ISPRS Benchmark for Multi-Platform Photogrammetry

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PIA 15: Photogrammetric Image Analysis, Munich, March 2015

BENCHMARK FOR MULTI-PLATFORM PHOTOGRAMMETRY

INITIATED BY F. NEX (FBK) AND M.GERKE (ITC), SUPPORTED BY ISPRS AND EUROSDR

AIM OF THIS BENCHMARK

Foster research concerning:

1) Fully automatic and reliable co-registration of multi platform/perspective imagery

2) Dense image matching within/across platforms

terrestrial image blocks

UAV (nadir/oblique)

conventional airborne (nadir/oblique)

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To be benchmarked:

1) (Joint) orientation/calibration of multi-platform imagery: terrestrial, UAV, airborne

2) Dense image matching of (fused) datasets

terrestrial image blocks

UAV (nadir/oblique)

conventional airborne (nadir/oblique)

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AREA 1 - City center (Dortmund, Germany)

OBLIQUE SYSTEM

- IGI PentaCam (80/80%),
- GSD 10cm – 1260 images (yellow area)

UAV (3 selected buildings)

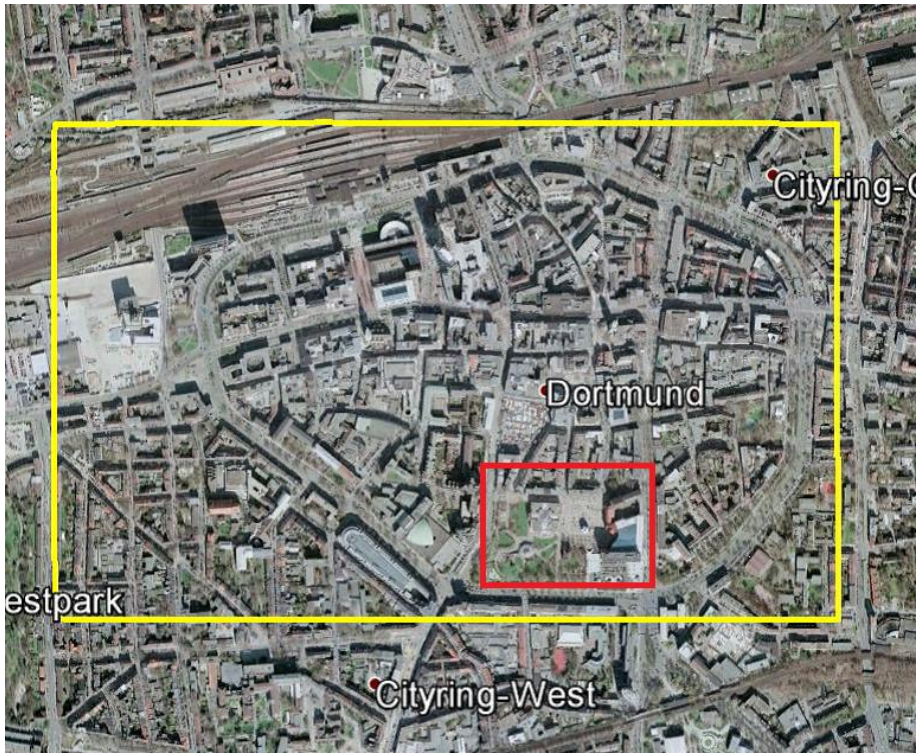
- oblique/nadir,
- GSD 1-2cm (red area)
- only rotary wing

TERRESTRIAL (3 selected buildings)

- GSD < 1cm (red area)

REFERENCE DATA

- GNSS, total station
- TLS, ALS



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AREA 2 - Zeche Zollern (Dortmund, Germany)

OBLIQUE SYSTEM

- IGI PentaCam (80/80%),
- GSD 10cm – 910 images (yellow area)

UAV (4 selected buildings)

- oblique/nadir,
- GSD 1-2cm (red area)
- rotary and wixed wing

TERRESTRIAL (4 selected buildings)

- GSD < 1cm (red area)

REFERENCE DATA

- GNSS, total station
- TLS, ALS

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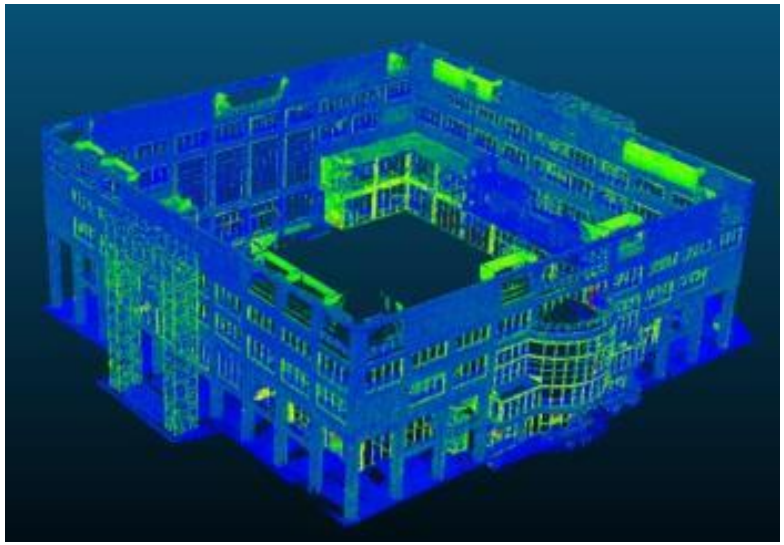
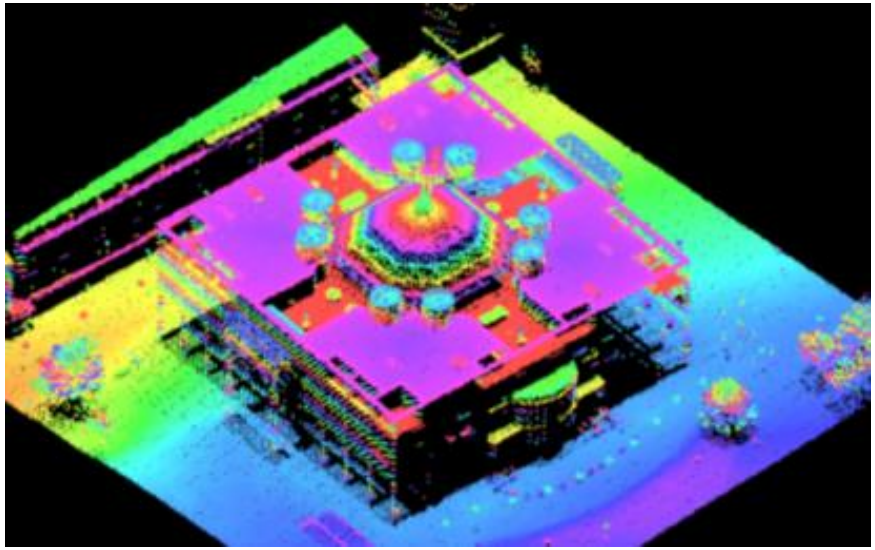
DATA PROCESSING

- A subset for each terrestrial/UAV dataset was selected
- Data have been registered in the same reference system





Town hall Dortmund: TLS and ALS

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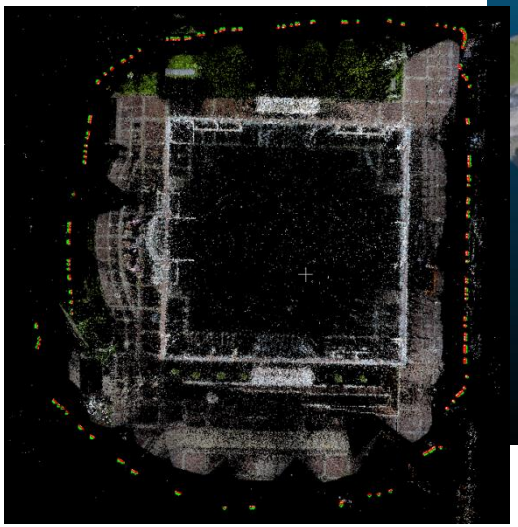
PRELIMINARY TESTS

- Image orientation and matching were preliminary performed to assess the reliability of the selected datasets. Several commercial software have been used for this task.



Terrestrial image orientation

Point cloud from PentaCam images

Manually cleaned point cloud from (interactively) co-registered UAV and terrestrial images

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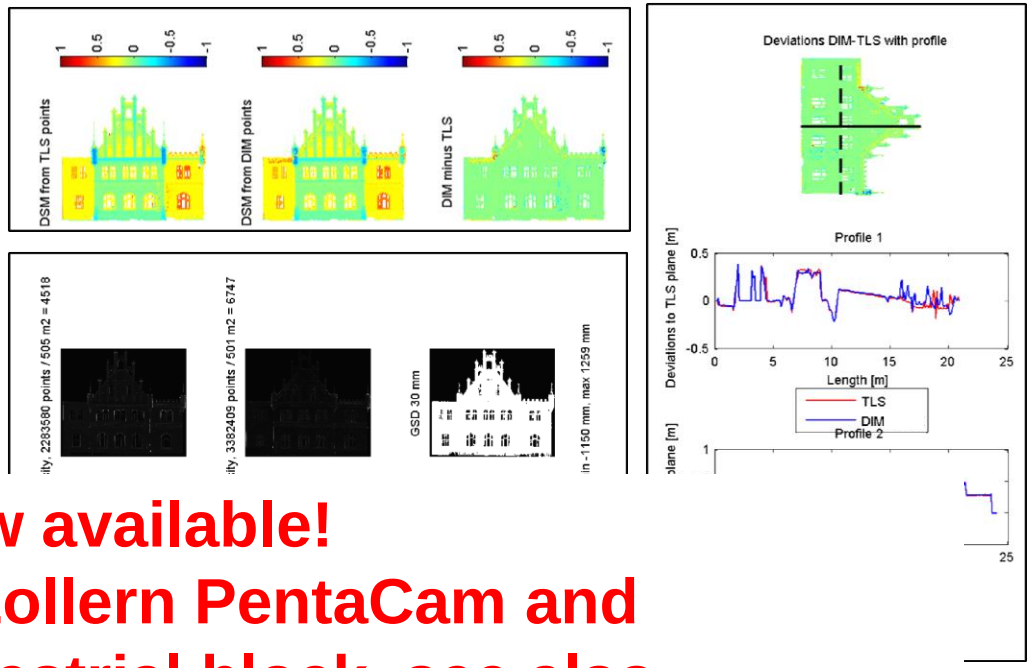
EVALUATION CRITERIA – IMAGE MATCHING



INPUT

- Images with fixed orientation and calibration (selected parts)

PROVIDED BY PARTICIPANTS

- Point clouds on selected areas

EVALUATION

- According to [Cavegn, 2

In collaboration with: **Euro**

Data now available! (Zeche Zollern PentaCam and UAV/terrestrial block, see also https://sketchfab.com/models/1b2ac361731d45da9134d74fd3677fa5)

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EVALUATION CRITERIA – IMAGE ORIENTATION

INPUT

- Images with approximate orientation and calibration (if available)
- GCP (different configurations): image and 3D coordinates
- CP: image coordinates.

Useful for camera head calibration

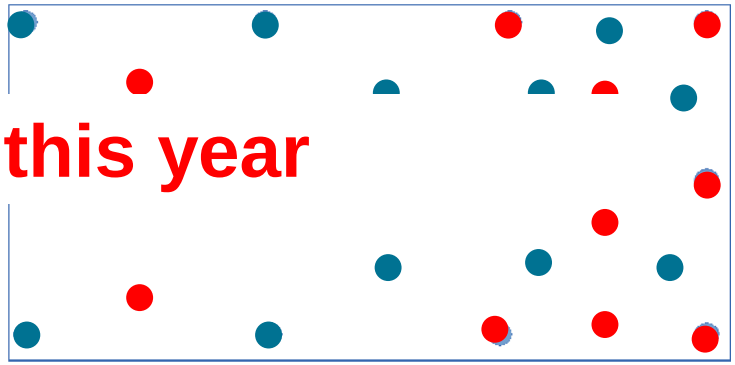
PROVIDED BY PARTICIPANTS

- CP 3D coordinate

Data available later this year

EVALUATION

- *Residuals CP*
- *Plane-fitting on selected surfaces*

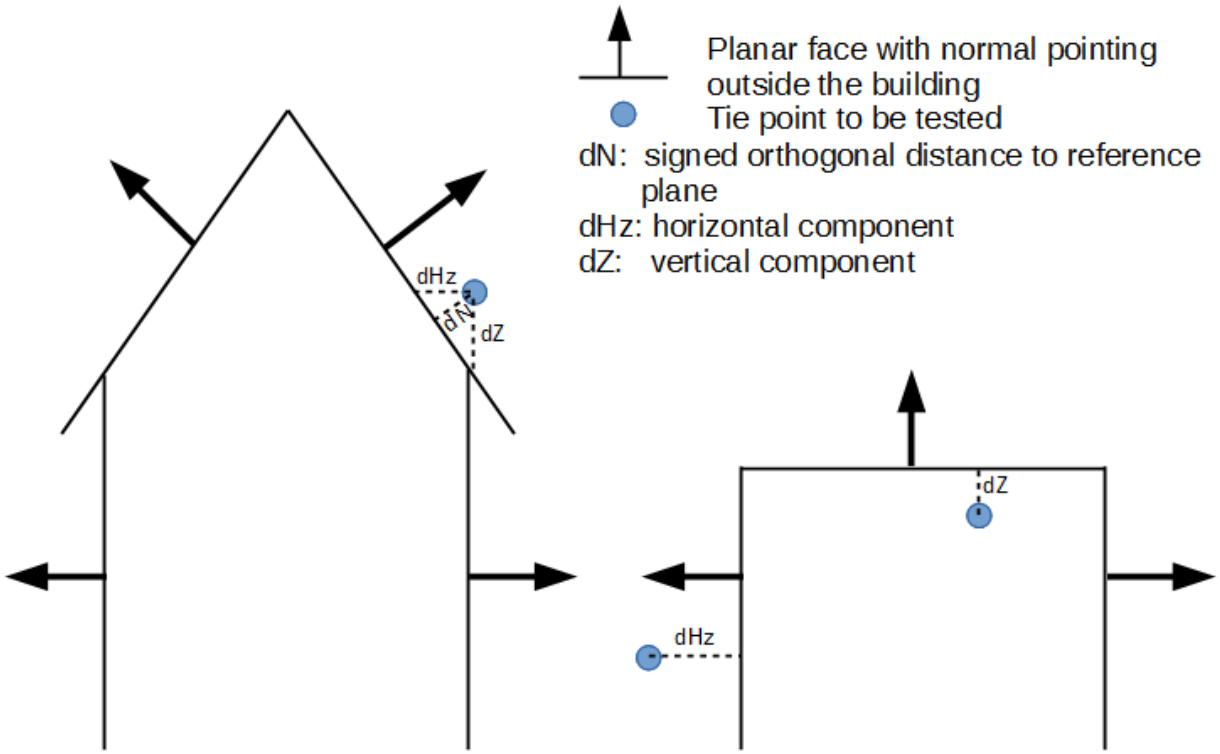


GCP to be used by participants

Check Points to assess quality

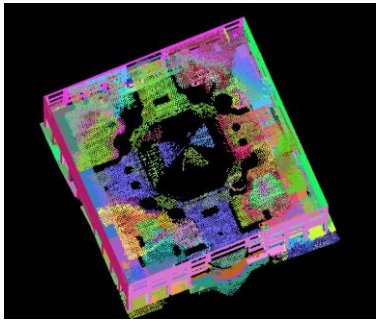
EVALUATION CRITERIA – IMAGE ORIENTATION

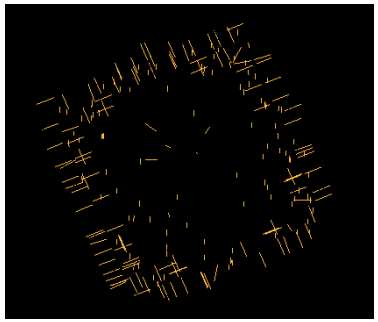
- ***Plane-fitting on selected surfaces***



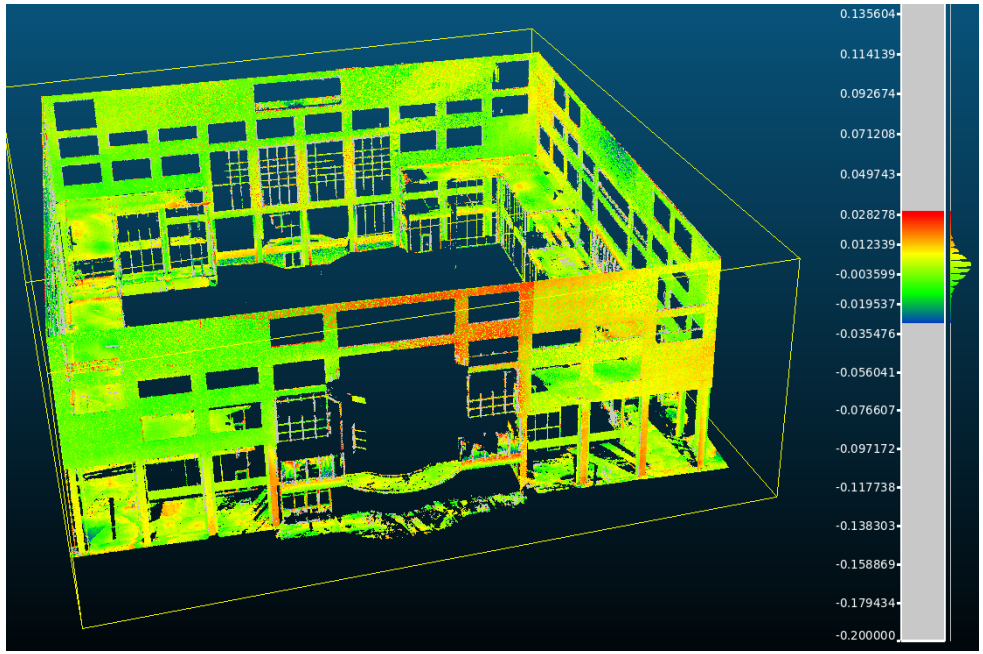
EVALUATION CRITERIA – IMAGE ORIENTATION

- ***Plane-fitting on selected surfaces Example:*** Townhall Dortmund





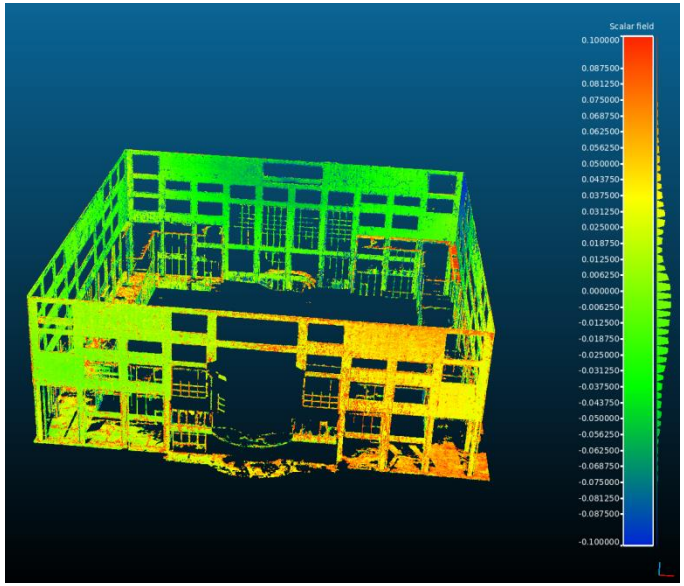
Planar segments and their normal vectors



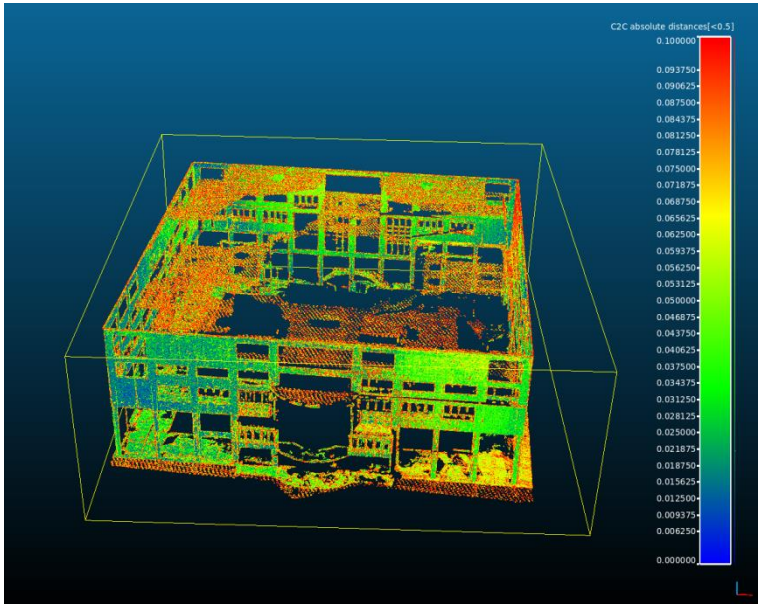
Example evaluation: use the TLS as “tie points” before the final registration

EVALUATION CRITERIA – IMAGE ORIENTATION

- ***Plane-fitting on selected surfaces Example:*** Townhall Dortmund



Example evaluation: dense matching point cloud, *max error 10cm,* different direction of error!



Comparison: point-to-point distance (absolute) in CloudCompare. Max error 10cm, but no sign

EVALUATION CRITERIA – IMAGE ORIENTATION

➢ ***Plane-fitting on selected surfaces***

Prilimilary observations:

- Signed distance helpful, in both close range and airborne data (at least for height element): direction of error helps to interpret result.
- TLS registration must be very accurate to provide useful results.

CONCLUSIONS

- ***Benchmark should give new insights into multi-perspective/-resolution photogrammetry and stimulate research***
- ***Data free of charge and usage not bound to benchmark → playground for other applications (City modeling, 3D GIS, cultural heritage documentation strategies…)***
- ***Evaluation of results a task on its own → new insights expected, as well***

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Thanks for your attention!

WEBSITE:
http://www2.isprs.org/commissions/comm1/icwg15b/benchmark_main.html

NEWSLETTER: http://www2.isprs.org/newsletter.html

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