Digital Silk Road : Reviving Silk Road Using Massive Geospatial Data
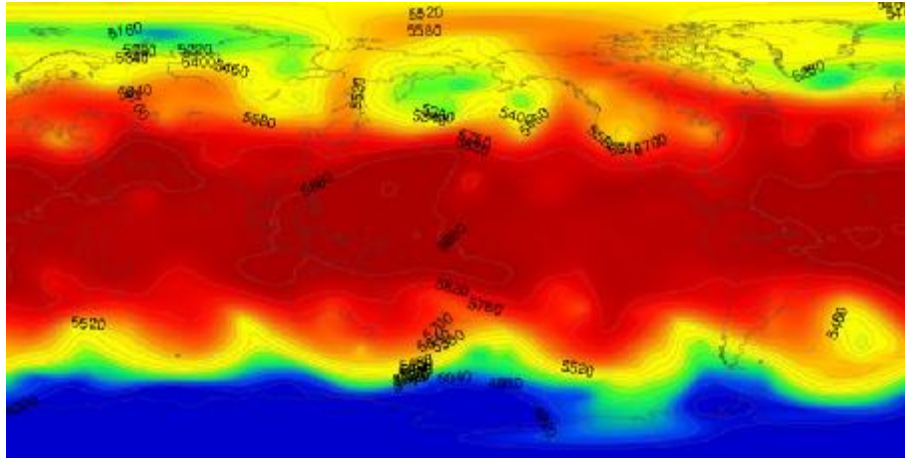
Asanobu Kitamoto

National Institute of Informatics

http://dsr.nii.ac.jp/

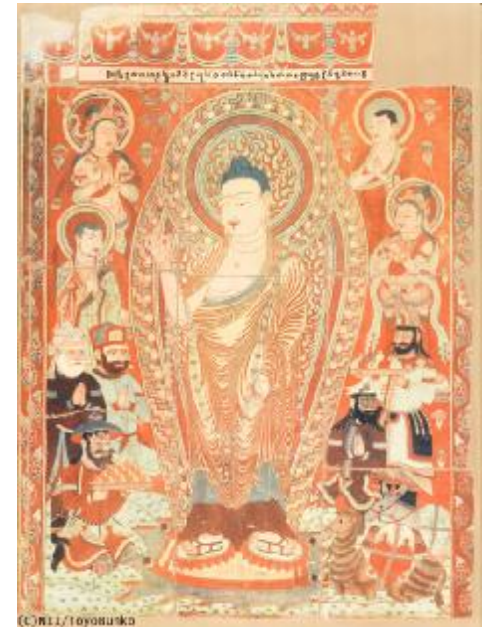# Data-Centric Approach – 4th Paradigm

Science / Technology

1. Observation
2. Theory
3. Simulation
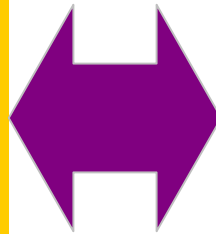4. Data Analysis

Frontier

Cultural Heritage (Digital Humanities)

Conflict of Interests

Humanities
- Culture as the target.
- Human interpretation.
- Results over techniques.

Informatics
- Culture as an example.
- Algorithmic interpretation.
- Something new over usefulness.

Work together for new thoughts and discoveries!

Challenges

- **Digitization** : Camera capture, manual modeling, automatic modeling.

- **Integration** : Media fusion, quality control, terminology and metadata.

- **Interpretation** : Multidisciplinary studies, information visualization, knowledge management.

Technical Problems

- **Digital Excavation** : Linking multiple sources for digging and uncovering hidden relationships.

- **Virtual City** : Integrating multiple sources for creating reliable databases and 3D models.

- Comprehensive and systematic digital infrastructure casts new lights on the studies of cultural heritage.
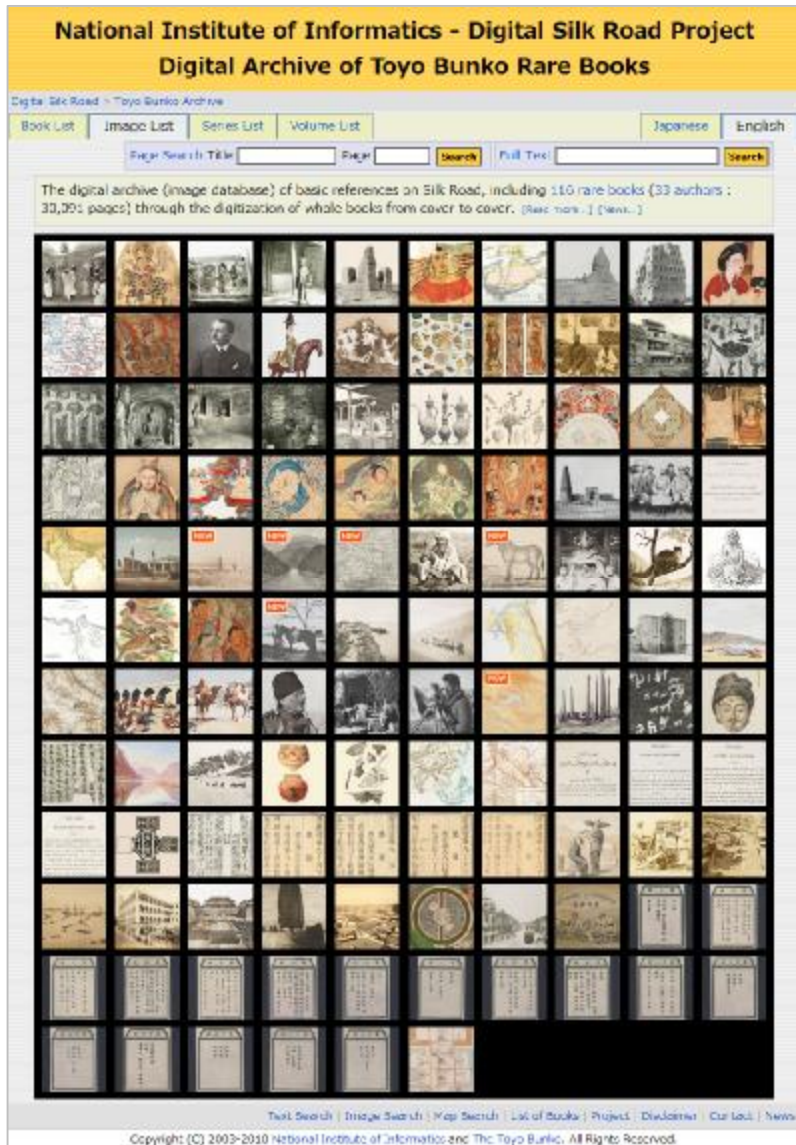
Digital Silk Road Project
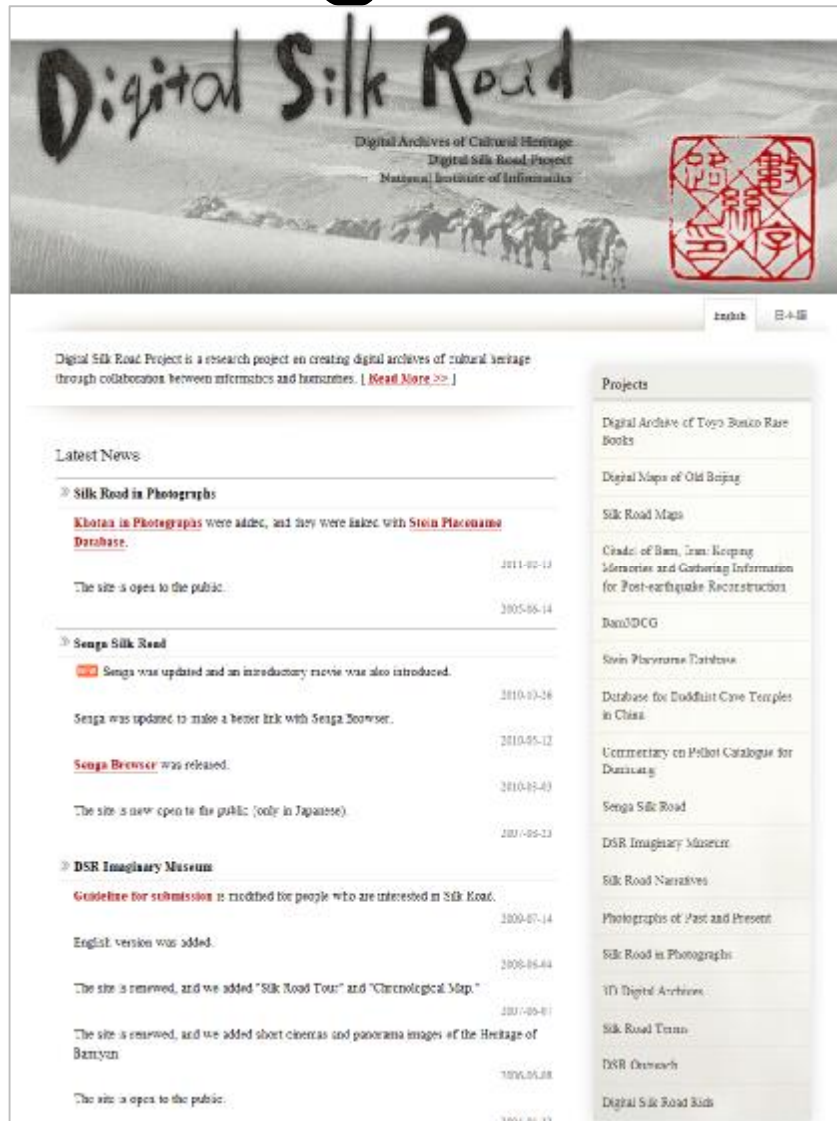
- Started in 2001.
- Collaborative work between informatics and humanities.
- Digital humanities (data-centric) approaches to Silk Road studies.
- 10+ sub-projects.

http://dsr.nii.ac.jp/

Digitization of Books

National Institute of Informatics - Digital Silk Road Project
Digital Archive of Toyo Bunko Rare Books

- 116 books, 30000 pages of Silk Road academic books.
- Selection based on quality rather than quantity.
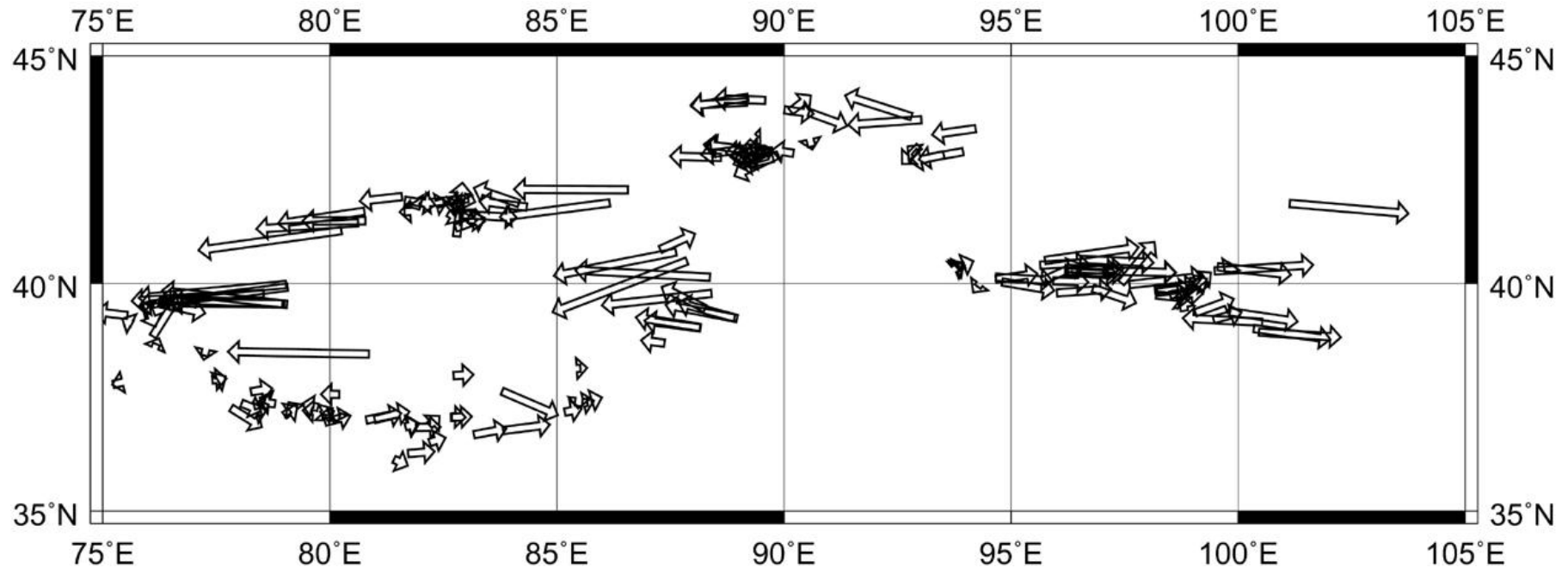- OCR for full-text search (error not corrected).

http://dsr.nii.ac.jp/toyobunko/

Integration of Maps
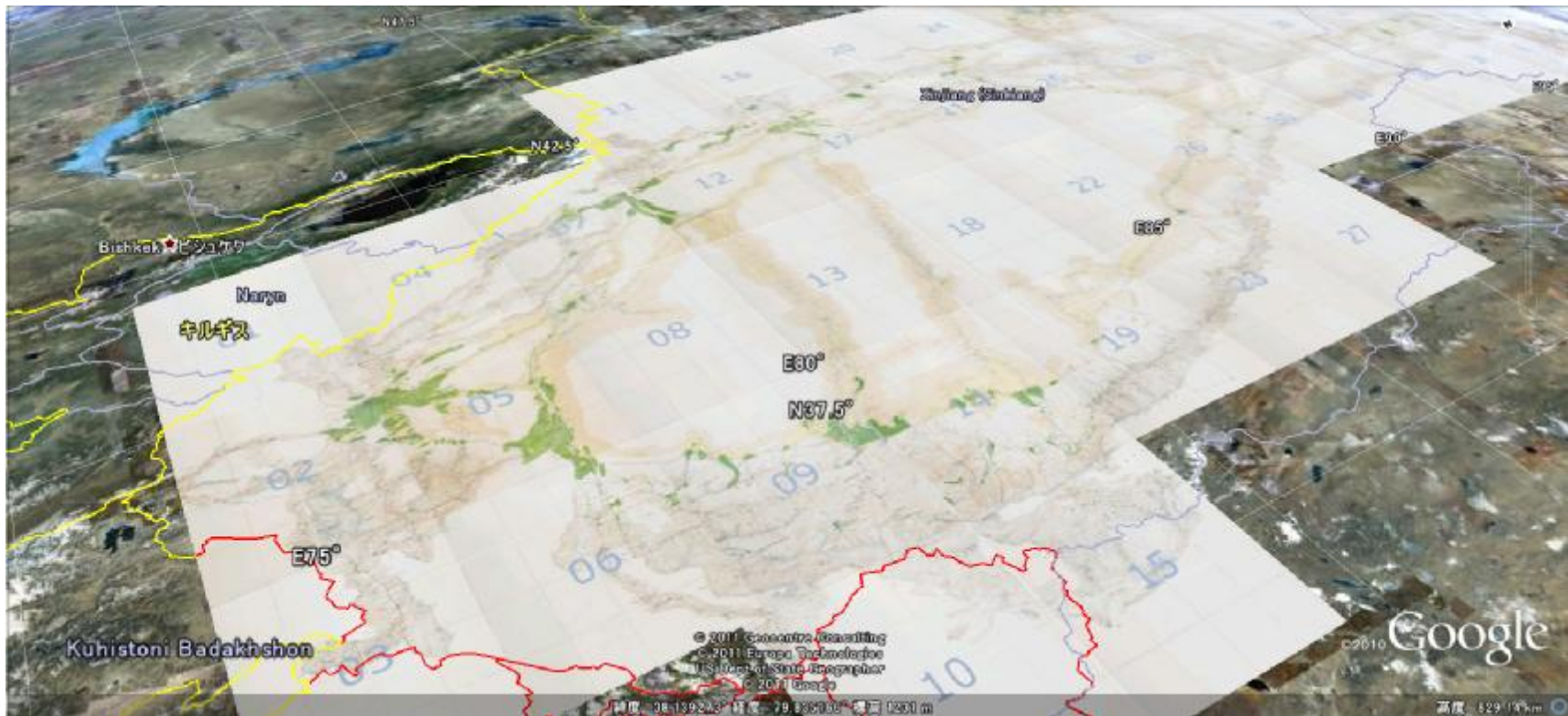
- Geometric correction of Stein maps using ground control points.
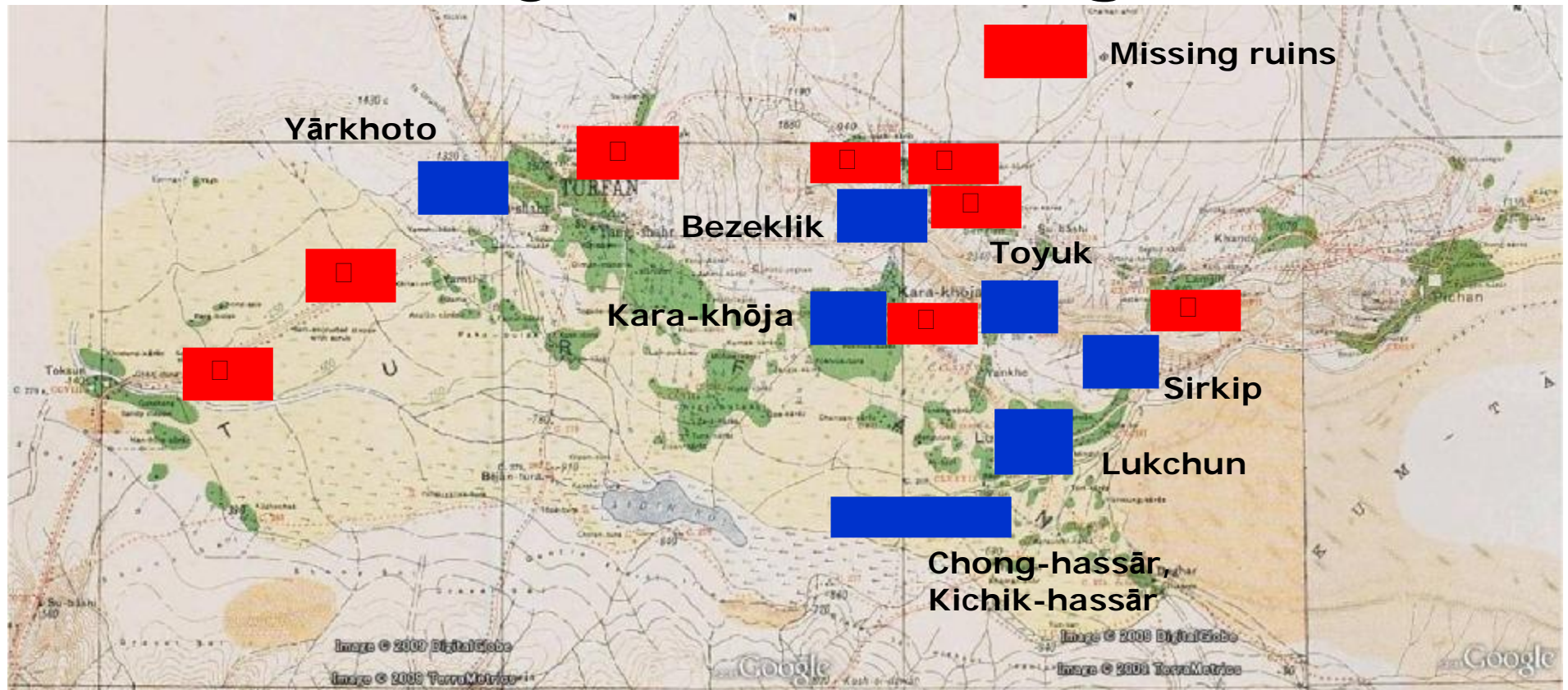
Quality Control

- Error is bigger along longitude than latitude (limitation of a chronometer).
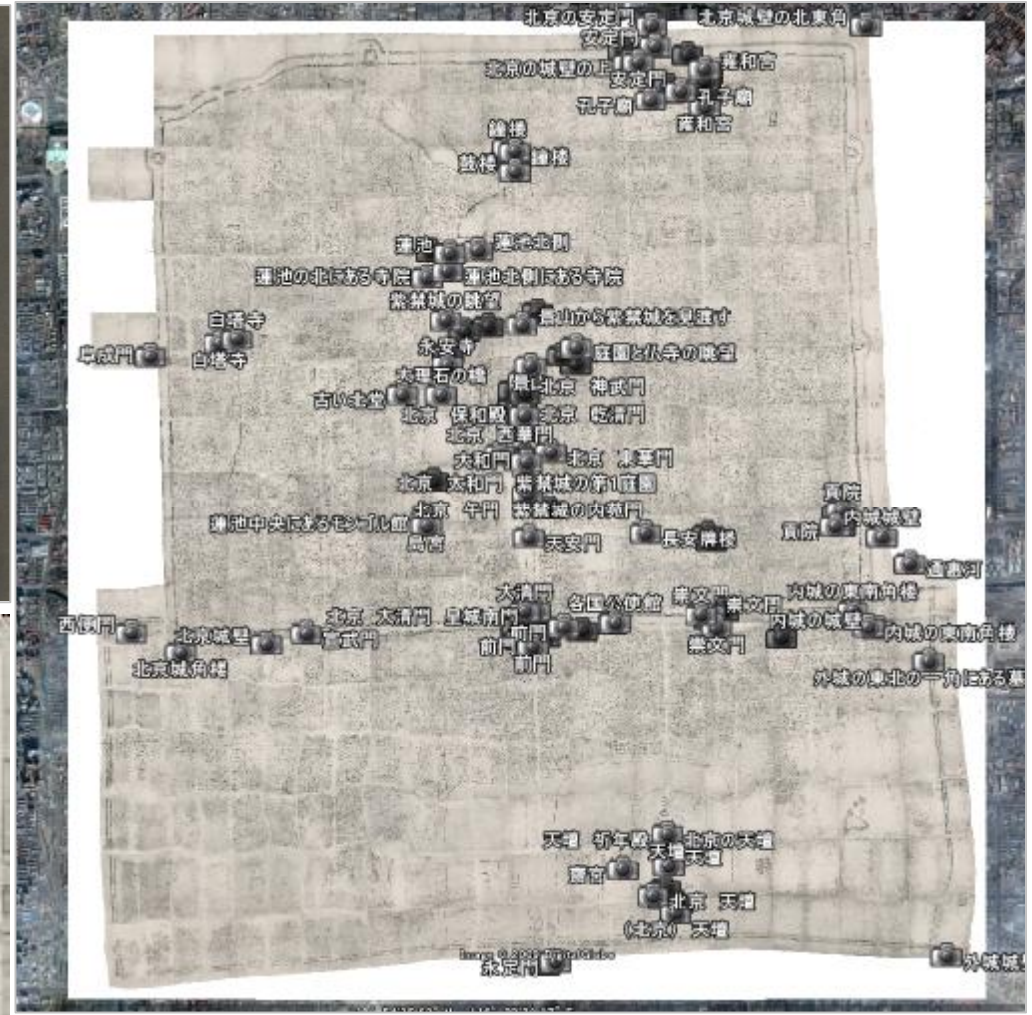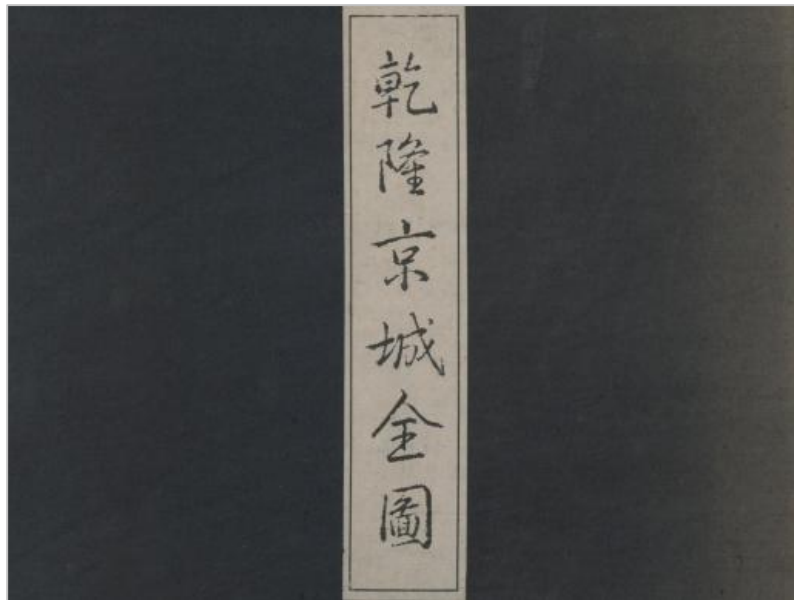- Error tends to be accumulative.

Discovery of "Missing" Ruins

- Old surveys can be linked with current surveys, leading to new discoveries.
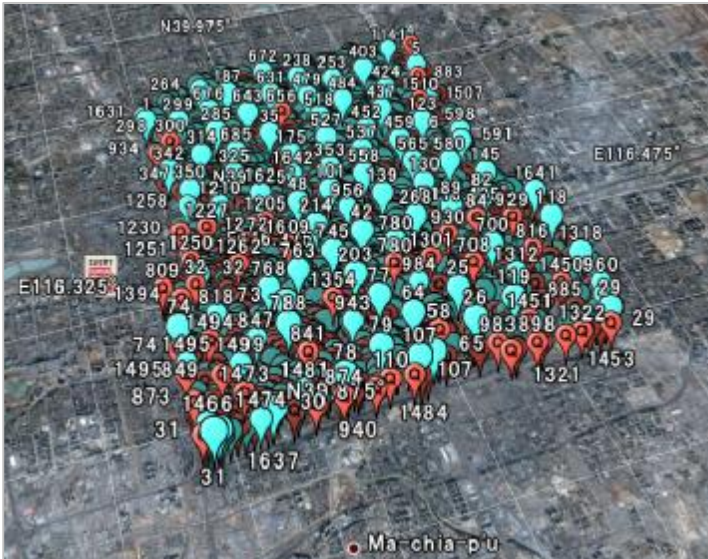
Digital Excavation

Tschyqqan(Čïqqan)Köl

Linking
Resources

- Materials can be
  studied from a
  "vantage point."

Revival of Old Beijing
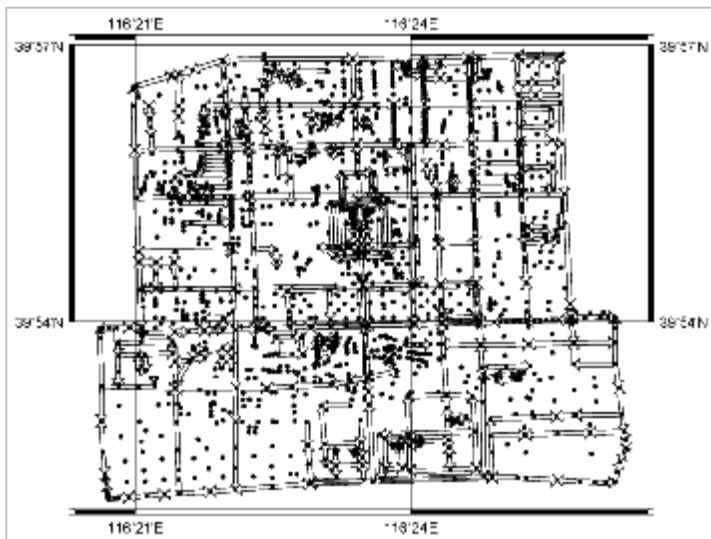
Massive Geometric Correction
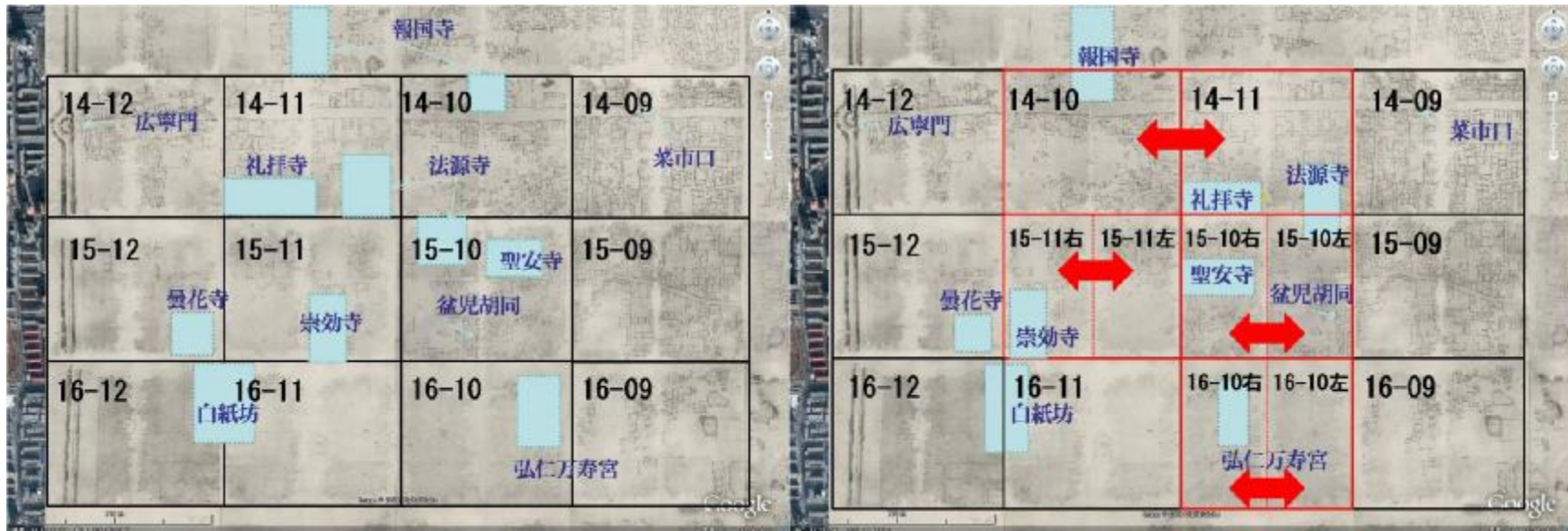

Huge size = W 13 m x H 14 m

Many sheets = 203 sheets in total

Massive pixels = 29 billion pixels

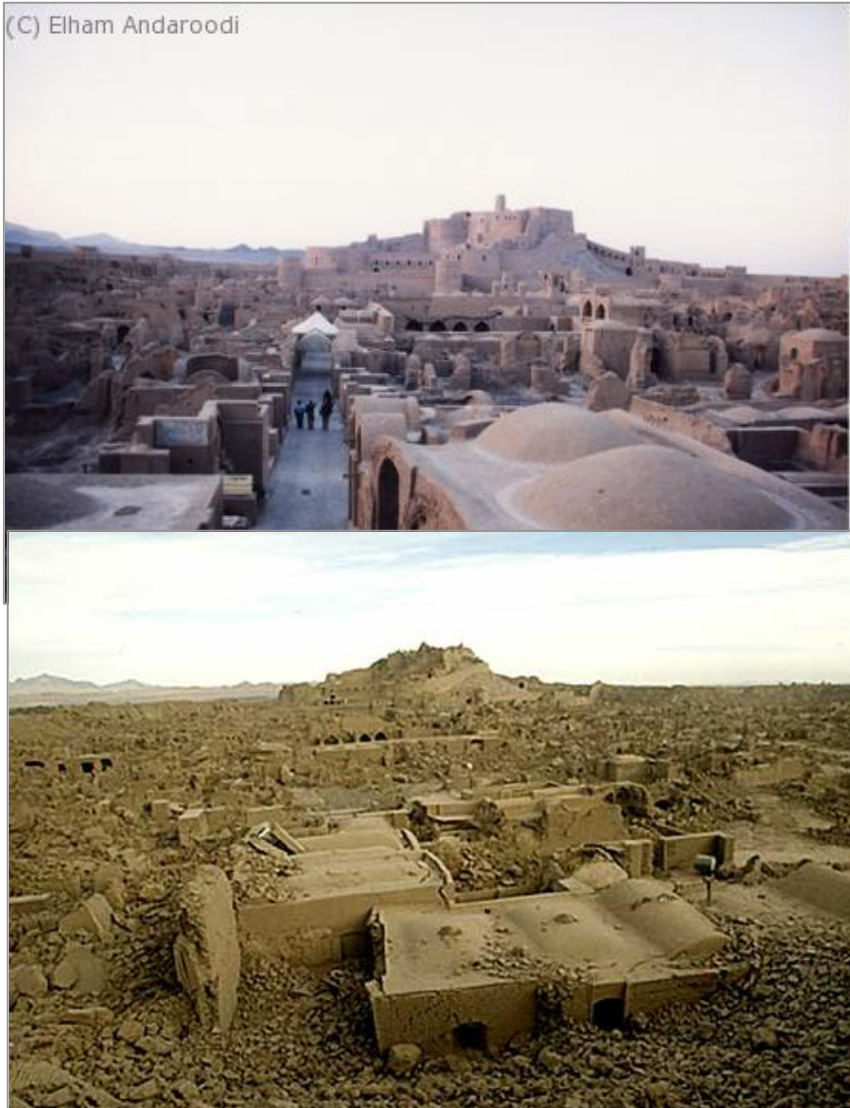- **Control points + lines**: propose a new geometric correction

Improvement of Reliability

- Mis-arrangements were found for 5 sheets (previously unknown).
- Many errors were found in the placename index.
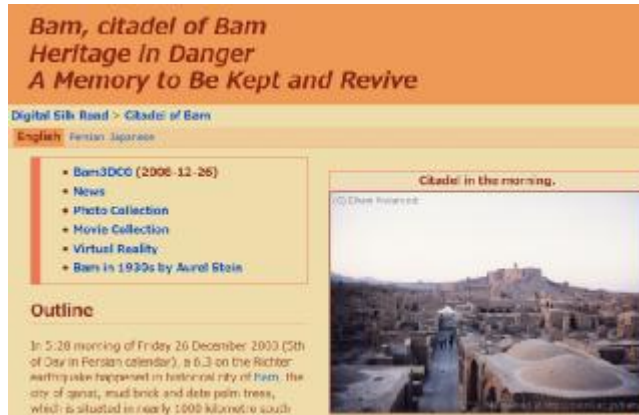
Revival of Bam Citadel

(C) Elham Andaroodi

- Citadel of Bam, Iran was almost collapsed by 2003 earthquake.

- How to revive the site?

- Answer: virtual reconstruction.

http://dsr.nii.ac.jp/bam/

http://dsr.nii.ac.jp/Bam3DCG/

Bam Project History

December 31, 2003

January 2004

April – June, 2006

December 26, 2008

Digitization of a Lost Site

New data cannot be captured from now!
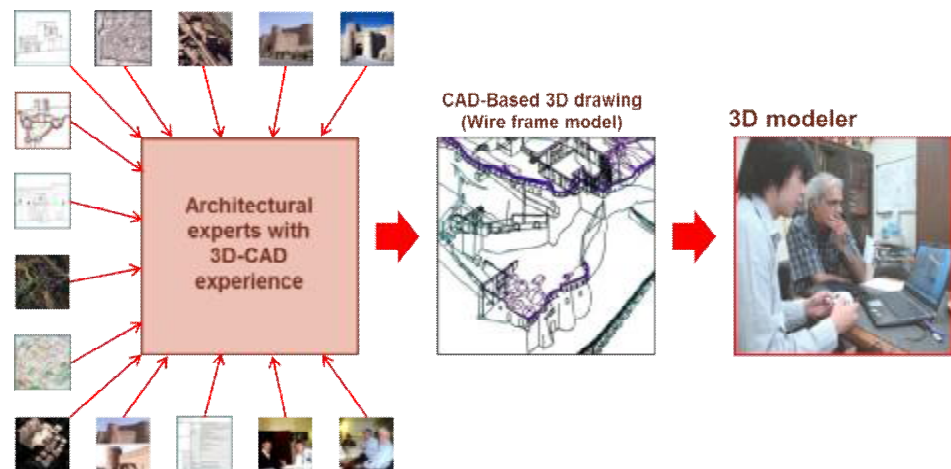
Laser scanning

Image: Wikipedia
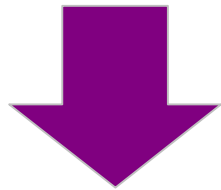
Structure from Motion

Image: Building Rome in a Day

Manual reconstruction from the integration of fragmented data and expert's knowledge.
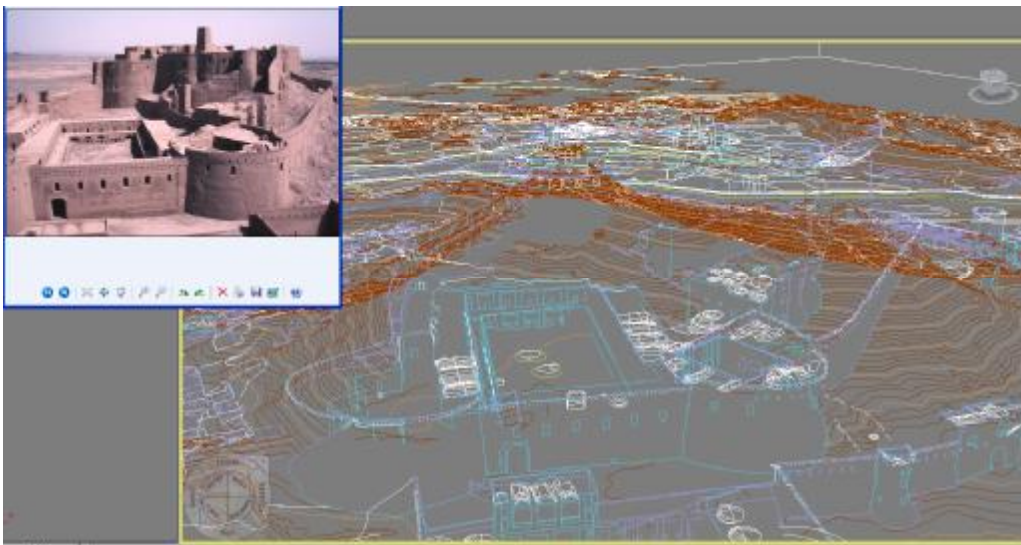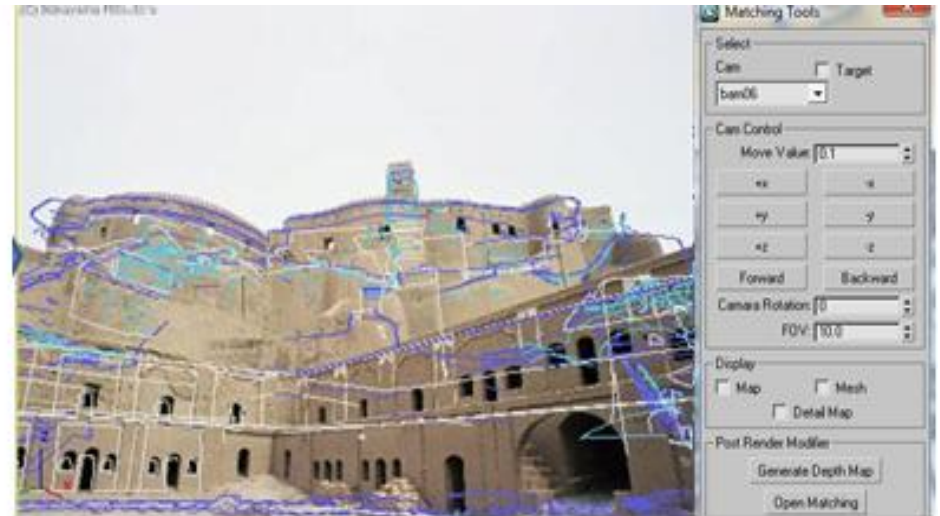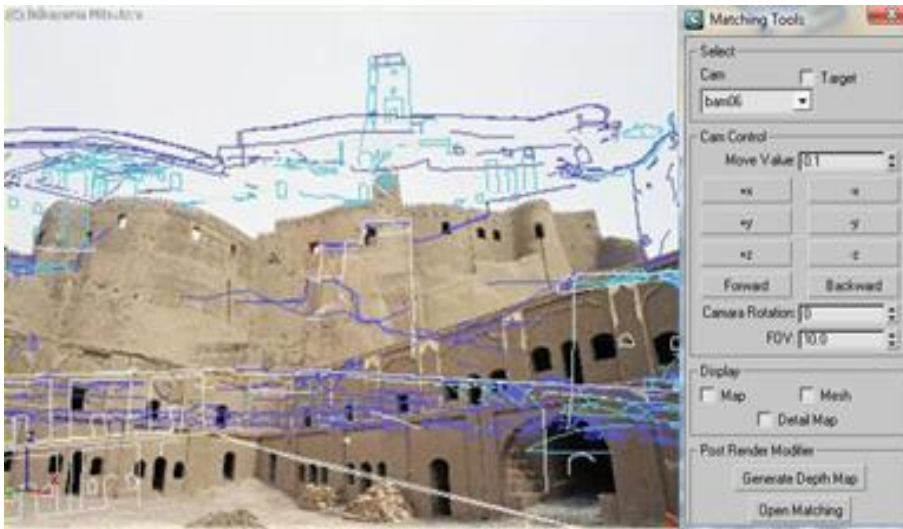
Manual Modeling

- Software: 3ds max + AutoCAD.
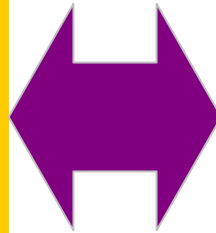- Quality control: by architects.

Semi-Automatic Modeling

Advantage of Data-Centric Approaches

Text-Centric	Data-Centric
• Insect's eye view = deeper.	• Bird's eye view = wider.
• Only focus on 'my' domain.	• Have a look on other domains.
• Studied for 100s of years.	• Still a frontier in humanities.

Renovate humanities and invent new technology!

Future Directions of Digital Humanities

- **Open access to cultural heritage data** for more research collaboration and public outreach.

- **Integration of physical and digital worlds** for improved on-site surveys in recording and analysis.

- **Working with crowds** for data creation and diverse interpretation.

Related Resources

- **Digital Silk Road**
  - http://dsr.nii.ac.jp/
- **Silk Road Old Maps**
  - http://dsr.nii.ac.jp/geography/
- **Bam Project**
  - http://dsr.nii.ac.jp/bam/
- **Digital Maps of Old Beijing**
  - http://dsr.nii.ac.jp/beijing-maps/