

# Visual Analytics for the exploration of heat loss over rooftops

It is important to know the energy situation, e.g. when considering whether a renovation of a roof would be necessary. Since roofs are under external influences and can differ visually, it is difficult to determine the energy situation comparatively. Therefore, it is necessary to make cross-comparisons over a larger number of house roofs based on similar elements between the roofs in order to make statements about the energetic situation. An interactive visualisation based on zonal statistics from RGBI, LIDAR and TIR was created. The tool offers the possibility to filter the data dimensions and therefore only view the same or very similar pixels in a cross comparison. The comparison of the houses was therefore achieved.

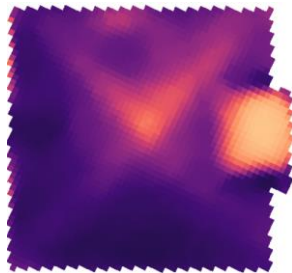


Fig. 1: Example thermal roof image by BSF Swissphoto

The aim is to enable a **cross-comparison** between houses in order to make statements about the energy status of the roof, because the energetic situation of roofs is influenced by different factors. Therefore, it is difficult to make a general statement about it based on thermal images (Allinson, 2007) (see Fig. 1).

To make this possible, elements of the roofs that are the same should be compared over a large number of roofs. The overall iterative workflow is shown in Figure 2. From RGBI, LIDAR and thermal image, individual **data dimensions** were defined, further ones were calculated.

For each data dimension, **zonal statistics** were calculated on a 1-metre grid and a correlation matrix was created to **analyse correlations** (see Fig. 2 confusion matrix). Data dimensions of the RGBI data source correlate strongly, so only two instead of the six data dimensions were chosen for the visualisation.

An **interactive visualisation** was developed with the data dimensions height, greyscale, NDVI, slope, orientation, sky view factor and thermal value (see Fig. 2). The visualisation allows to filter the data, select roofs and hover over the points for more information. Using different filter settings, pixels can be compared that lie within the selected interval i.e., are similar for this dimension. This process can be run over several roofs and filter settings, whereby recurring sequences regarding the thermal values should emerge.

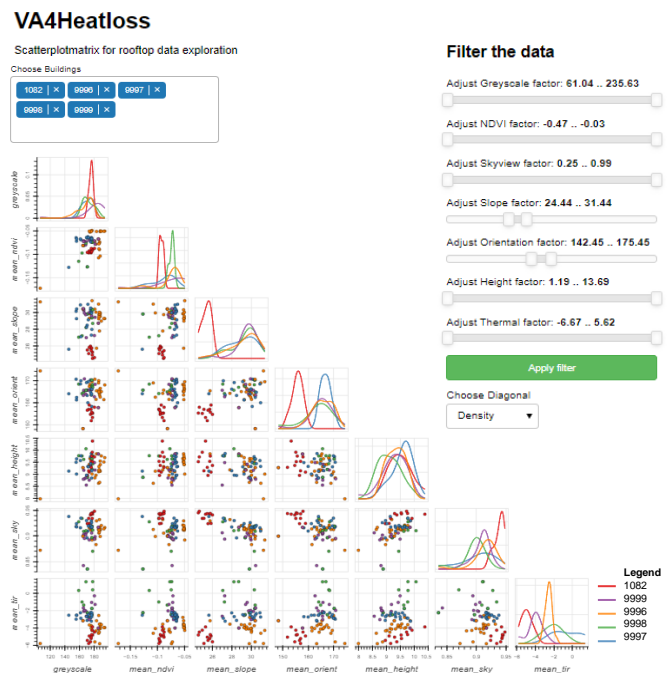


Fig. 3: Final visualisation in the form of an interactive scatterplot matrix with the option of filtering for the cross-comparison.

**In conclusion**, the visualisation enabled house roofs to be **successfully compared** with each other, based on similar elements. This also applies to houses that are visually very different from other buildings, because elements that are similar to other buildings were also found. This was tested prototypically with 18 roofs and the project goal was achieved. However, in order to be able to make definitive statements about the roofs, it will be necessary to incorporate the microclimates into the data, as well as to integrate further reference roofs.

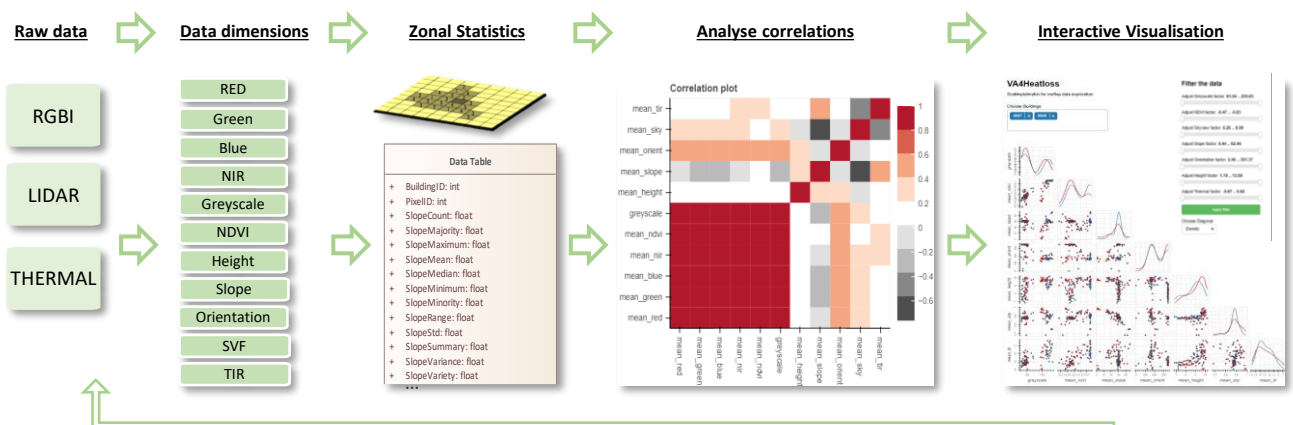


Fig. 2: Schematic representation of the workflow from the raw data to the interactive visualisation

**Bibliography:** Allinson, D. (2007). Evaluation of aerial thermography to discriminate loft insulation in residential housing. 207

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