CARICATURISTIC VISUALIZATION OF DEFORMATION DATA BASED ON HIGH DENSITY POINT CLOUDS

Peter RAUTEK[1], Alexander REITERER[2], M. Eduard GRÖLLER[1]

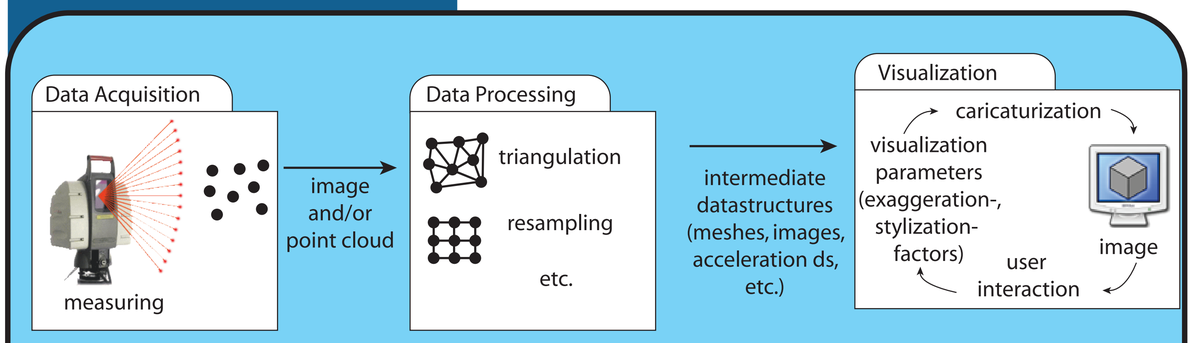
Abstract

Modern deformation monitoring techniques offer possibilities to measure and analyze deformation processes in detail. There are various different sensor systems on the market that can be used in these application fields, each having specific features in terms of accuracy, robustness, user interaction, operational range, measurement speed and frequency, resolution, or other relevant parameters. The selection of an appropriate sensor system for a particular application is not trivial.

In recent years research on image-based measurement systems and laser scanners has gained increasing interest – in many cases a combination of different sensors has advantages over a single-sensor system (e.g. different accuracy and reliability classes, different measurement range, etc.).

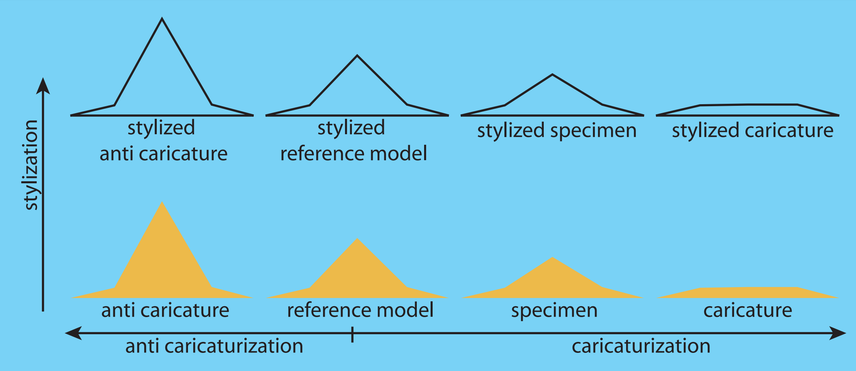
The point clouds produced by such systems potentially consist of a vast number of points. One of the main problems concerning the analysis and interpretation of deformation measurements is the visualization of the data respectively of the underlying deformation. In this paper we present the application of the recently developed caricaturistic visualization method to deformation data based on high density point clouds. Caricaturistic visualization depicts the deformation data in an exaggerated way. The exaggeration of the deformation accents subtle deviations and supports the viewer for the correct interpretation of the underlying deformation. We show results for facade deformation data as well as for landslide data.

Pipeline



High density point clouds and/or images of the object of interest are measured in the data acquisition stage. This output is prepared for visualization in the data processing stage. Data processing may involve triangulation, resampling, registration, etc. of different point clouds. The intermediate data structures such as meshes, images, acceleration data structures, etc. are used for the interactive visualization. The user can interactively manipulate the visualization parameters to achieve the desired visualizations and to gain insight into the data.

Caricaturistic Visualization



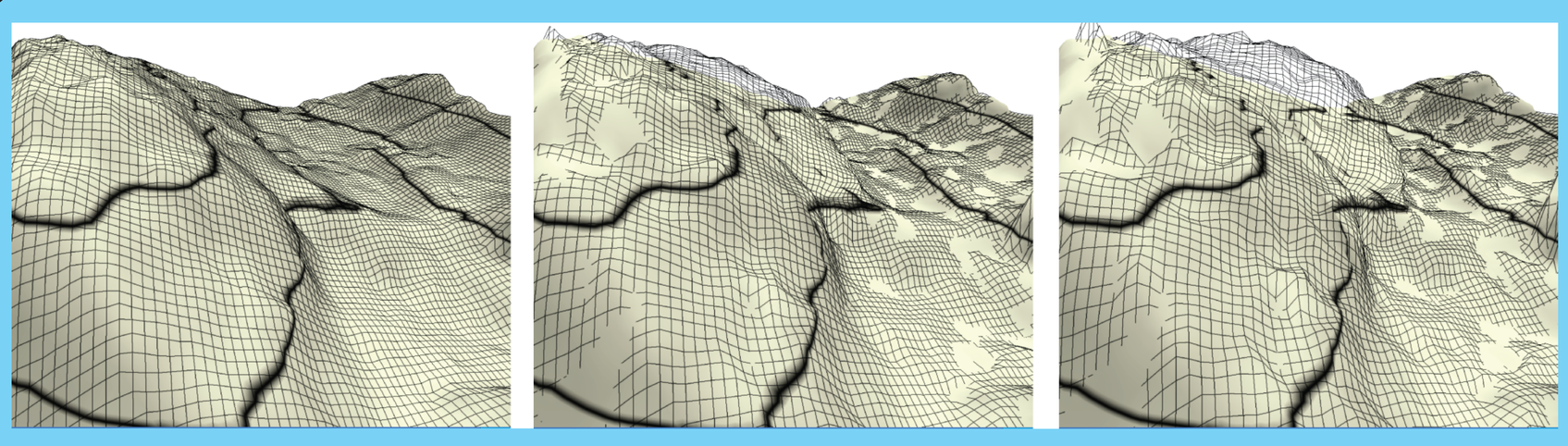
Caricaturization is the exaggerated depiction of the deviations of a specimen to a reference model. Like in traditional caricature, the caricaturistic visualization technique takes a reference model and a deviating specimen and depicts the deviations in an exaggerated way. In the case of deformation data the reference model is a measurement of the object of interest and a specimen is the consecutive epoch. The caricaturistic visualization of such a specimen depicts the deformation of the object of interest in an exaggerated way. The opposite of caricaturization is anti caricaturization, i.e. the exaggeration of the deviations of the reference model from the specimen. In the lower row of the Figure a simple shape is used to illustrate caricaturization and anti caricaturization.

Stylization or abstraction are concepts that can be typically found in traditional caricature. In the upper row of the above Figure, stylized visual representations of the shapes of the lower row are shown. The more stylized versions of the shapes are sparse representations and can therefore be used as overlays for the original image. Stylization and exaggeration (i.e. caricaturization respectively anti caricaturization) are the most important concepts of caricaturistic visualization. The application of these concepts for two different scenarios are shown below.

Visualization of Facade Deformations

Repeated measurements of facades are taken for surveillance purpose. The first measurement serves as a reference model for the following measurements. Small deformations that are hardly visible are exaggerate to make them clearly visible. The stylized caricature is overlaid over the meassured image. The deformation in the two images above is depicted with different exaggeration factors. The caricaturization of the deformation allows a fast inspection of the underlying data and provides an intuitive representation of the deformation.

Visualization of Landslides



Zoom in on a caricaturistic visualization which emphasises the deformation of a landslide. In the left image the deformed surface is shown. A regular grid is overlaid. In the middle and right image the grid is deformed in an exaggerated way. It clearly accents the deformation that is represented in the underlying deformation data. The exaggerated deformation of the grid clearly shows where the underlying deformations occur and supports the correct interpretation and classification of the deformation. The caricatures accent regions of lifting while regions of settlement are occluded by the yellowish shaded surface. However, the regions of settlement can be accented with the corresponding anti caricature.

Supported by:

FWF Der Wissenschaftsfonds.

TU VIENNA Technische Universität Wien
Vienna University of Technology

[1] The Institute of Computer Graphics and Algorithms, Computer Graphics Group

[2] Institute of Geodesy and Geophysics, Research Group Engineering Geodesy

Contact:
Peter Rautek
rautek@cg.tuwien.ac.at