PhoWo 2015.

55th Photogrammetric Week

Balla Csilla

Földmérési és Távérzékelési Intézet

oblique

Oblik

OBL/QUE

OBLIQUE

OBLIQUE

OBLIQUE

oblique®

SURE – PHOTOGRAMMETRIC SURFACE RECONSTRUCTION FROM IMAGERY

Az előző PhoWo óta a SURE felkészült true ortofotók automatikus előállítására:
az eredeti képanyag DFM-be vetítésével, élkiemeléssel, a 16 bites radiometriai információ megtartásával négy csatornán...(a képen egy GSD = 10 cm minta)

SURE – PHOTOGRAMMETRIC SURFACE RECONSTRUCTION FROM IMAGERY

Felkészítették a olyan képsorozatok feldolgozására, melyek a fényképezés irányába történő mozgás közben készülnek (mobile mapping, UAV)

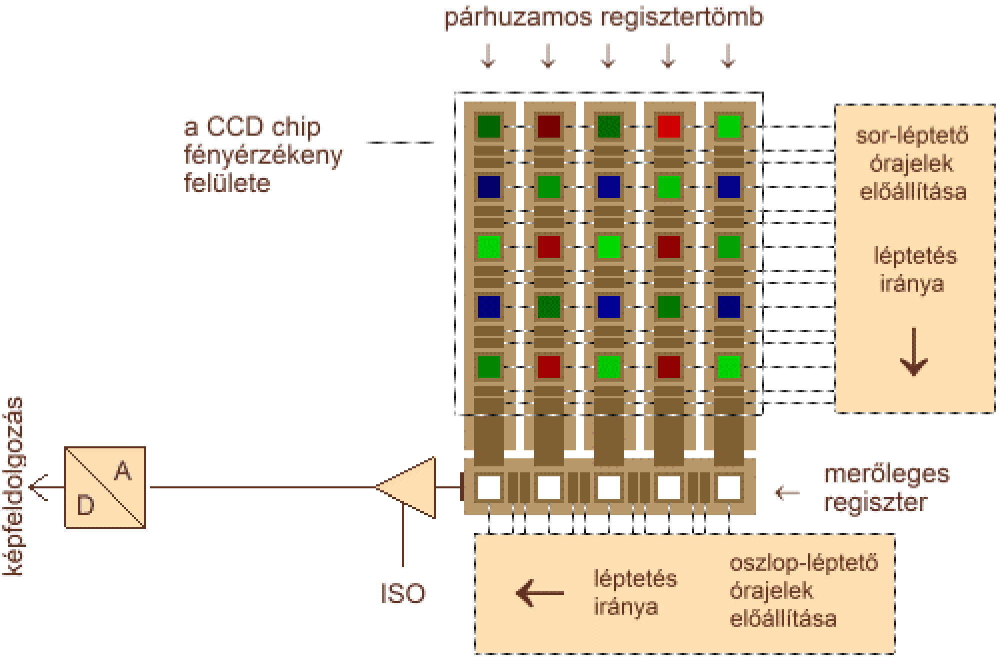
Figure 3b: Point cloud generated by in sequence matching.

Airborne Imaging

Leica

HEXAGON

			
DMC III	**ADS100**	**RCD30 Penta Oblique**	**RCD30**
• 50% performance + • 26,112 px in swath • 25% more area • CMOS technology • 5cm GSD at 1,180m	• Full multispectral color swath width • 20,000 pixels • Select TDS stages • Full color RGBN	• World's first 80MP multi-spectral MFC • High accuracy urban and 3D corridor map • CH82 multi-spectral	• Only one: 80MP RGBN co-registered • FMC along two axis • Rugged and thermal stabilised lenses


párhuzamos regisztertömb
a CCD chip fényérzékeny felülete
sor-léptető órajelek előállítása
léptetés iránya
képfeldolgozás
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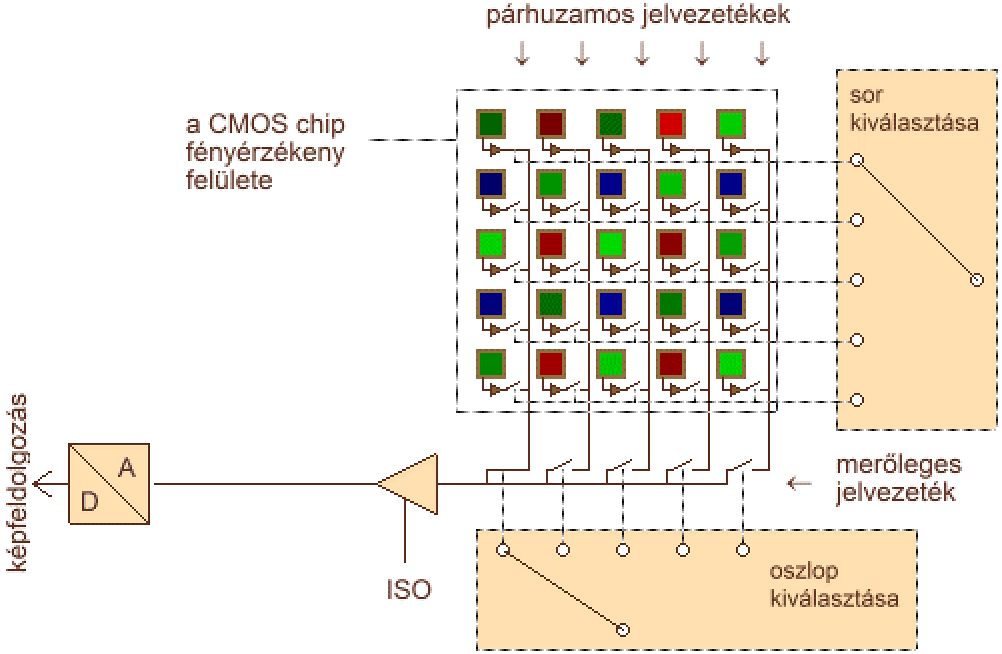
léptetés iránya
oszlop-léptető órajelek előállítása


párhuzamos jelvezetékek
a CMOS chip fényérzékeny felülete
sor kiválasztása
képfeldolgozás
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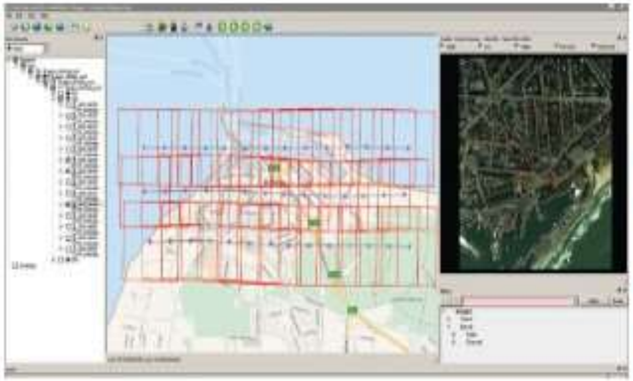
merőleges jelvezeték
ISO
oszlop kiválasztása

High productivity = Leica DMC III + HxMAP Real City

HxMAP RealCity – processing suite



• Enabler:	Pushbroom/Frame/Oblique
• Provider:	Image Ingest, RawQC
• Core:	APM Triangulation, Ortho, etc.
• 3D Modeller:	TextureMapper, 3D Editor
• 3D Presenter:	3D Viewer, Geospatial Portal
Optional	
• Stereo Mapping:	Photogrammertry Workstation
• 3D Modeller:	BuildingFinder 3D Mesh
• 3D SDK:	HxMAP SDK

Leica CityModeller

- Enables the automatic generation of 3D city models in LoD1 and LoD2 from building footprints and stereo aerial imagery and/or airborne LiDAR and/or other point clouds
- Using stereo satellite imagery is possible
- The source data can be combined and individually prioritised
- More applications are available with the 3D Editor and Texture Mapper etc.

GEOMETRIC ACCURACY

Integrating temperature readings from sensors which are attached to each lens cone of the camera.

Aerial triangulation icluding the temperature model

The reduction of the vertical displacement from a magnitude of approximately 1.5 GSD to 0.2 GSD or less for 5 individual flight-lines.

The Version 5.0 (2016. 03.) will mainly implement the 3D algorithms which have been developed by Microsoft researchers for the automated 3D TIN generation for BING maps.

The UMap color balancing now includes the automated color balancing of the oblique images.

VisionMap A3 Edge

RGB or RGB+NIR

The system has been integrated with 3rd party software that enable automated 3D model generation, quickly and in high quality.

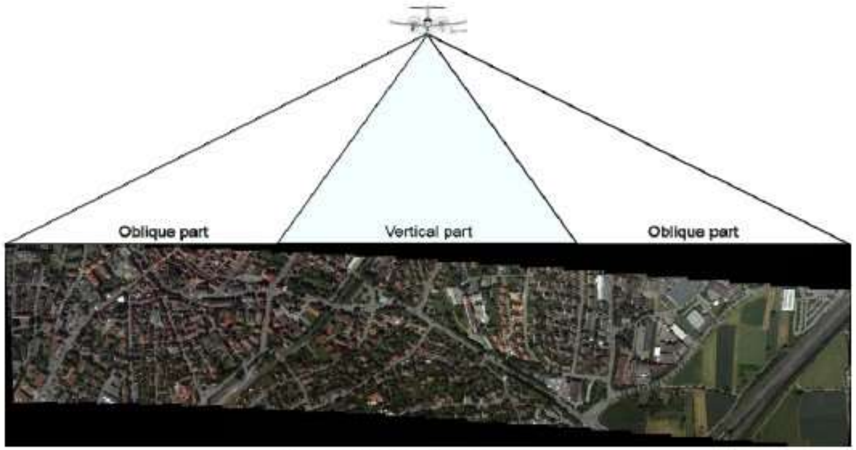


Figure 3: A3 SLF – Super Large Frame.

Oblique Aerial Imagery – A Review

The indisputable virtue of oblique photography lies in its simplicity of interpretation and understanding and in the fact that they can reveal building façades and footprints.

Applications:

- road land updating (Mishra et al., 2008),
- building registration and preliminary parcel boundary determination (Lemmens et al., 2008),
- urban classification and 3D city modelling (Gerke and Xiao, 2013; Nex et al., 2013),
- identification of unregistered buildings (Fritsch and Rothermel, 2013),
- mass events' monitoring (Grenzdoerfer et al., 2008),
- damage assessment (Gerke and Kerle, 2011; Murtiyoso et al., 2014), etc.

System	Type	# sensors	Geom. Res. [px]	Pix. size [µm]	Spectral bands	Focal length [mm]
Leica RCD30 Oblique	MC	4+1	10320 x 7752	5.2	RGB, NIR	50 / 80
Vexcel Osprey 2	MC	4+1	11674 x 7514 8900 x 6650	6	RGB, NIR	80 / 120
Dimac Oblique	MC	4+2	(2x) 13000 x 8900 (4x) 7600 x 8900	6	RGB	55 / 210
Pictometry	MC	4+1	2672 x 4008	9	RGB	65 / 80
Midas 5	MC	4+1	5616 x 3744 (Canon EOS-1D) 7360 x 4912 (Nikon D800E)	6.4 4.8	RGB	27/ 90
IGI DigiCAM Penta	MC	4+1	7304 x 5487 8176 x 6132 8959 x 6708 (Hasselblad)	6.8 6 6	RGB, CIR	50 / 80
IGI Quattro DigiCam Oblique	B	4				80 / 300
Optron/Trimble AIC	B	4	7228 x 5428 (RolleiMetric)	6.8	RBG, CIR	60 / 100
VisionMap A3 Edge	F	2	4864 x 3232 (Kodak)	7.4	RGB, CIR	300

Table 1: Primary commercial oblique multi-camera systems. MC = Maltese Cross; F = Fan; B = Block.



Dense image matching

Oblique images provide information for a deeper and more complete description of urban areas, allowing to extract denser point clouds and more information in the 'smart city' domain, with façades and buildings typically completely reconstructed.

Example of dense point clouds from oblique datasets. Shaded view produced with MicMac from a MIDAS dataset (left) and colour cloud obtained using SURE on a PentaCam IGI dataset (right).

3D city models

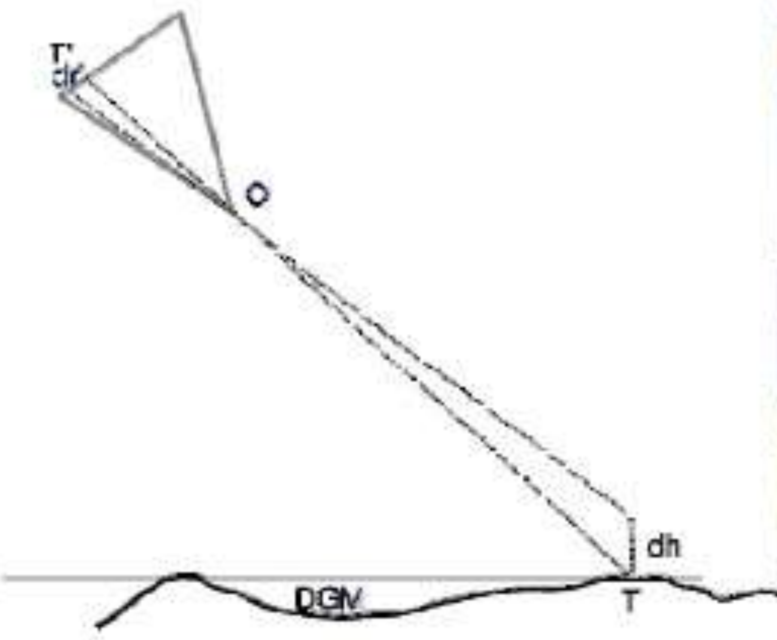
a 3D model derived from oblique images

Oblique imagery can also be used for interpretation and inspections, e.g. to derive the number of floors or building usage. For more detailed modelling, e.g. in LOD3 according to the cityGML standard (architectural models), details along the façade and on lateral parts on the roof can be extracted.

This is feasible in software which uses a dense matching point cloud as input, or – for higher accuracy and detail – uses the images directly. In Figure 5 an example is given, showing

Monoplotting

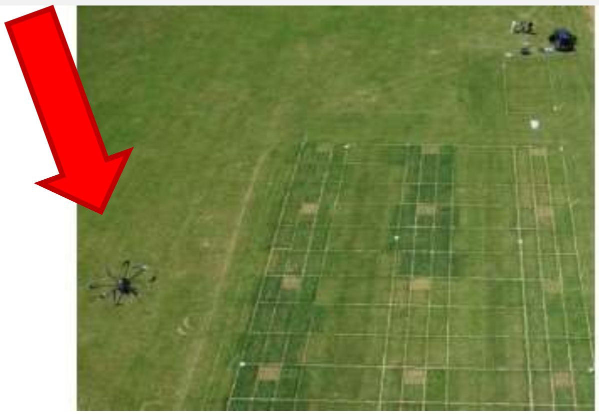
Façades are visible in airborne oblique images makes them attractive for height measurements.

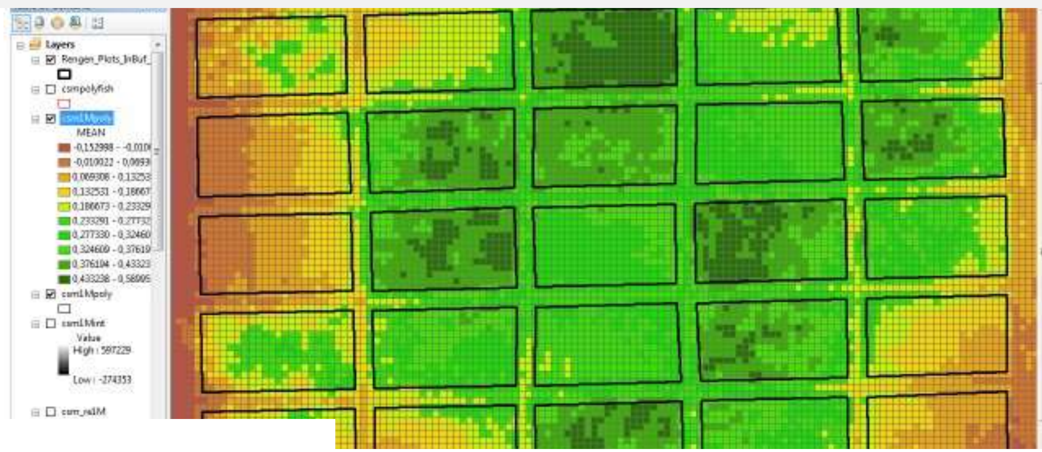


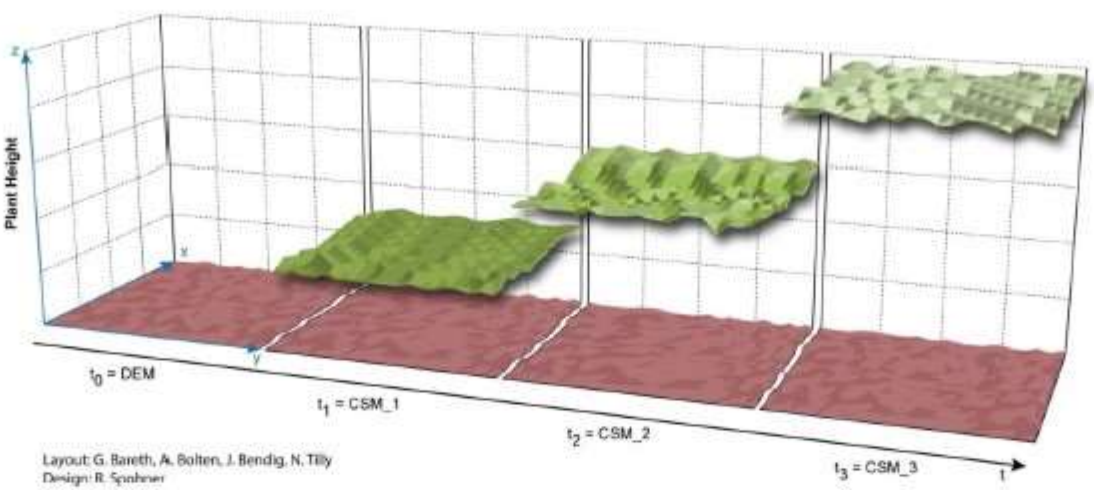
3D Data Acquisition to Monitor Cropping Systems: Sensors and Methods

(i) 3D data analysis using multi-temporal Crop Surface Models (CSM),
(ii) understanding the 3D information of crop surfaces derived by different sensors,
(iii) applying an established GIS method for resampling plant height data .

Concept of Terrestrial Laser Scanning (TLS) was transferred on an UAV approach using RGB imaging and Structure from Motion (SfM) data analysis.
Biomass can be reliable monitored with 3D data capturing approaches.





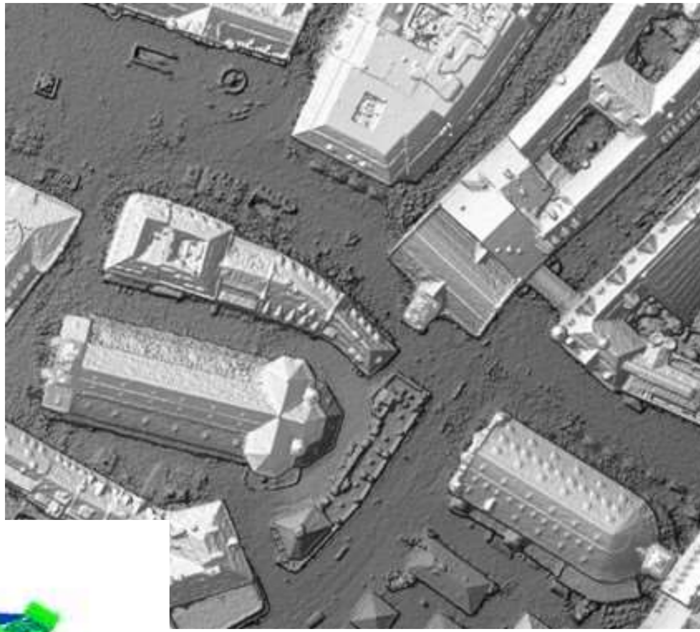


SGM

Image-based 3D Data Capture in Urban Scenarios (N. Haala)

URBAN DSM GENERATION
FROM
AIRBORNE NADIR IMAGERY

80% in flight and 80% cross flight lap. Results in up to fifteen images per object point >> generation of DSM at vertical accuracies close to the sub-pixel level.



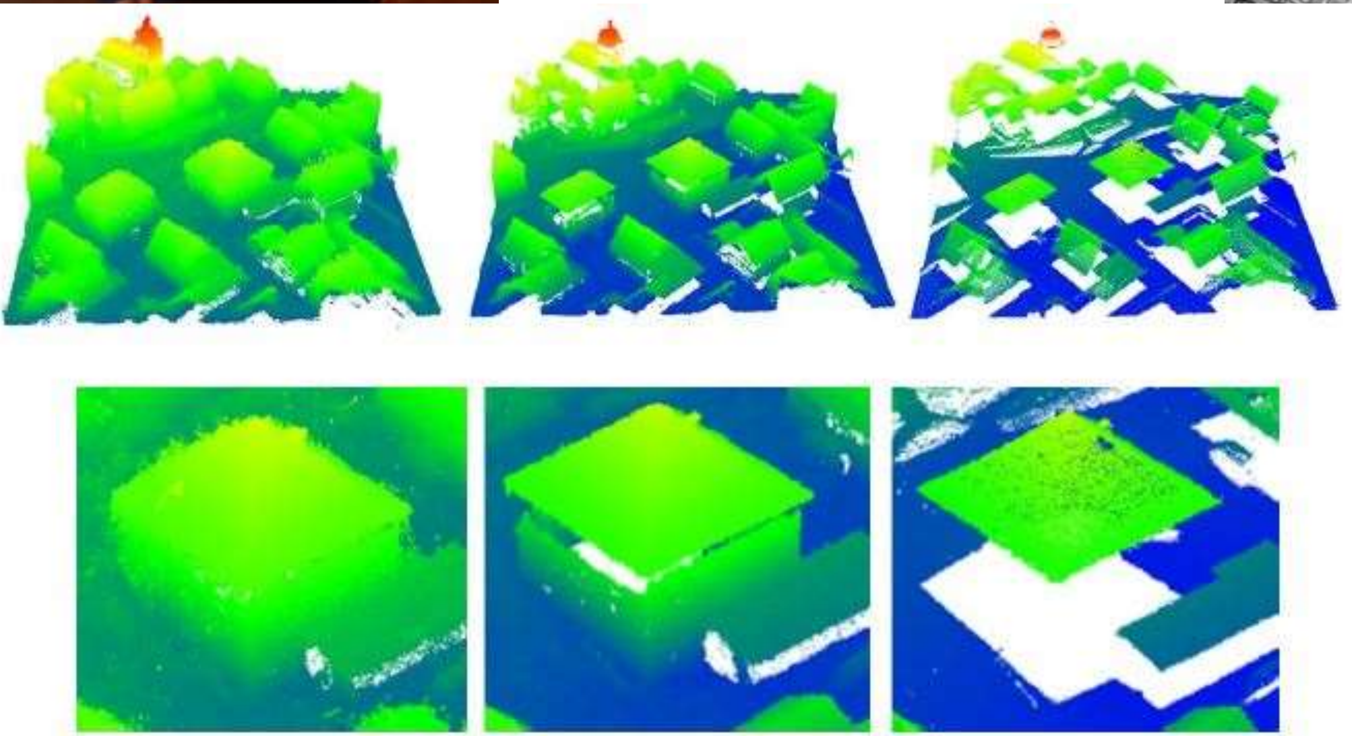


Fig. 2: Filtering of 3D points generated from stereo matching for larger scene (top) and detailed view (bottom) with point cloud from stereo matches (left), reduced points from multi-view constraints (middle) and gridded points (right).

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Image-based 3D Data Capture in Urban Scenarios (N. Haala)

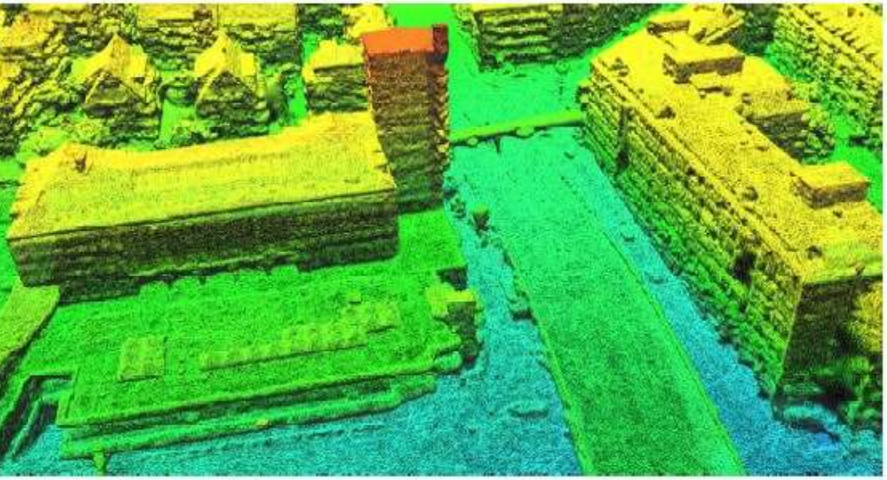
Fig. 4. Texture mapping for triangulated DSM raster, visualisation of vertices (top) and faces (bottom).

Since this can be acceptable for applications like visualisations, structural information on building façades is extremely beneficial for further interpretation.

Image-based 3D Data Capture in Urban Scenarios (N. Haala)

RECONSTRUCTION OF FAÇADE GEOMETRY

Evaluation of oblique aerial imagery



Complex urban area represented by 3D meshes from multi-stereo matching of oblique aerial images.

Fig. 7: Texture mapped visualisation of 3D reconstruction depicted in Fig. 6.

Terrestrial point clouds from mobile mapping imagery

Fig. 8: Platform and sensor configuration of the IVGI mobile mapping system.

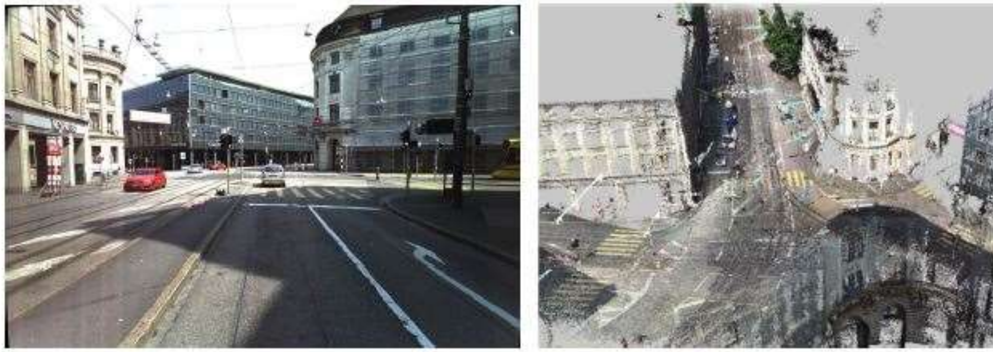


Fig. 9: Example image of investigated sequence (left) and point cloud from matching (right).

Computer Vision for Mobile Robot Navigation (Heiko Hirschmüller)

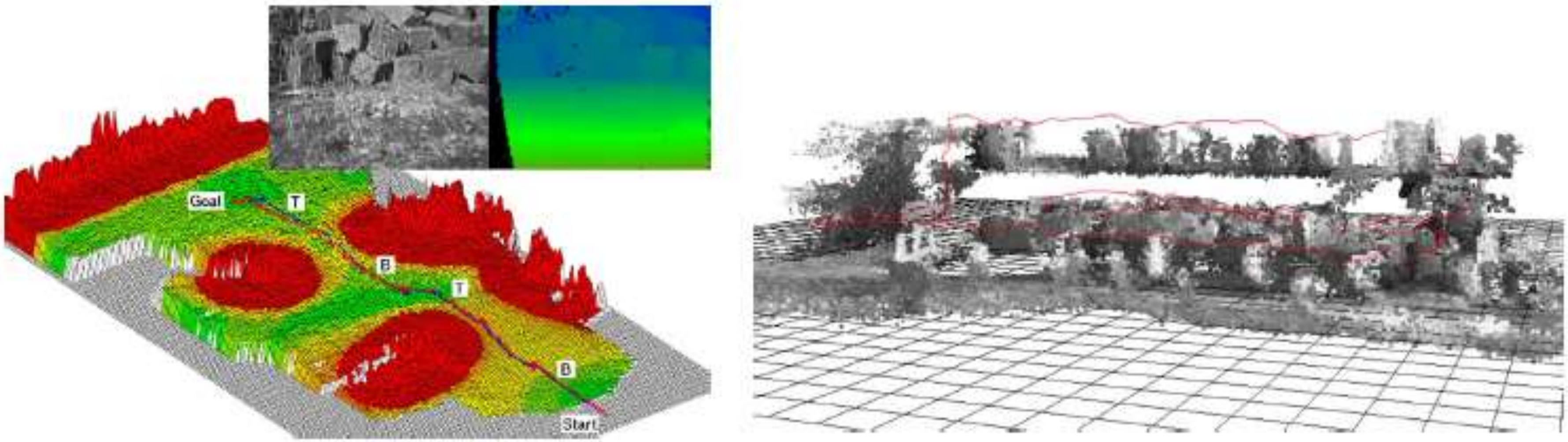
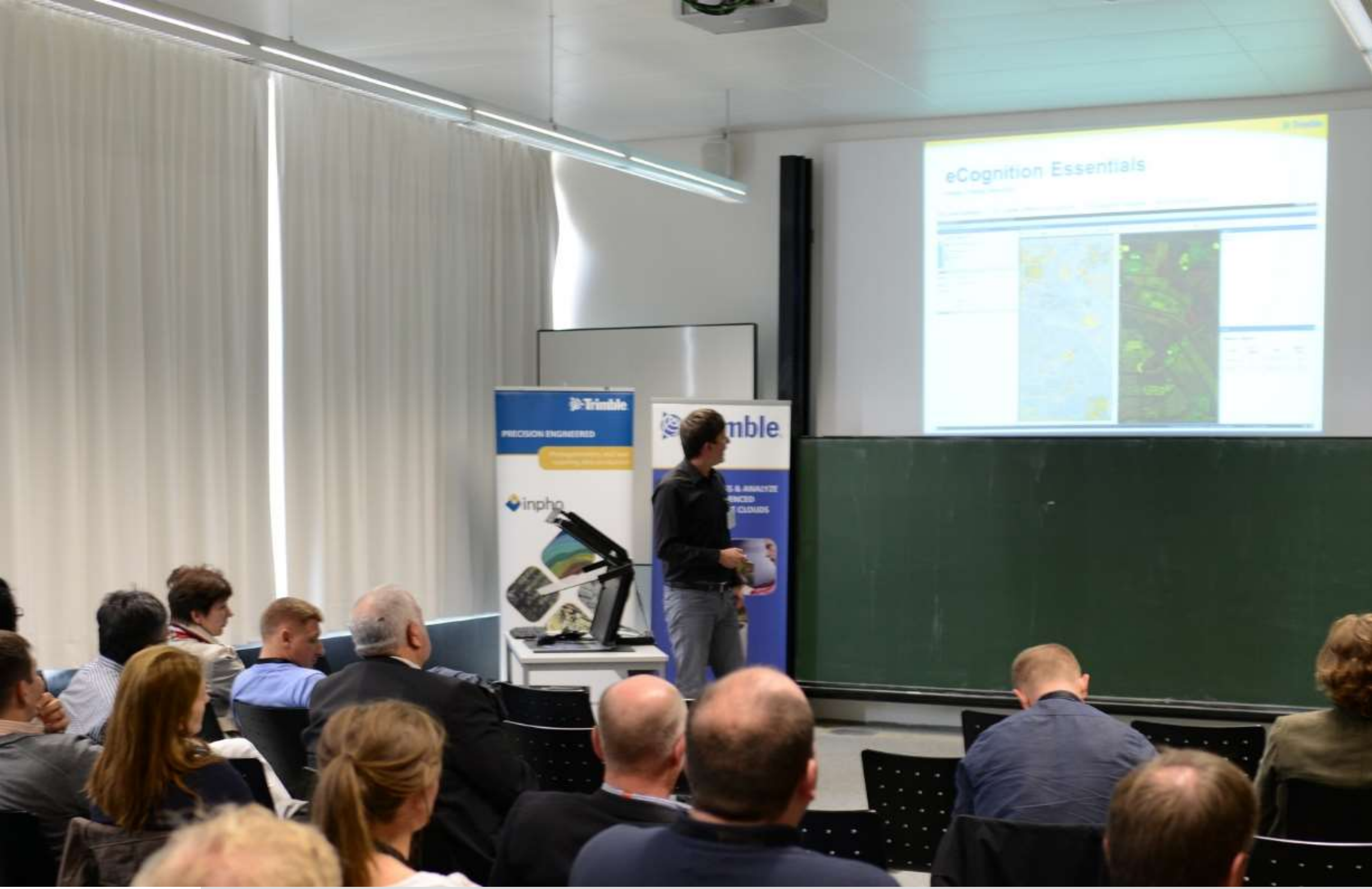


Figure 4: 2.5D (left) and 3D (right) maps, created from dense stereo images and ego-motion measurements.

Figure 5: DLR crawler.

Figure 7: Autonomous flight of the DLR Pelican quadcopter in a coal mine.


eCognition Essentials
Trimble
PRECISION ENGINEERED
inpho
mble

GerMAP


UHB
IGI


D-MUHB


Music Performance
Greetings by Universities

KÖSZÖNÖM A FIGYELMET!

Balla Csilla
balla.csilla@fomi.hu

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