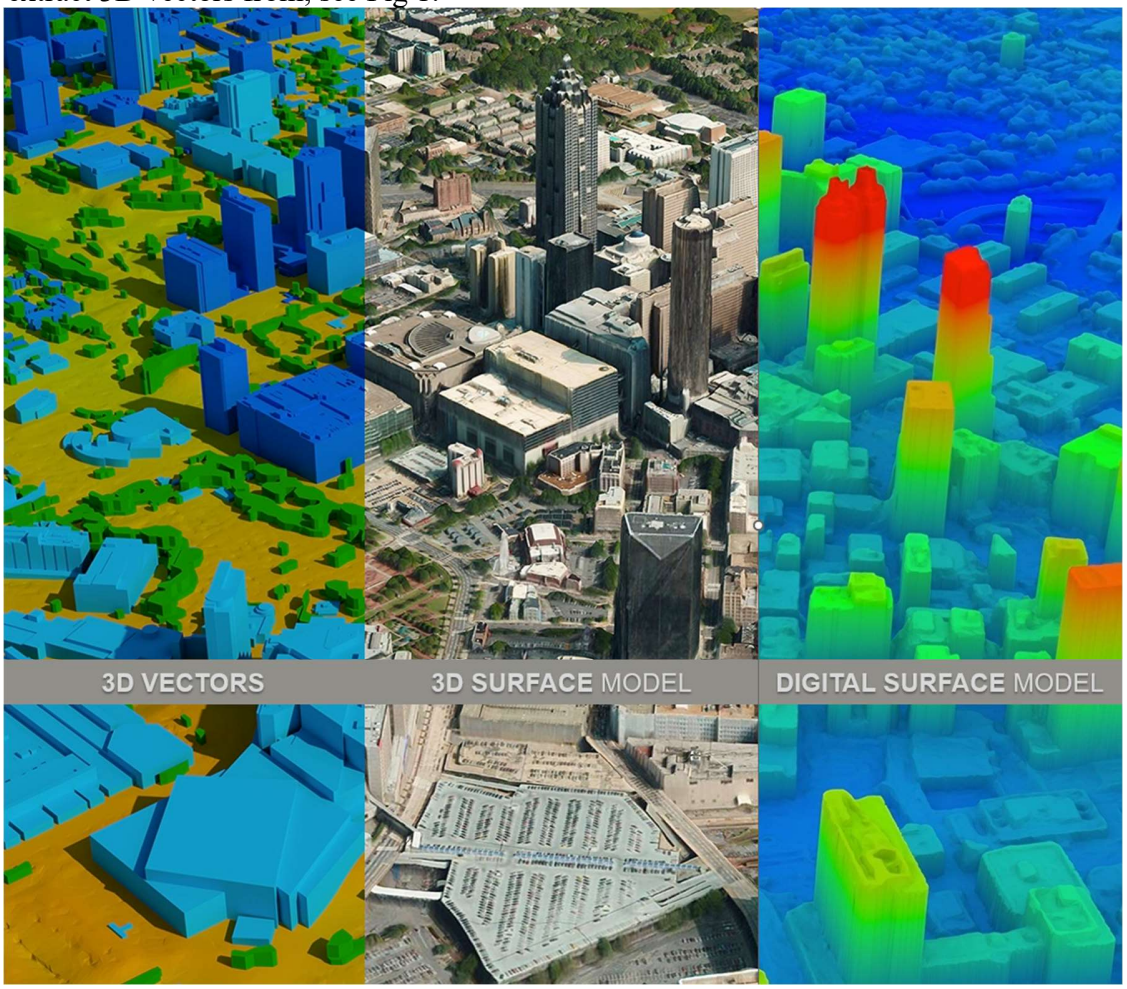

Fig 1: Illustration of the textured 3D DSM.

The last year Maxar has launched 6 new satellites with 30 cm resolution. Utilizing these a much higher texture quality is achievable, see *Fig 2* and *Fig 3*.

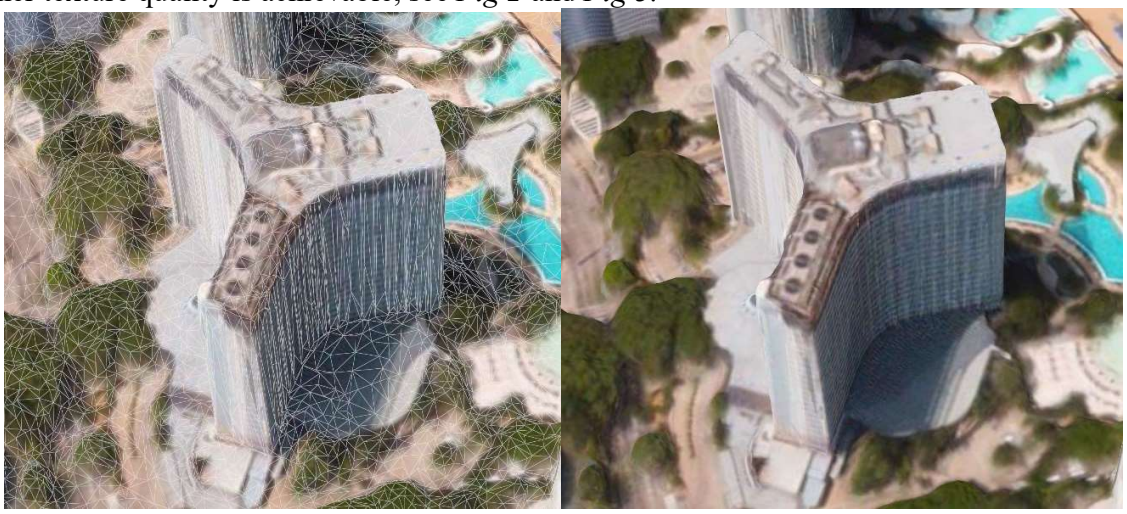

Fig 2: Current 50 cm 3D model; left with overlayed mesh structure

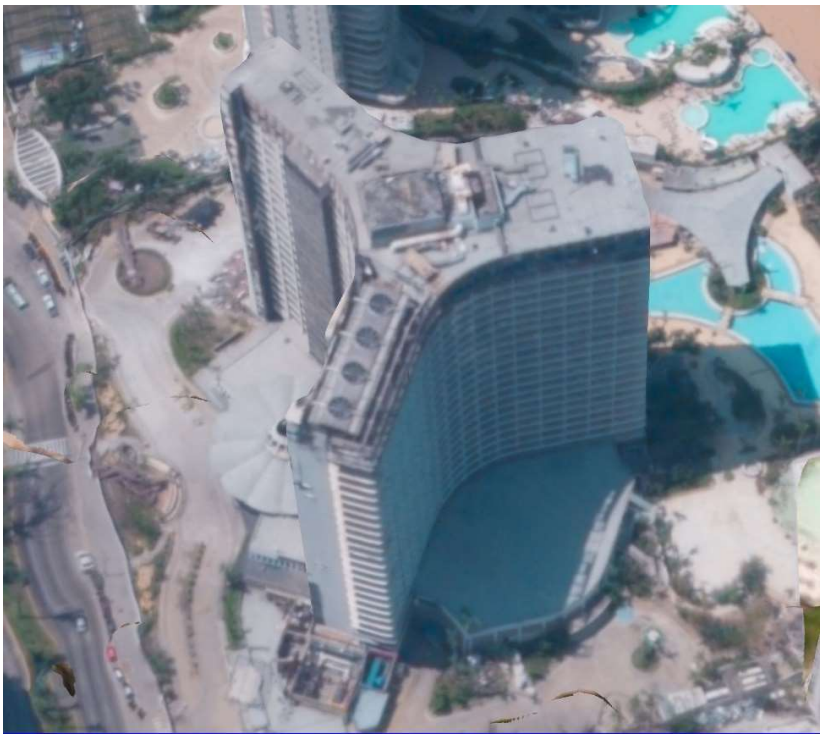

Fig 3: Same mesh as Fig 2, but with a 30 cm image projected. More details are more apparent given the higher resolution.

The task is to texture a model with these higher resolution images, not only for visualization but also for reasoning like line-of-sight, radio propagation, semantic features (windows, doors …), coordinate extractions, i.e. Gaussian splatting and Nerfs can be tools but are currently not sufficient.

There are numerous applications for these models; like simulation, training, rehearsal for public safety, higher fidelity textures also allows for better correlations and accuracy in SLAM algorithms etc etc

Participants

Industrial partner: Maxar Intelligence, Sweden

Industrial supervisor: Leif Haglund, leif.haglund@maxar.com.

Academic supervisor: Michael Feldsberg, Prof CVL, LiU, Michael.Felsberg@liu.se.

Coordinating WARA representative: Jesper Tordenlid, Jesper.Tordenlid@combitech.se, WARA-PS

Suggested WASP PhD students: <optional>

Challenges to investigate

There are several challenges to achieve this in a global context, e.g.:

- *Atmosphere*; given images from several days, the atmosphere changes and gives rise to color and contrast differences which need to be compensated for.
- *Seasons*; is it possible to combine images from different seasons?
- *Only partial coverage*; in many cases some collection angles are missing – is it possible to infer data from the visible facades?
- *Change in model, e*.g. new buildings; How to realize that these pixels should not be used when texturing the old ones – and flag that change has occurred.
- *Obscurations*; Can trees in front of a building be filtered away when texturing the façade?
- *etc*

Possible AI algorithms to utilize could be generative approaches for (facade) texture generation like, masked auto-encoders, implicit neural representations and/or conditional diffusion models.

Resources

Input will be

- Textured 3D models, e.g. in 3D tiles format
- As set of high resolution satellite images, either in 30 cm native resolution and/or in High Definition 15cm format
- Building vectors place on a Digital Terrain Map (surface without buildings and vegetation) of the areas covered by the 3D models.

Deliverables

- The best 3D model ever seen!

References

<references>

Keywords

<keyword 1>, <keyword 2>,…