SIVT – Spatial Image analysis and Viewing Tool

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Technical challenges of Case Study:
- huge number of data sets are produced
- difficult to keep track of various data sets
- a variety of techniques are applied for documentation of
  - entire walls
  - details of wall paintings

Approach:
Test data set for combined visualisation:
- 5 photos of 1 wall for SfM
- 7 images from technical photography of one detail
Combined visualisation of all data sets in flexible tool(s) allowing analysis and mapping of interpretations
Data processing:
From the 5 photos we generated 3D data of an entire wall-painting
  > Registered ortho-photo
  > 2.5D image, normal image, difference image

Task 1:
Allow a semi-automatic registration of detail images using an ortho-photo as basis.

Considerations:
The ortho-photo is rectified
  > allows measurements if scaled
The 7 images from technical photography are not rectified
  > Both data-set types have different dpi
Corresponding information between ortho-photo and 7 image needs to be there > sometimes problematic for IR/IRR/UV/IRFC images.
Germolles
Registration tool

Spectral image

Ortho-photo
Registration tool

Through measuring the same distance on both images a scale factor is calculated
The tool asks the user to create a bounding box which provides an approximate area for comparison.
Registration tool
Registration tool
Registration tool
Registration tool
Registration tool

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Registration tool
**Approach:**

In a first step for each of the 7 images matching points are identified and outliers are eliminated – at least 4 matching points are needed. If all images are taken by the same device AND from the same position, in a second step the matching points of all 7 images are compiled again – again at least 4 matching points are needed.

**result:**

If all images are taken by the same device AND from the same position, all spectral images can be rectified and registered using all matching points/one transformation.

> Spectral images with low correspondence can be registered, too.

**Task 2:** Visualise the 3D derivates (2.5D data, normal image, difference image), ortho-photo, and registered spectral images in one tool for further analysis

> SIVT – Spatial Image analysis and Visualisation Tool.
Capabilities:

• visualise multi-sensory digital data sets
• analyse individual and combined data sets
• capture humanities interpretations through mapping and storage
• export these mapped interpretations for archiving and data-sharing
SIVT - Overview

- Standalone Windows Application
- Two different kind of data are the basis
  - referenced images (rectified photos, ortho-photos, maps etc.) & 2.5D images (DEM)
- Four different functionalities to visualise individual images (2.5D or referenced image)
  - water-filling, colour mapping, moveable virtual light source, edge filter
- Layer-structure enables a combination of different visualizations and input-data (photos, maps, GeoTif…)
- Mapping with recording of meta data (such as author, notes, date, mapping parameters)
  - Exchange and discussion between various researchers (if they have the tool)
  - print export
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Tool bar: load & safe a project, mapping tools

Visualisation window with zooming functionality

List of loaded images which are stacked.

Different functionalities

Vector layers for mapping
Through a Digital Elevation Model (DEM) (= 2.5D data) the general topography of the wall is visualised. The height of each pixel is represented in greyscale. Through the interactive Waterfilling Functionality the overall geometry gets more visible.
Subtracting the general topography from the 2.5D data the surface geometry of the wall gets visible. The height of each pixel is represented in greyscale. Through the interactive Waterfilling Functionality the surface geometry is visualised.
The surface normals of the 3D data are used to visualise the surface geometry of the wall. A virtual light source can be moved using the Phong Shading Functionality.
Through the transparency functionality it is possible to display e.g. the ortho photo on top of the shading image. Moving the virtual light source the surface geometry gets visible in combination with the ortho photo.
The Sobel Filter / edge detection Functionality might be of interest to easily create stencils/templates of the letters or thistles.
On top of the ortho photo and shading functionality the registered spectral images with higher resolution can be visualised. E.g. an RGB image, and on top a UV image set at 50 % transparency. As the transparency functionality is interactive, differences are easily visualised.
Zooming on the spectral image, details can be analysed. Here an edge detection filter was applied on the RGB image, e.g. supporting the mapping of stenciles/templates.
Displaying the various spectral images on top of each other can also help to identify differences. First, the edge of the P is mapped based on the IR image.
Displaying this mapping on the IR Reflectography (IRR) image clearly shows a differing edge of the P.
Displaying this mapping on the IRR image clearly shows a differing edge of the P mapped in red. However, the reason for this difference needs to be discussed. In this case it seems the device was slightly moved.
Various images generated by different technologies can be registered on the basis of an ortho-photo.

- Problem: spectral images can have differing information than an RGB image / ortho-photo making a registration difficult.
- If several spectral images are taken by one device from the same position, a combined registration is possible raising the chances for a proper semi-automatic registration.
- One single spectral image might need a manual registration.

SIVT is a tool to visualise all data to keep track of various documentation data and interpretation.

Through various data combinations and functionalities the data can be analysed.

- E.g. the edge filter supports the creation of stencils/templates
- E.g. the visualisation of the surface geometry might support the understanding of retouching work.
- E.g. if the ortho-photo is scaled, measurements are possible.

Results or other information can be mapped (including meta-data).
Thank you for your attention!

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