

## **CE-317 GIS/RS Application to Civil Engineering Spring 2011**

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- Lecture 11: Image Processing

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## **Overview**

- IM Software
- Scanning
- Resolution
- Brightness and Contrast
- CP
- Other Processing Techniques

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## Image Processing Software

- LISA BASIC: A raster GIS software with a lot of possibilities in image processing, terrain modelling and more.
- LISA FOTO: Extension of LISA BASIC, digital photogrammetric workstation.
- BLUH: A professional bundle block adjustment software optimised for aerial triangulation.
- Hugin

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## Image Processing Software

- A “light” version including the central five modules of this programme system with reduced functionality will be installed on your computer.
- <http://www.ipi.uni-hannover.de/lisa>

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## Image Processing Software

- Digital Photogrammetric Workstation (DPW) provides:
  - Stereo DPW: Interactive stereo plotting, optional elevations from a DTM
  - Mono DPW: Planimetric plotting, optional elevations from a DTM

## Image Processing Software

- Aerial triangulation DPW: Manual and automatic aerial triangulation measurement, block adjustment with BLUH
- DTM DPW: Automatic derivation of terrain models, contours etc.
- Ortho image DPW: Creation of ortho images and mosaics

## Image Processing Software

- <http://www.maptec.de>
- <http://www.salford.co.uk/>
- <http://www.media21.de/>
- <http://freeimage.sourceforge.net/>
- IMA3D plugin

## Scanning

- A3 Scanners are used.

## Geometric Resolution

- pixel size in [ $\mu\text{m}$ ] = 25400 / resolution in [dpi]
- resolution in [dpi] = 25400 / pixel size in [ $\mu\text{m}$ ]

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## Geometric Resolution

Resolution [dpi]	150	300	600	1200	2400	4800
Pixel size [ $\mu\text{m}$ ]	169.3	84.7	42.3	21.2	10.6	5.29
Image size ca. [MB]	2	8	32	128	512	2018

### Photo scale

1: 5000	0.847	0.423	0.212	0.106	0.053	0.026
1: 7500	1.270	0.635	0.318	0.159	0.079	0.040
1:10000	1.693	0.847	0.423	0.212	0.106	0.053
1:12500	2.117	1.058	0.529	0.265	0.133	0.066
1:15000	2.540	1.270	0.635	0.317	0.159	0.079
1:17500	2.963	1.482	0.741	0.370	0.175	0.093
1:20000	3.386	1.693	0.846	0.424	0.212	0.106
1:25000	4.233	2.117	1.058	0.529	0.265	0.132
1:30000	5.080	2.540	1.270	0.634	0.318	0.159
1:40000	6.772	3.386	1.693	0.846	0.424	0.212
1:50000	8.466	4.234	2.116	1.059	0.530	0.265

Pixel size in terrain units ca. [m]

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## Radiometric resolution

- 8 bit / 256 grey values
- Grey value =  $0.3 \cdot \text{red} + 0.11 \cdot \text{green} + 0.59 \cdot \text{blue}$

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## Brightness and Contrast

Let  $g$  be the grey value of a pixel in the image, then

$$f(g) = c \cdot g + b$$

4.2.3.1

defines the grey value on the screen with contrast ( $c$ ) and brightness ( $b$ ).

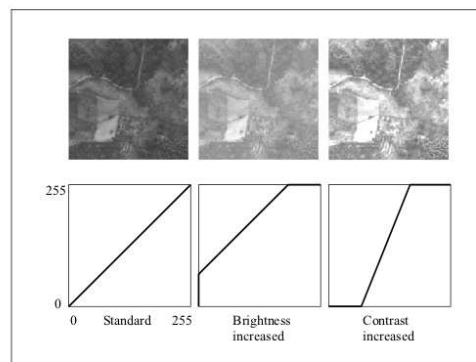


Fig. 15: Relations between grey values in the image and on the screen.

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## Control Points

- The final step within the orientation process will be calculating the relation between image and object co-ordinates, the so-called *exterior orientation*.
- A ground control point (GCP) is an object point which is represented in the image and from which the three-dimensional object (terrain) co-ordinates (x, y, z) are known.

## Control Points

- Topographic points are **Signalised** on the ground by white bars (size e.g. 1.2 by 0.2 m) forming a cross with the point itself marked with a central “dot” of e.g. 0.2 m diameter.
- Another type of GCP is **Natural**.

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## Natural CP

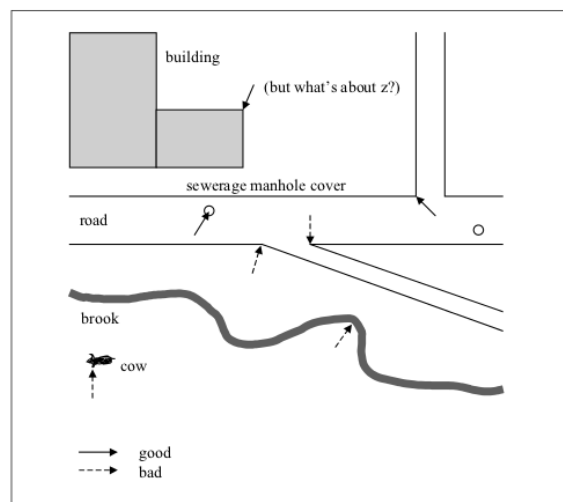


Fig. 16: Examples for natural ground control points.

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## **Other Processing Techniques**

- Identifying Objects of Interest
- Plotting Contours
- Vectorization
- Measurements