PVISION PhotoVoltaIc System Installation OptimizatioN

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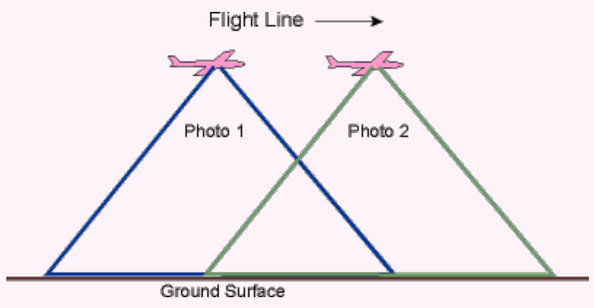
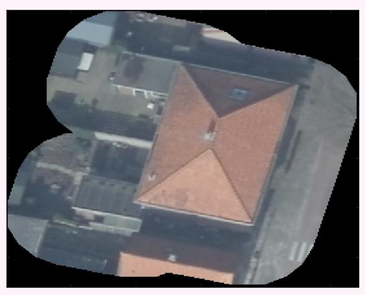
A collaboration to improve rooftop pv installations. The extraction of rooftop data from aerial imagery provides inputs for improved yield modelling, which in turn enables more accurate calculation of rooftop potential used by commercial software. Roof segments are used to generate feasible pv-system designs autonomously.

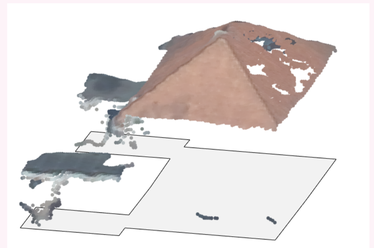
Extracting roof data from aerial imagery



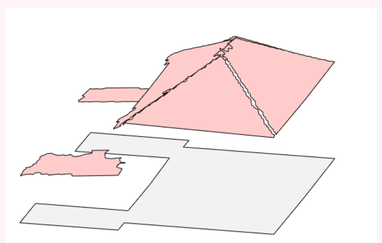


The same building is visible in two different overlapping aerial images.

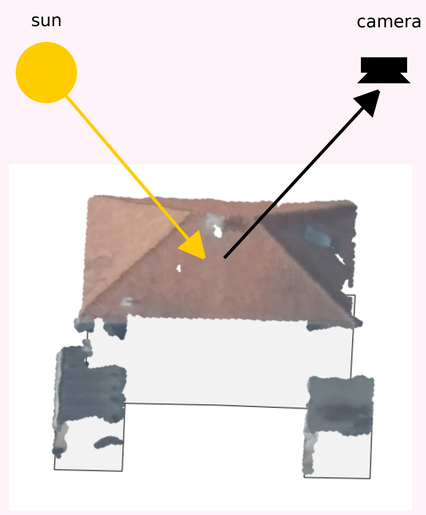
For each pixel in the left image the corresponding pixel in the right image is found. The offset between two matching pixels gives depth information. Objects far away from the camera have a small offset (black) and objects close to the camera have a large offset (white).



The offset values make it possible to reconstruct the matched pixels in 3D.

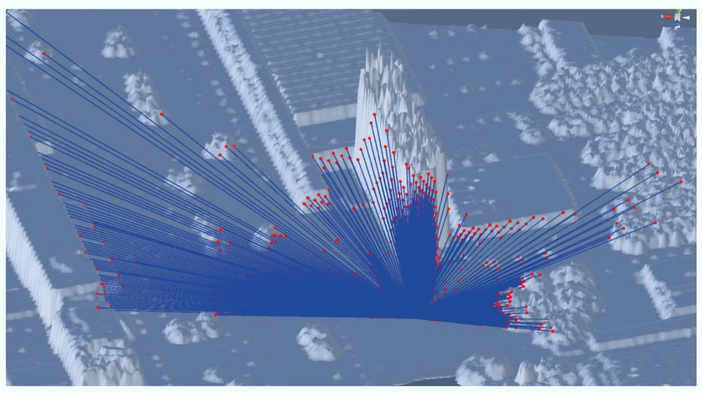


The 3D (x,y,z) and color information is used to find planar roof segments.

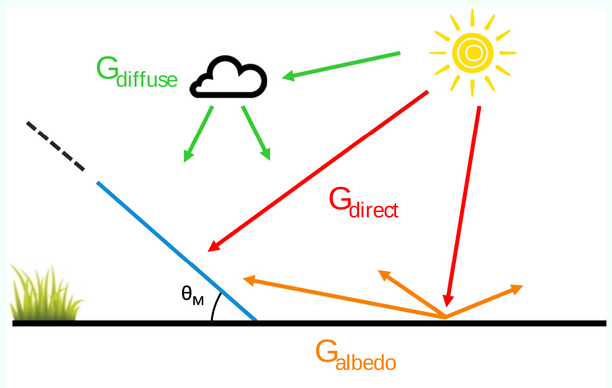


Using the sun position, atmospheric conditions, the derived 3d model, the camera position and the camera response function, pixel values are translated into albedo values

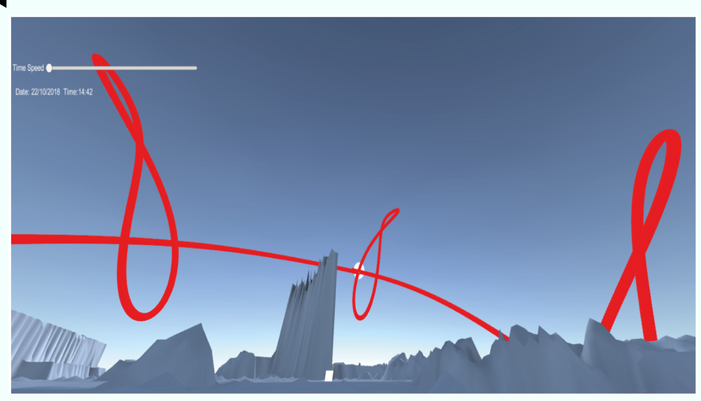
Improved yield modelling



LiDAR data & Ray-casting
(Sky View Factor and View Factor)



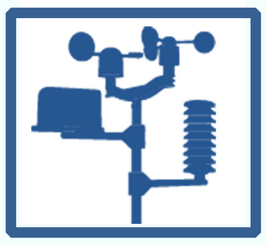
Irradiance components



Sun-path

ASTER spectral albedo database

$G_{albedo} = f(SVF, VF, \alpha, DNI, DHI, SF, \theta)$



Metrological data

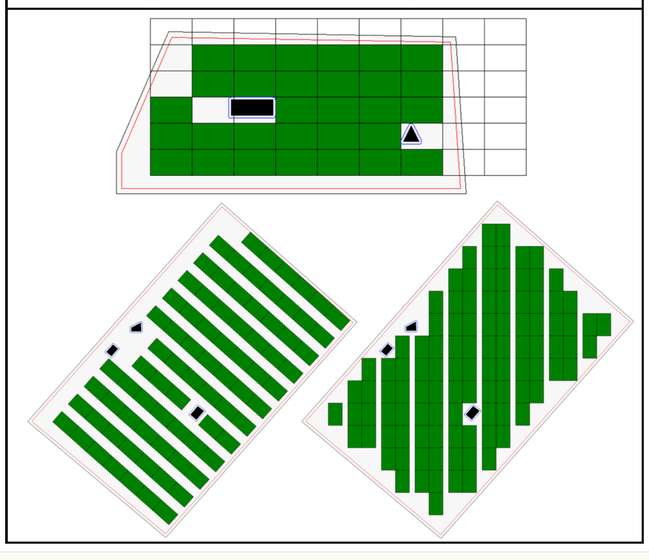
Automated pv system design

Input: roof surface, roof obstacles, weather data

Output: panel layouts that meet the design requirements

Maximum panel placement

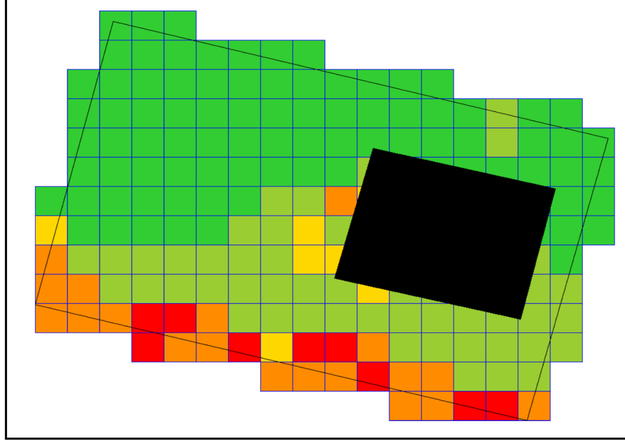
Shift a grid on flat or pitched roof



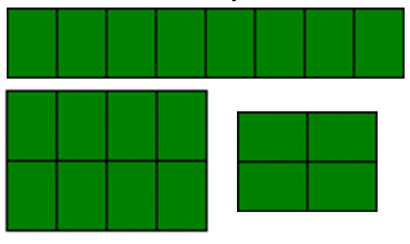
Finite panel placement

Build solutions with panel sections

1. Calculate yields on the roof



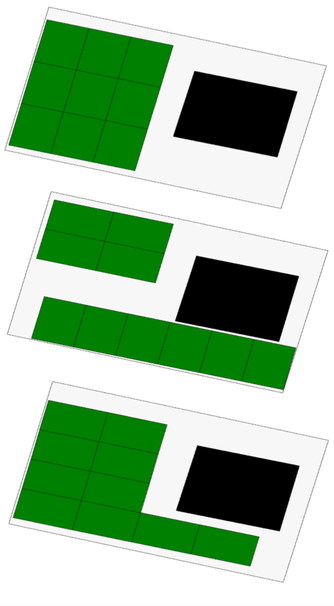
2.Determine panel sections



3. Build solutions & evaluate

- Combine panel sections
- Aesthetics grading
- Ease of installment grading
- Multi-objective ranking

4. Present designs



Monitoring of installed pv-systems

Based on the present design of hundreds of existing systems, yields will be calculated with the automated PV system design, and compared to actual measured yields to validate and improve the software platform.

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