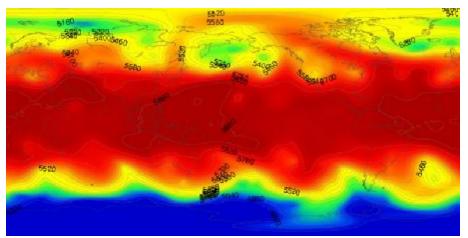
Digital Silk Road : Reviving Silk Road Using Massive Geospatial Data

Asanobu Kitamoto National Institute of Informatics <u>http://dsr.nii.ac.jp/</u>

Data-Centric Approach – 4th Paradigm



Science / Technology

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



Cultural Heritage (Digital Humanities)

Frontier

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!

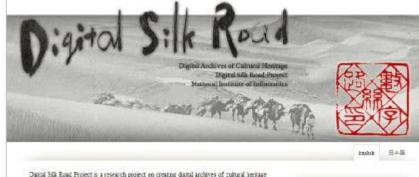
Challenges

- 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

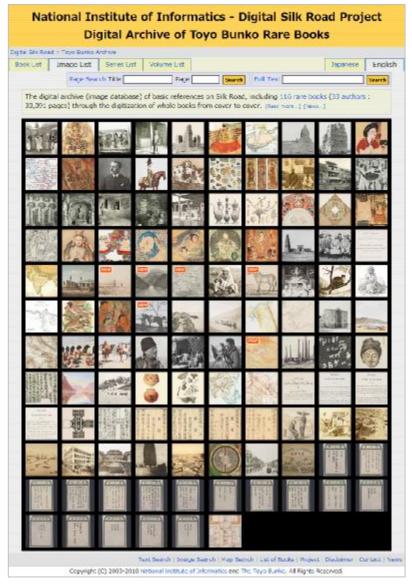


through collaboration between informatics and humanities. [<u>Read Nore >></u>]		Projects	
Latest News		Digital Archive of Toyo Bunko Rare Books	
NAME TO A LONG T		Digital Maps of Old Brijing	
» Silk Road in Photographs		Contractor and the second second	
Khotan in Photographs were added, and they were inked with Stoin PL	ne com a trave	Silk Road Maps	
Darahase.		Gradel of Barn, Jran: Keeping	
	3011-00-13	Meraories and Gathering Information	
The site is open to the public.		for Post-earthquake Reconstruction	
	2005-08-14		
		BandDCG	
³⁰ Senga Silk Read		Stein Playname Database	
🧰 Senga was updated and an introductory racvie was also introduced.		Soon Posytome Landove	
	3010-07-36	Database for Duddhist Cave Temples	
Senga was updated to make a better link with Senga Stowser.		in China	
	2010.05-12		
Songa Browser was released.		Commentary on Pethot Catalogue for	
Sedia proviser was received.	301048-49	Duricaty	
	2010-02-03	Senga Silk Road	
The site is new open to fix gublic (only in Japanese).		octiga bak post	
	2007-05-23	DSR Imiginary Museum	
DSR Imaginary Museum			
ment of the second s		Silk Road Narratives	
Guideline for submission is modified for people who are interested in Si		2001032322000000000	
	2009-07-14	Photographis of Past and Present	
English version was added.		Silk Road in Photographs	
	2008-05-04	the total of charge date.	
The site is renewed, and we added "Silk Road Tour" and "Chronological Map."		3D Digital Archines	
	2007-05-01		
The site is ensewed, and we added short cinemas and panorama images of the Heritage of		Sik Road Tenno	
Bamyan		DSB Onnewh	
	105.05.08	LATE LAURER I	
The site is open to the public.		Digital Sile Road Bids	
	3004.04.73	1250	

- 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/

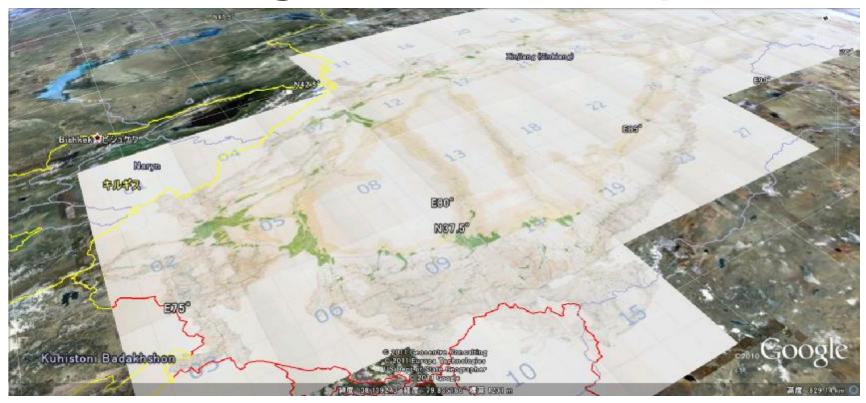
Digitization of Books



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

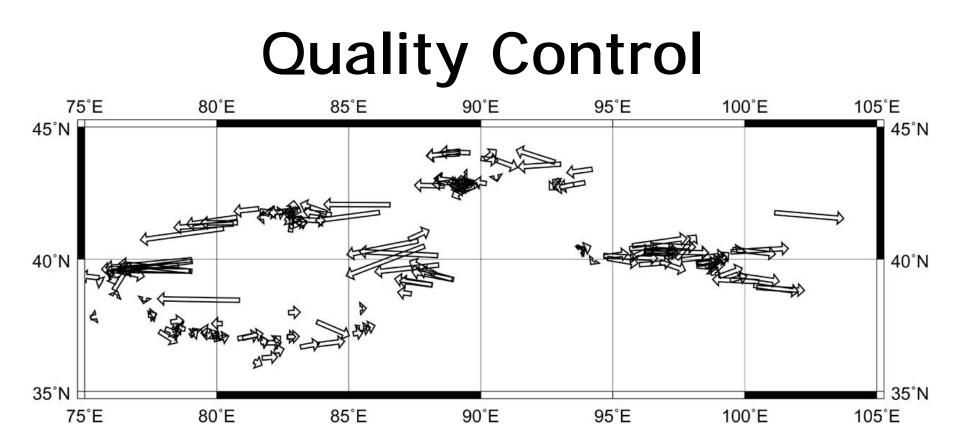
http://dsr.nii.ac.jp/toyobunko/

Integration of Maps



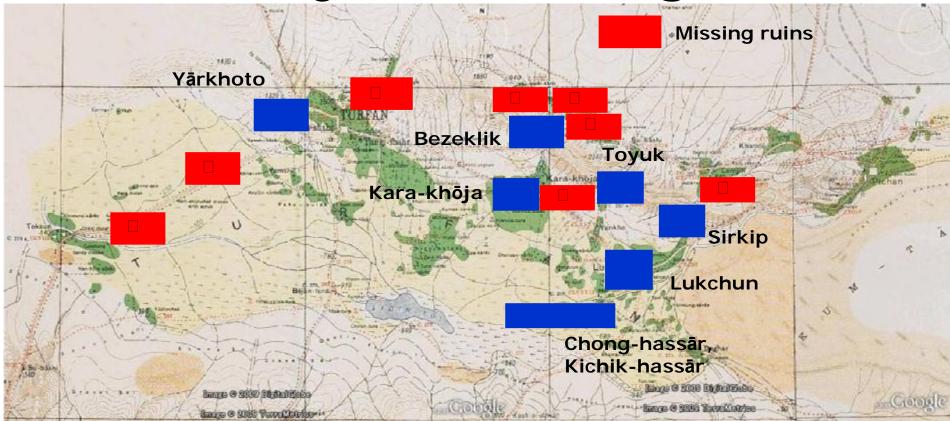
 Geometric correction of Stein maps using ground control points.

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



- 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.

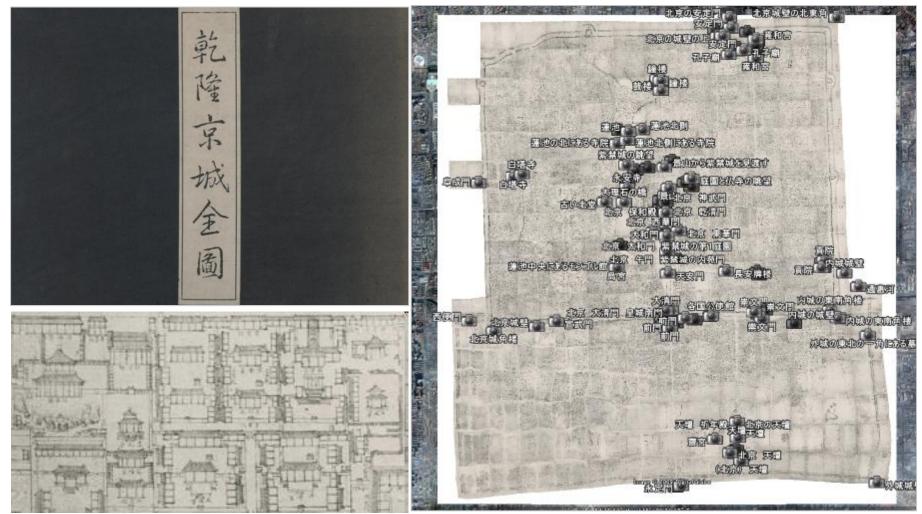
Digital Excavation



 Materials can be studied from a "vantage point."

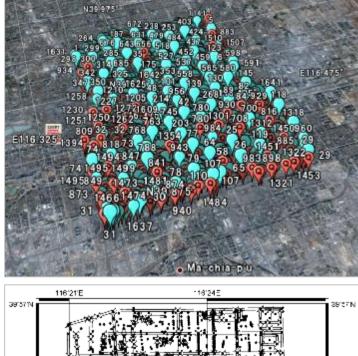


Revival of Old Beijing



http://dsr.nii.ac.jp/beijing-maps/

Massive Geometric Correction

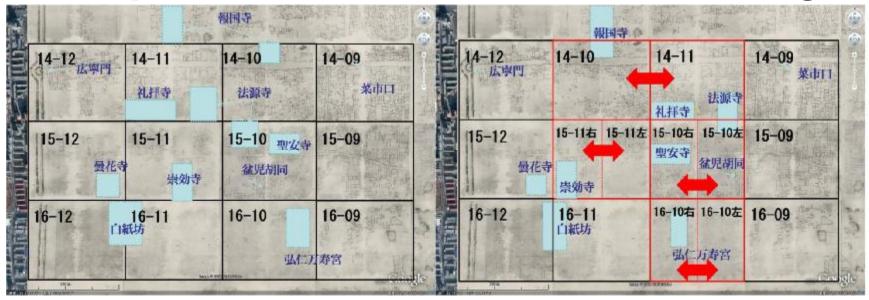


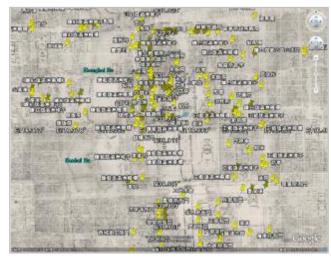


Huge size = W 13 m x H 14 m Many sheets = 203 sheets in total Massive pixels = 29 billion pixels

 Control points + lines: propose a new geometric correction

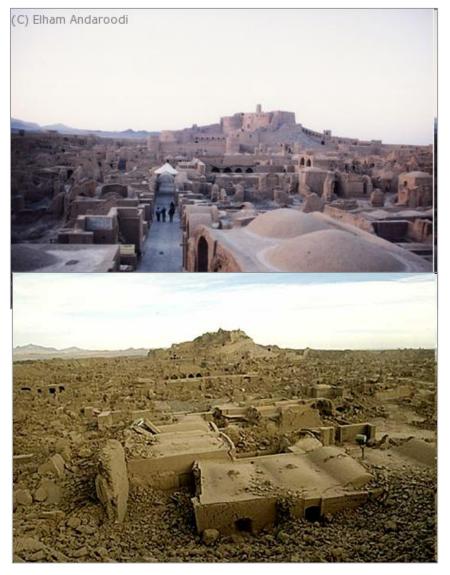
Improvement of Reliability





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

Revival of Bam Citadel

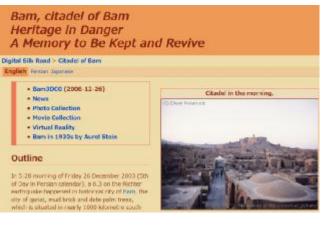


- Citadel of Bam, Iran was almost collapsed by 2003 earthquake.
- How to revive the site?
- Answer: virtual reconstruction.

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

Bam Project History

December 31, 2003



April – June, 2006



January 2004



December 26, 2008



Digitization of a Lost Site

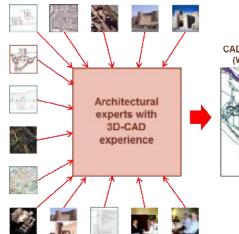


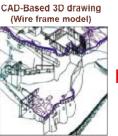
New data cannot be captured from now!

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.





3D modeler



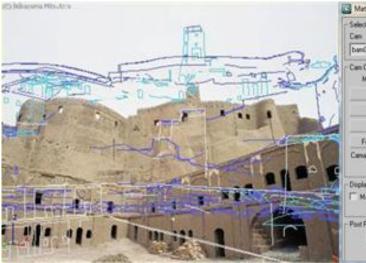
Manual Modeling



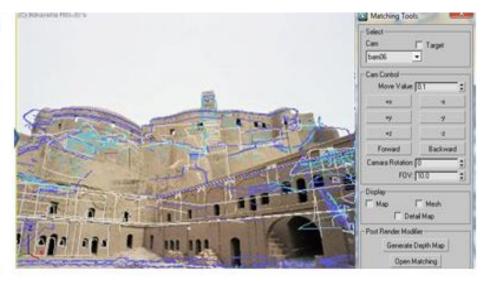
- Software: 3ds max + AutoCAD.
- Quality control: by architects.

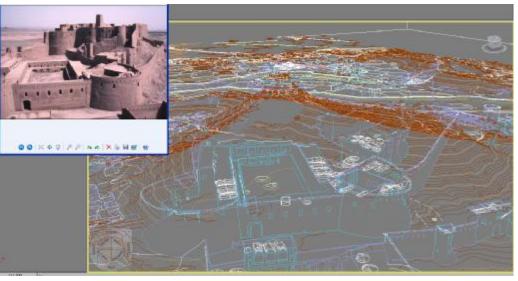


Semi-Automatic Modeling











Advantage of Data-Centric Approaches

Text-Centric

- Insect's eye
 view = deeper.
- Only focus on 'my' domain.
- Studied for 100s of years.

Data-Centric

- Bird's eye view = wider.
- Have a look on other domains.
- 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
 - -<u>http://dsr.nii.ac.jp/bam/</u>
- Digital Maps of Old Beijing
 - -<u>http://dsr.nii.ac.jp/beijing-maps/</u>