EuroSDR

INSTITUT NATIONAL DE L'INFORMATION GÉOGRAPHIQUE ET FORESTIÈRE

European Spatial Data Research

EuroSDR activities on historical data

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EuroSDR is a not-for-profit organisation linking National Mapping and Cadastral Agencies with Research Institutes, Universities and Companies in Europe for the purpose of applied research in spatial data provision, management and delivery… **since 70 years**

http://www.eurosdr.net
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2010-2014 : WG **Archiving**, recommandations

2012-2017 : WG "Preserving the **Geographic Production Process**", report

2014 : WS **On-line distribution** of historical data : slides

Survey : what kind of geo-historical data, how to access them, for which usages

2017 : WS **Graphical Interfaces for historical data**, report

CSA FET FLAGSHIP TIME MACHINE (**BIG DATA OF THE PAST**) : contribution to write Roadmaps on Exploitation Avenues to include applications to Smart Cities and Sustainable Territories,

Survey on **Usages of historical aerial imagery,** results analysis

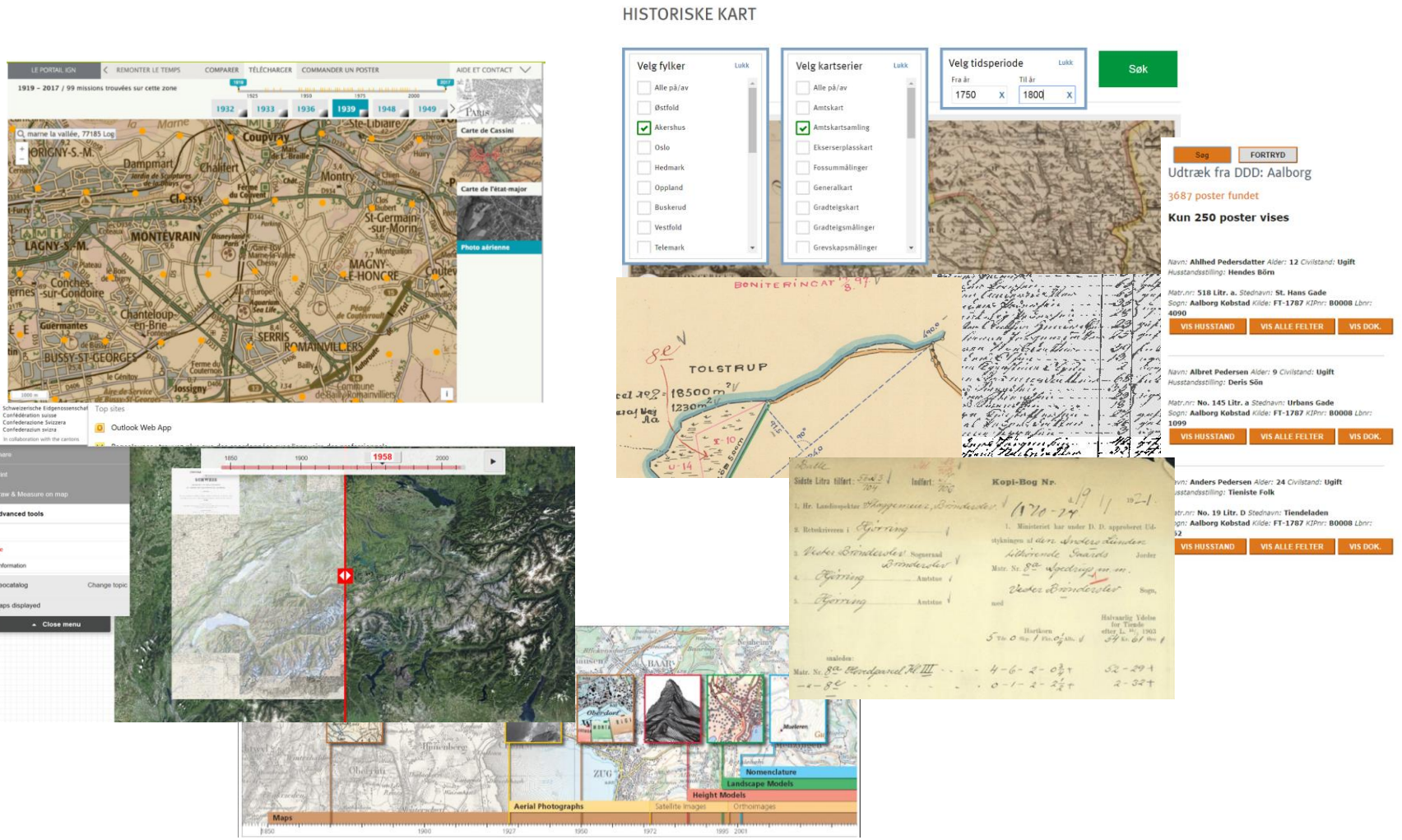
2019 : WS **Geoprocessing and Archiving of Historical Aerial Images**, report

2021 : **TIME benchmark**

2022 : WS **Geoprocessing and Archiving of Historical Aerial Images**, program

Survey on encountered limits and expectations from european approach

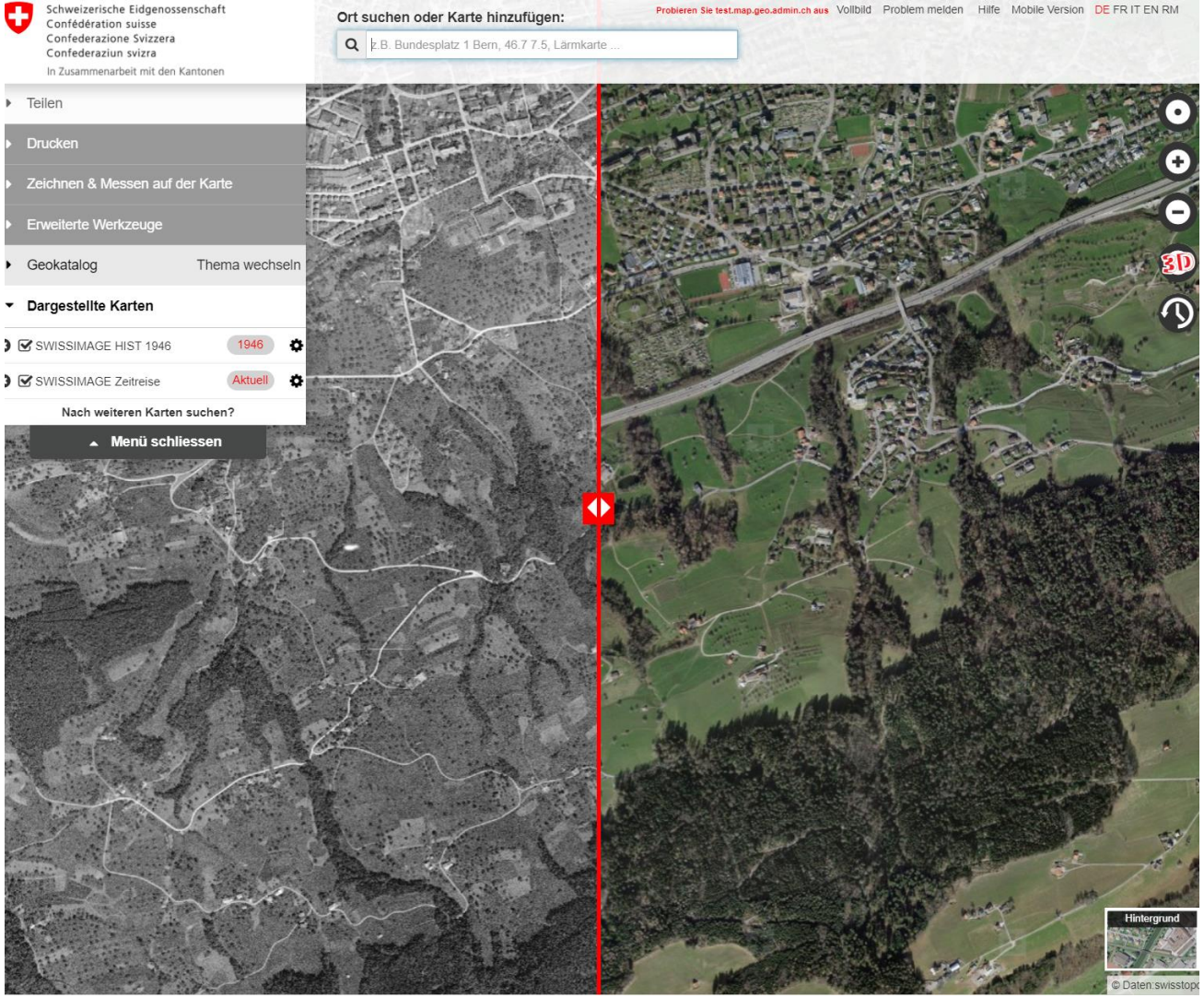
Historical and **time stamped** data with geo characteristic: digitized maps, pedestrian and aerial photographs, satellite, topographic databases, placenames, statistics, DEM, textual



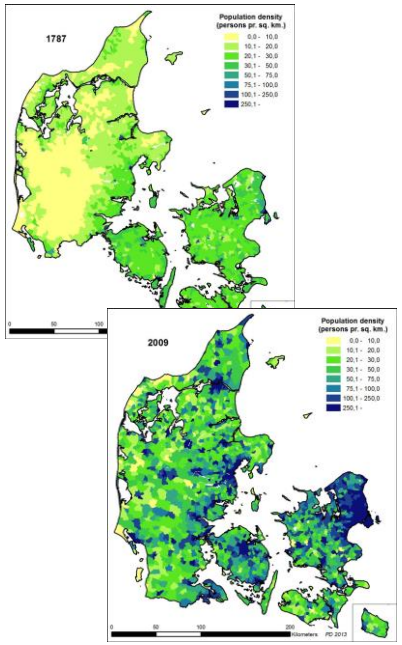
Technologies, Authorities, Expressiveness vs Tractability

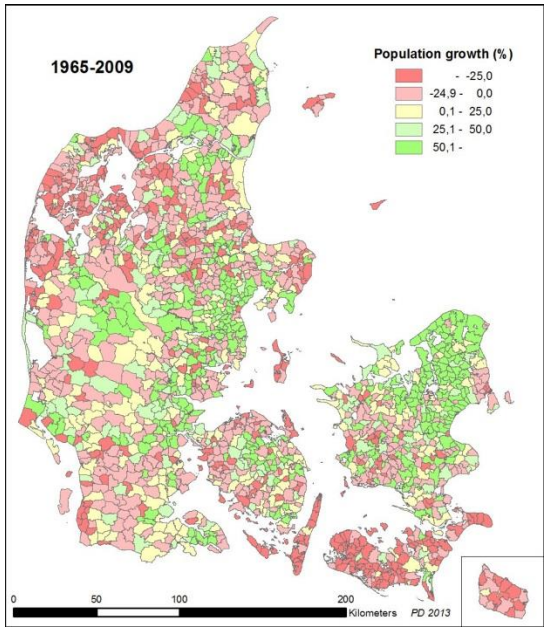
Tremendous popularity of dissemination portals !

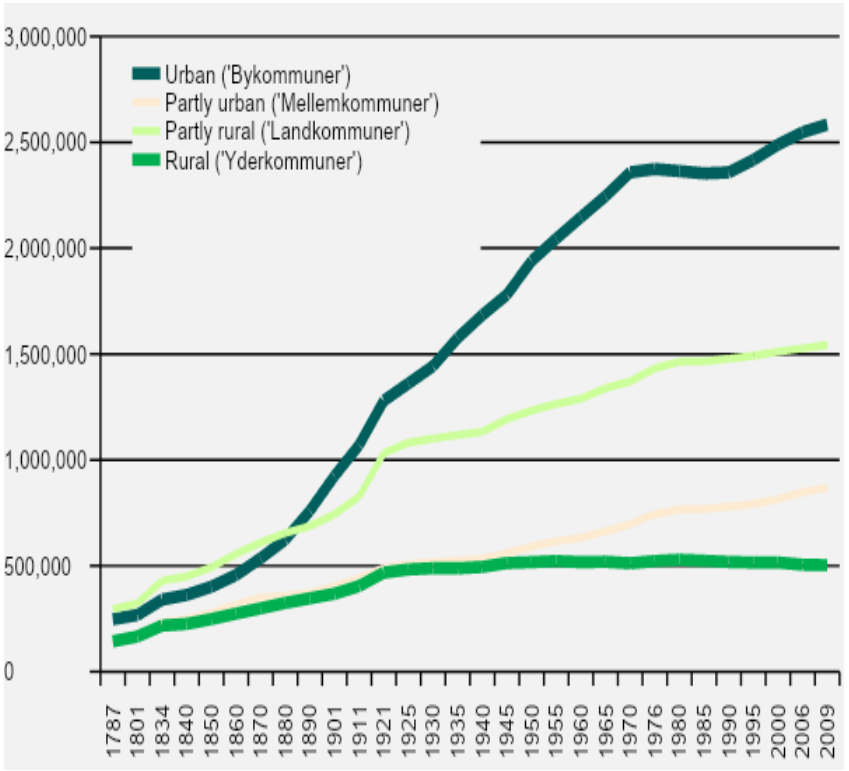
Prime time SwissTV : publication of orthorectified US 1946 aerial campaign (1m)



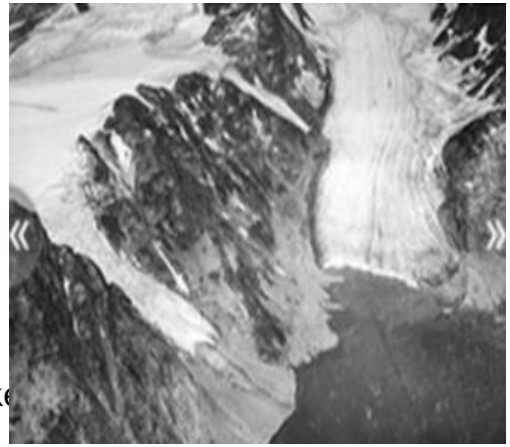
Geo-historical data are also used for policies, studies, research







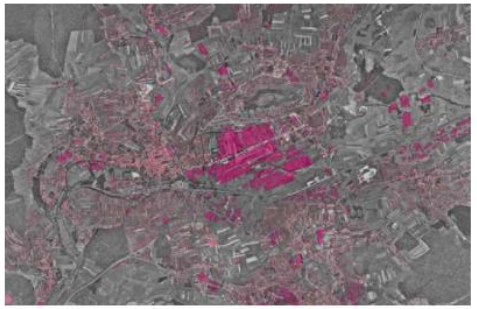
Greenland: ice sheet / glacier 1932



Greenland: ice sheet / glacier 2013

Used for Education

- teachers prepare maps and map stories using data services that include access to historical data
- services embedded in the digital workplace of teachers and students



Photographie aérienne de 1977 et couche bâtiments

La carte permet de mesurer l'emprise des activités automobiles dans l'espace urbain : l'usine occupe 265 hectares, à comparer aux 350-400 hectares de la commune.

La place de l'industrie dans la ville peut se lire en confrontant la couche photographie ancienne et la couche surfaces bâties actuelles. Au 1/16000, la couche surfaces bâties permet de distinguer les différents types de bâtiments. La légende s'obtient en cliquant sur le i de la couche bâtiments. Il est facile ensuite de repérer les zones industrielles ou commerciales.

2022-23 Survey : limits NMCAs encounter in online distribution of such data

- Rights (IP) and political issues
- Funding for the digitizing and the infrastructure,
- Lack of user awareness
- Background knowledge more complex to acquire, quality evaluation
- Heterogeneities, lack of accurate referencing,
- Lack of standard definition for timelines

…and benefits they expect from European approach :

- knowledge exchange,
- raise awareness, develop user-oriented search interface,
- fund digitization and infrastructure,
- provide a trans-european historical vision, integrate other different archives and access points (see Pangaea.de)
- more cooperation with standard, with science and with business opportunities,
- include the past in European environmental discussions

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European Spatial Data Research

The TIME dataset
- hisTorical aerIal iMagEs -

https://time.fbk.eu/

www.eurosdr.net

TIME dataset – motivation and aim

- Many archival aerial images are under digitization worldwide
- A considerable amount of data is nowadays available for several applications and investigations
- The potential of these valuable information sources has not been still fully explored

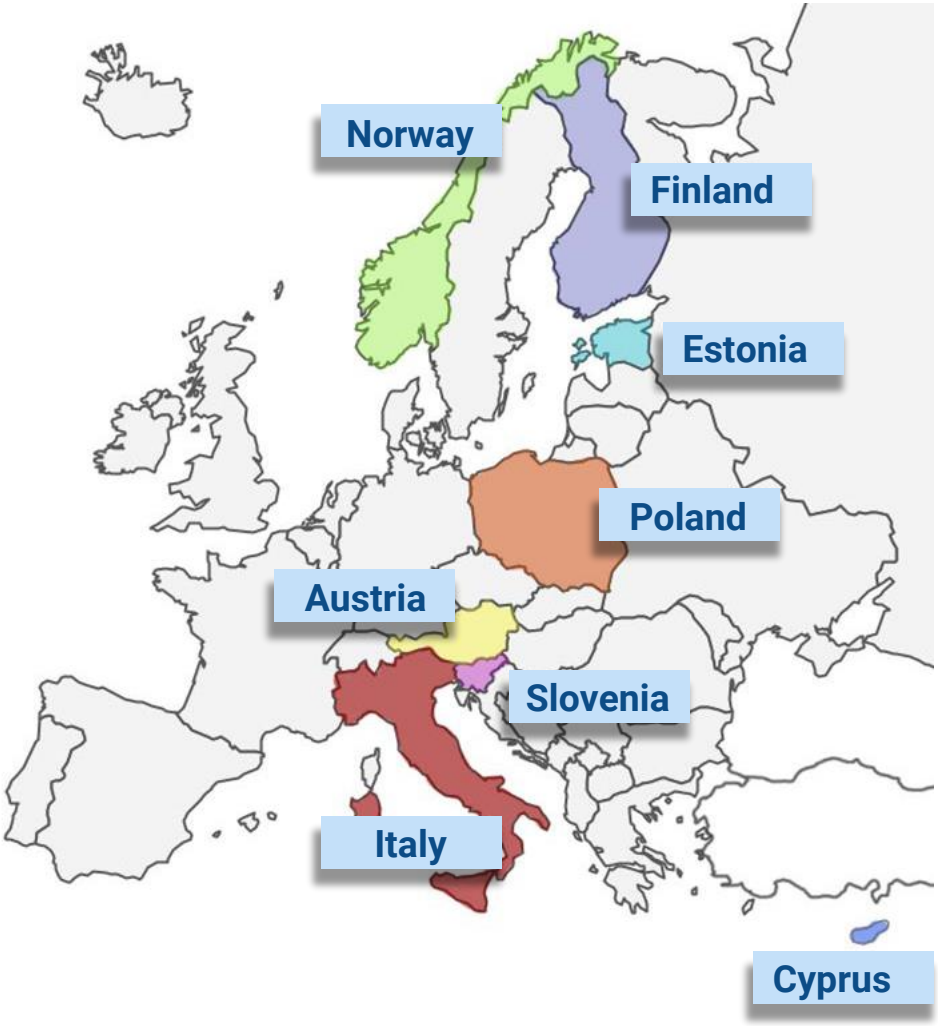
Estonia, 1962

Finland, 1951

- ➢ Stimulate research activities for valorizing these historical sources
- ➢ Test and develop automated procedures for data processing
- ➢ Expand geospatial applications and investigations
- ➢ Prepare best-practices and lesson learnt for NMCAs

TIME dataset – engaged countries / NMCAs

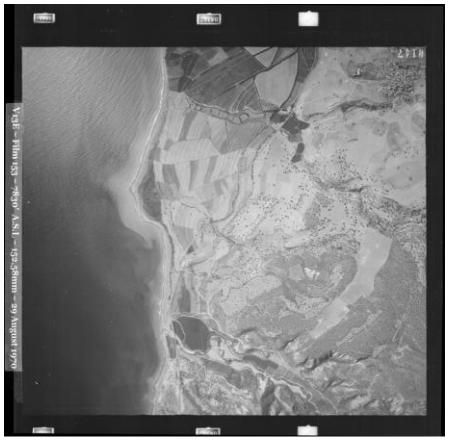
- 8 contributing countries
  - Norway
  - Finland
  - Estonia
  - Poland
  - Austria
  - Slovenia
  - Italy
  - Cyprus
- About 1000 archival aerial images collected
- Temporal range of about 50 years
- Different multi-temporal datasets



TIME dataset – collected data

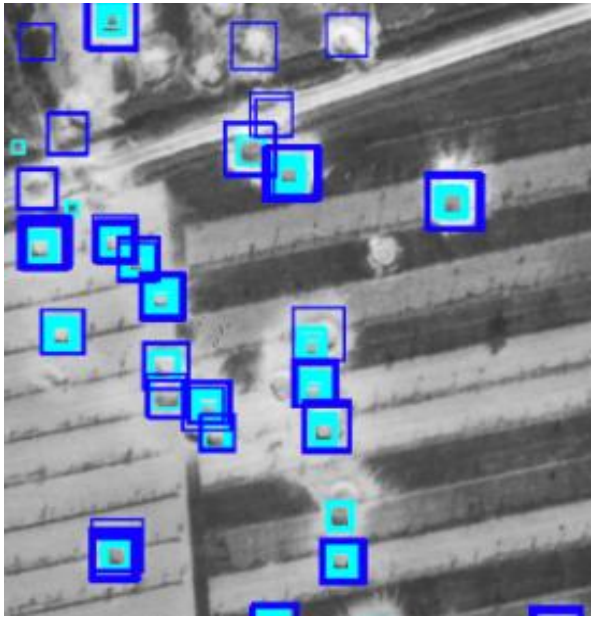
Heterogeneous datasets in terms of:

- Number of images
- Used cameras (Wild RC5/10/20, RMK21, F49 MK4, etc.)
- Image format (18x18 cm, 23x23 cm)
- Image quality
- Image scale
- Scan resolution (from 10 to 50 micron)
- Availability of ancillary information about flight details (IO, EO, GCPs, etc.)
- Availability of Ground Control Points for geo-referencing purposes



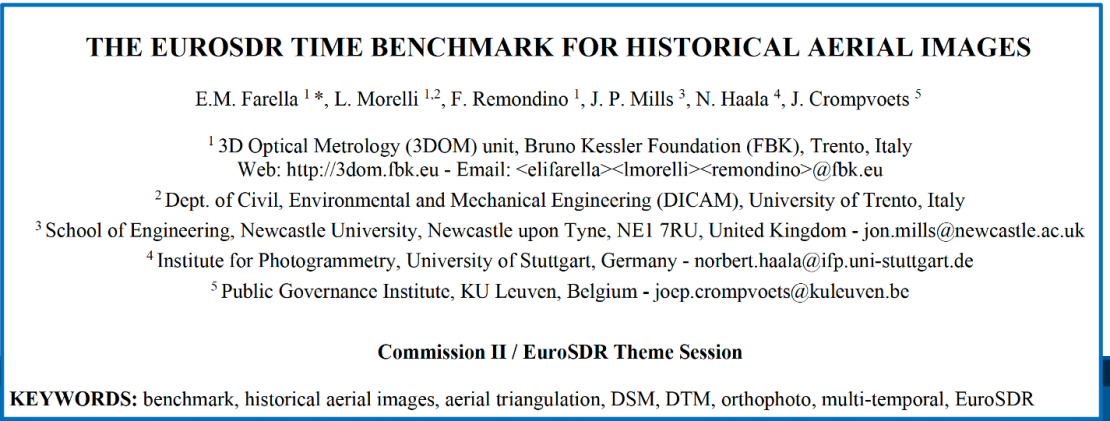
TIME dataset – research topics

- Radiometric equalization and image enhancement
- Automatic idenfitication and recognition of fiducial marks
- Automatic aerial triangulation and geo-referencing
- Automatic DSM-DTM generation
- Multi-temporal analyses and change detection
- Land-use / land-cover (LULC) map generation
- Detection of bomb craters
- Automatic colorization of grayscale images



TIME dataset – wrap up

- TIME is the first benchmark collecting historical aerial images captured in European countries since 1950s
- The TIME benchmark offer new opportunities for the exploration and valorization of historical aerial images
- Many datasets are available to test and validate 2D and 3D processing algorithms
- Performed tests and experiments have shown the difficulties and challenges of processing historical data, opening new research scenarios
- Further info/data is available on the project website: https://time.fbk.eu/



THE EUROSDR TIME BENCHMARK FOR HISTORICAL AERIAL IMAGES

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Commission II / EuroSDR Theme Session

KEYWORDS: benchmark, historical aerial images, aerial triangulation, DSM, DTM, orthophoto, multi-temporal, EuroSDR

Farella, E. M., Morelli, L., Remondino, F., Mills, J. P., Haala, N., Crompvoets, J., 2022: The EuroSDR TIME benchmark for historical aerial images. Int. Arch. Photogramm. Remote Sens. Spatial Inf. Sci., XLIII-B2-2022, 1175–1182

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Thank you, any question ?

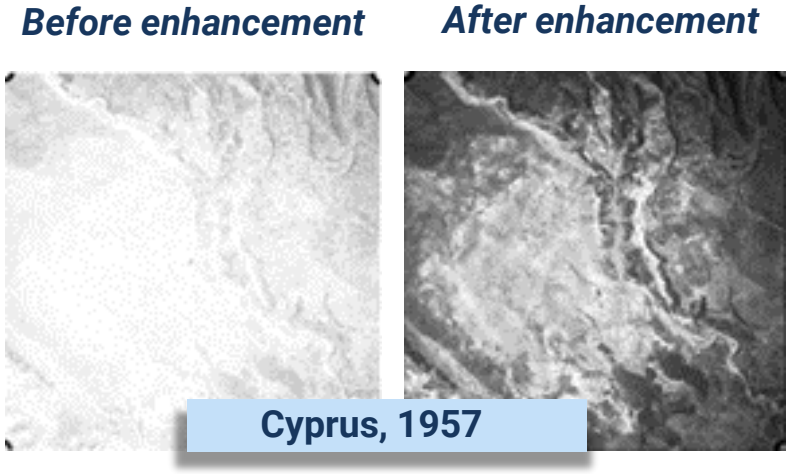
TIME benchmark – ACKNOWLEDGMENTS

- BEV Austria - Wolfgang Gold
- DLS Cyprus - Georgia Papathoma, Andreas Demosthenous
- Maaamet Estonia - Erkko Grunthal
- NLS Finland - Mikko Sippo
- Kartverket Norway - Jon Arne Trollvik, Hardy Buller
- GI Slovenia - Dalibor Radovan, Vasja Bric
- Warsaw University of Technology, Poland - Krzysztof Bakuła
- Italian National Aerial Photo Library - Elizabeth Sheperd

TIME benchmark – image pre-processing

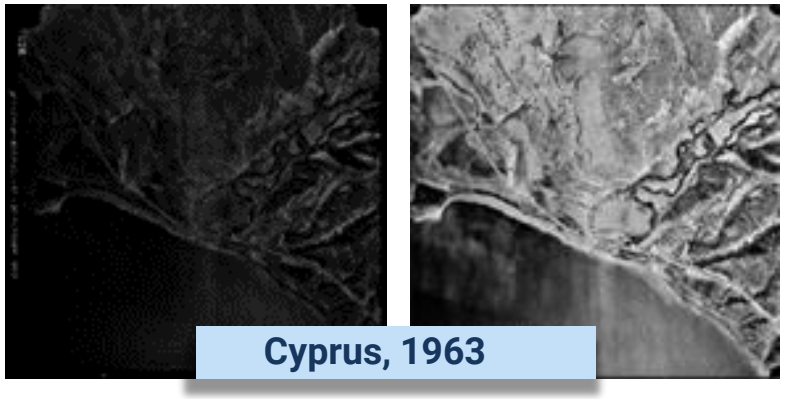
IMAGE ENHANCEMENT

- Issues in the digitization process
- Radiometric problems
- Poor contrast/brightness levels
- Issues in handling further 2D/3D processing tasks



PROCESSING

- Application of standard brightness and contrast adjustment algorithms
- Need of further analyses to deep radiometric distorsion and noise level introduced with pixels' manipulation



TIME benchmark – photogrammetric processing

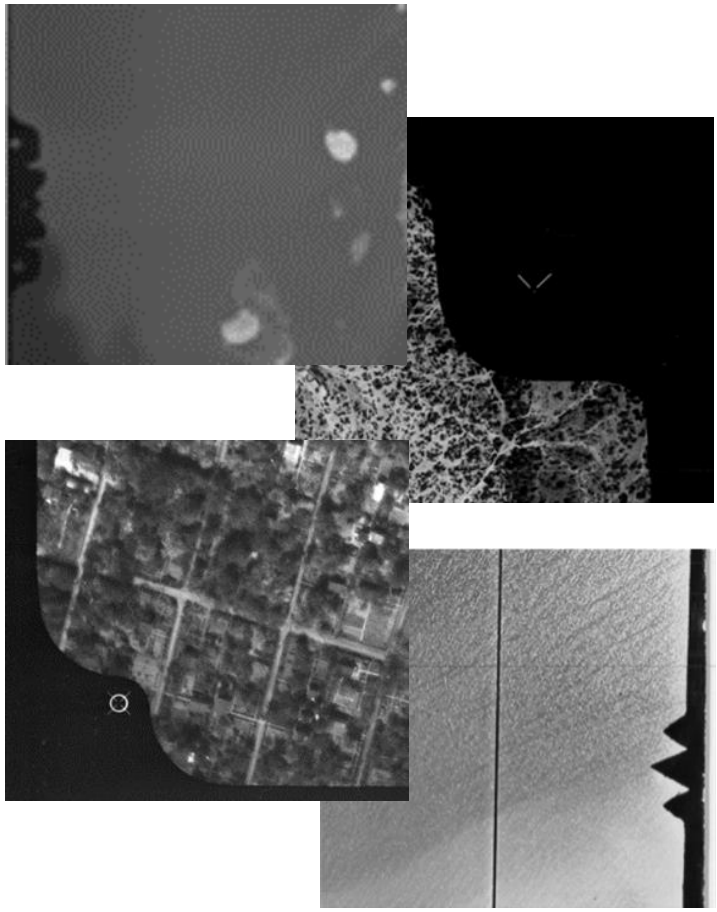
FIDUCIAL MARKS

- Compute the initial transformation between the pixel and image coordinate systems
- Fiducial marks coordinates are not always available
- Some initial approximations are needed

PROCESSING

- Coarse transformation adopting a virtual reference system
- Manual measurement of some fiducial marks for the affine transformation and image cropping
- Estimation of the camera parameters in a bundle block adjustment

Examples of fiducial marks visible in the TIME datasets



TIME benchmark – photogrammetric processing

TIE POINTS EXTRACTION

- Test different hand-crafted and learning-based approaches for tie points extraction with multi-temporal datasets

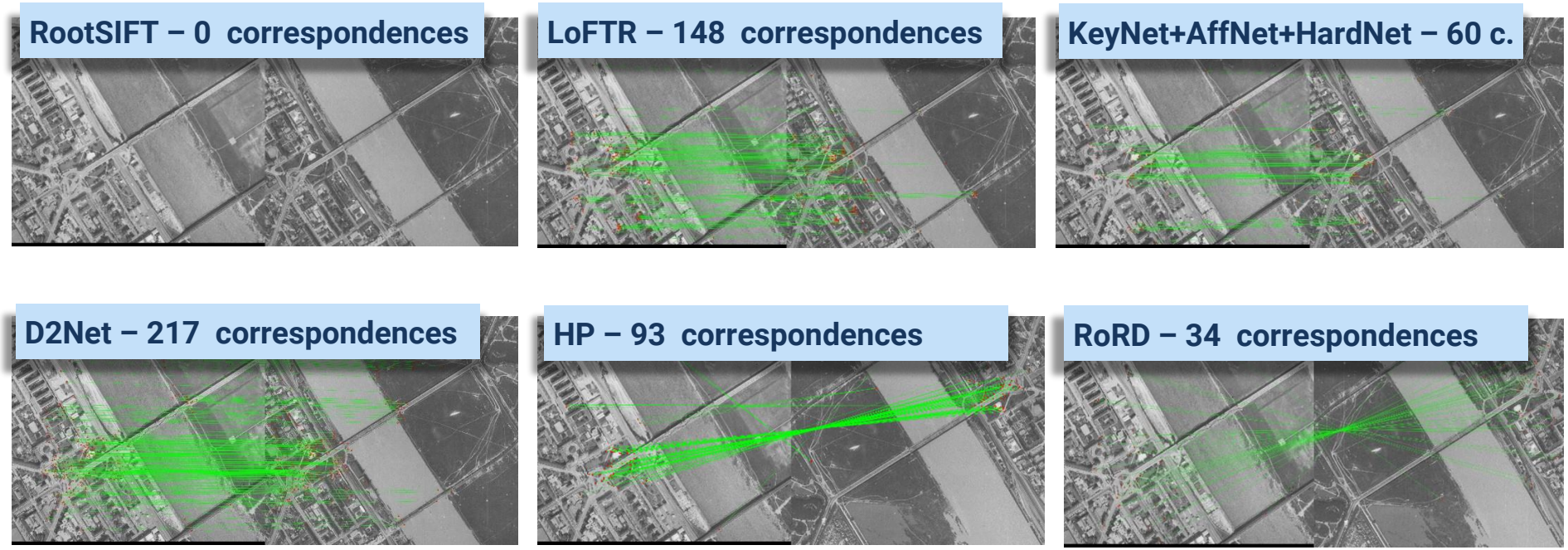
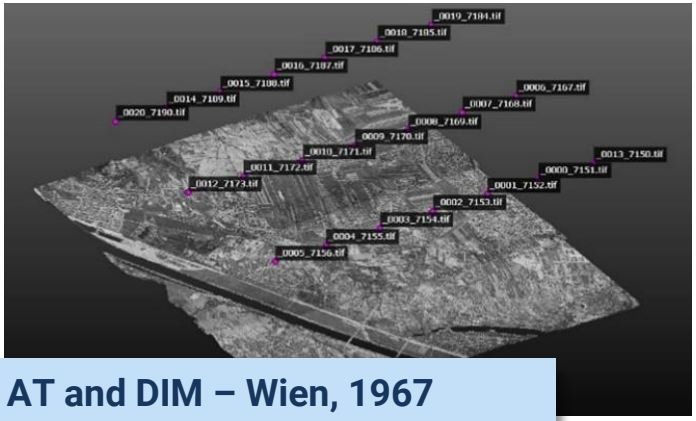


Image pairs from the Wien datasets (1958-1976)

TIME benchmark – photogrammetric processing

AERIAL TRIANGULATION

- Test several photogrammetric software to assess the capability of SfM processes with analogue grayscale images



AT and DIM – Wien, 1967

GEO-REFERENCING

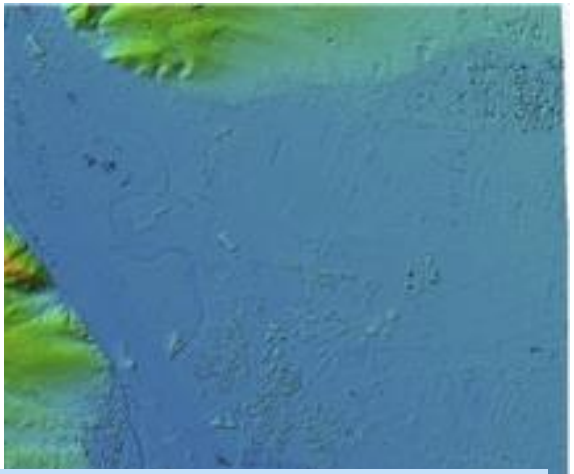
- Stable-over-time GCPs are rarely availble or clearly visible in historical images
- When modern GPCs are available, their manual measurement can be a tricky and insidious task

GCP – Cyprus, 1993

TIME benchmark – photogrammetric processing

DSM and orthoimages

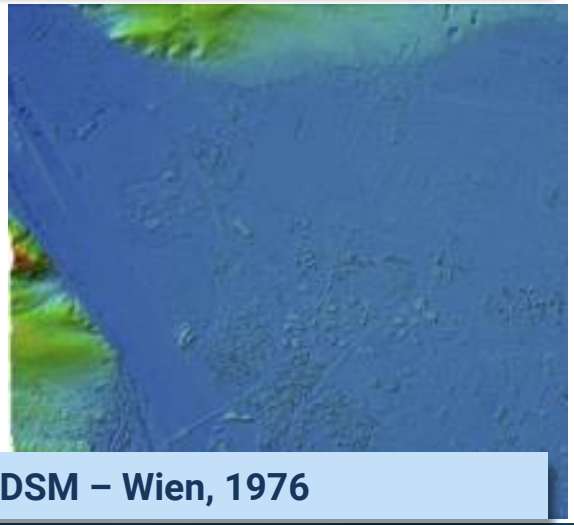
- Test several photogrammetric software and dense image algorithms (DIM) for the DSMs production
- Orthorectification and moisaicking for the orthoimages generation



DSM – Wien, 1958

DIM – Norway, 1950

Orthoimage – Wien, 1958



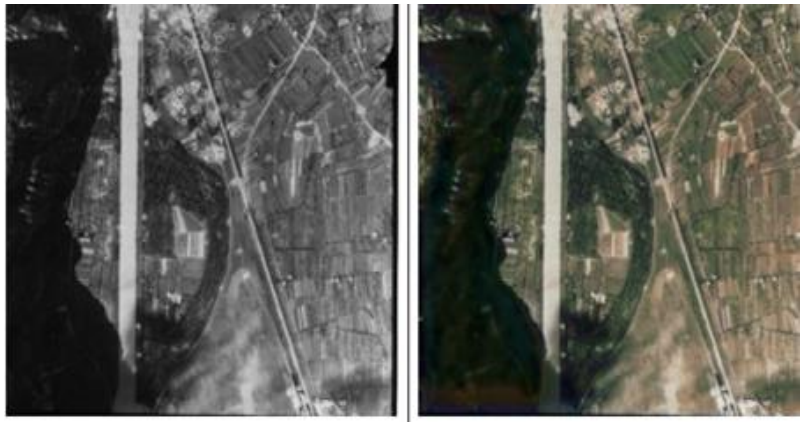
DSM – Wien, 1976

TIME benchmark – automatic colorization

COLORIZATION OF GRAYSCALE IMAGES

- Colorized grayscale images can improve further 2D-3D processing tasks (data classification, object recognition…)

- A new deep learning architecture and method for the automatic colorization of black and white historical images



Examples of colorization results with the implemented deep learning architecture with the Italian dataset