



HAL
open science

A fully automated incremental photogrammetric processing dedicated for collaborative remote-computing workflow

Anthony Pamart, François Morlet, Livio De Luca

► To cite this version:

Anthony Pamart, François Morlet, Livio De Luca. A fully automated incremental photogrammetric processing dedicated for collaborative remote-computing workflow. 8TH INTERNATIONAL WORKSHOP 3D-ARCH “3D VIRTUAL RECONSTRUCTION AND VISUALIZATION OF COMPLEX ARCHITECTURES”, Feb 2019, Bergamo, Italy. hal-02936421

HAL Id: hal-02936421

<https://hal.science/hal-02936421v1>

Submitted on 11 Sep 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

A FULLY AUTOMATED INCREMENTAL PHOTOGRAMMETRIC PROCESSING DEDICATED FOR COLLABORATIVE REMOTE-COMPUTING WORKFLOW

Anthony Pamar¹, François Morlet², Livio de Luca¹

¹ Modèles et simulations pour l'Architecture et le Patrimoine, UMR 3495 CNRS/MC, Marseille, France

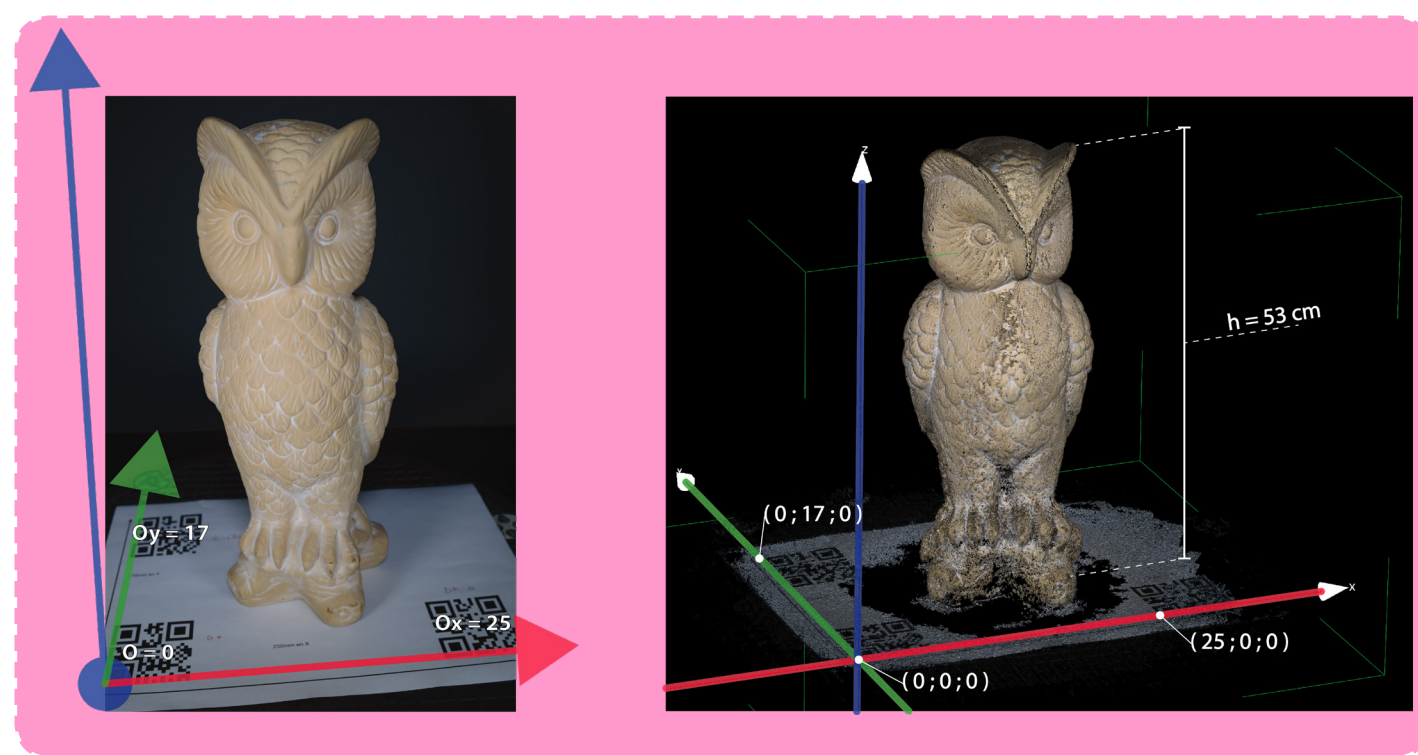
² Centre Interdisciplinaire de Conservation et de Restauration du Patrimoine, LABCOM CICRP/MAP, Marseille, France



Get this poster or get the paper scanning the QR code on the bottom

ABSTRACT :

Image based-modeling (IBM) practices in the field of Cultural Heritage studies are nowadays no longer seen as one-shot applications but as various and complex multimodal scenarios. Current use of SFM and photogrammetric methods implies their extensions to facilitate the management of complex multimodal data sets carried-out by different experts around a single heritage asset. In order to fully benefit of collaborative semantic enrichment of spatially oriented resources, a versatile and robust solution have been developed to enable incremental registration of image-sets within the web-based platform AIOLI (www.aioli.cloud).



TACO (Totally Automated Co-registration and Orientation) :

It is an inter-operative, automated, robust and versatile IBM data processing methodology dedicated to multimodal and incremental registration of CH resources. It have been formalized as an iterative-recursive algorithm based on open-source packages combining the velocity of SfM and the accuracy of photogrammetric methods, structured as follow :

I) Automatic best sub-sampling parametrization for tie-points extraction and matching using best-neighbours pre-selection

II) Self-adaptive incremental internal and external calibration

III) Automatic scaling and user defined world-space orientation based on QR-code detection

IV) Fully automatic 3D dense matching

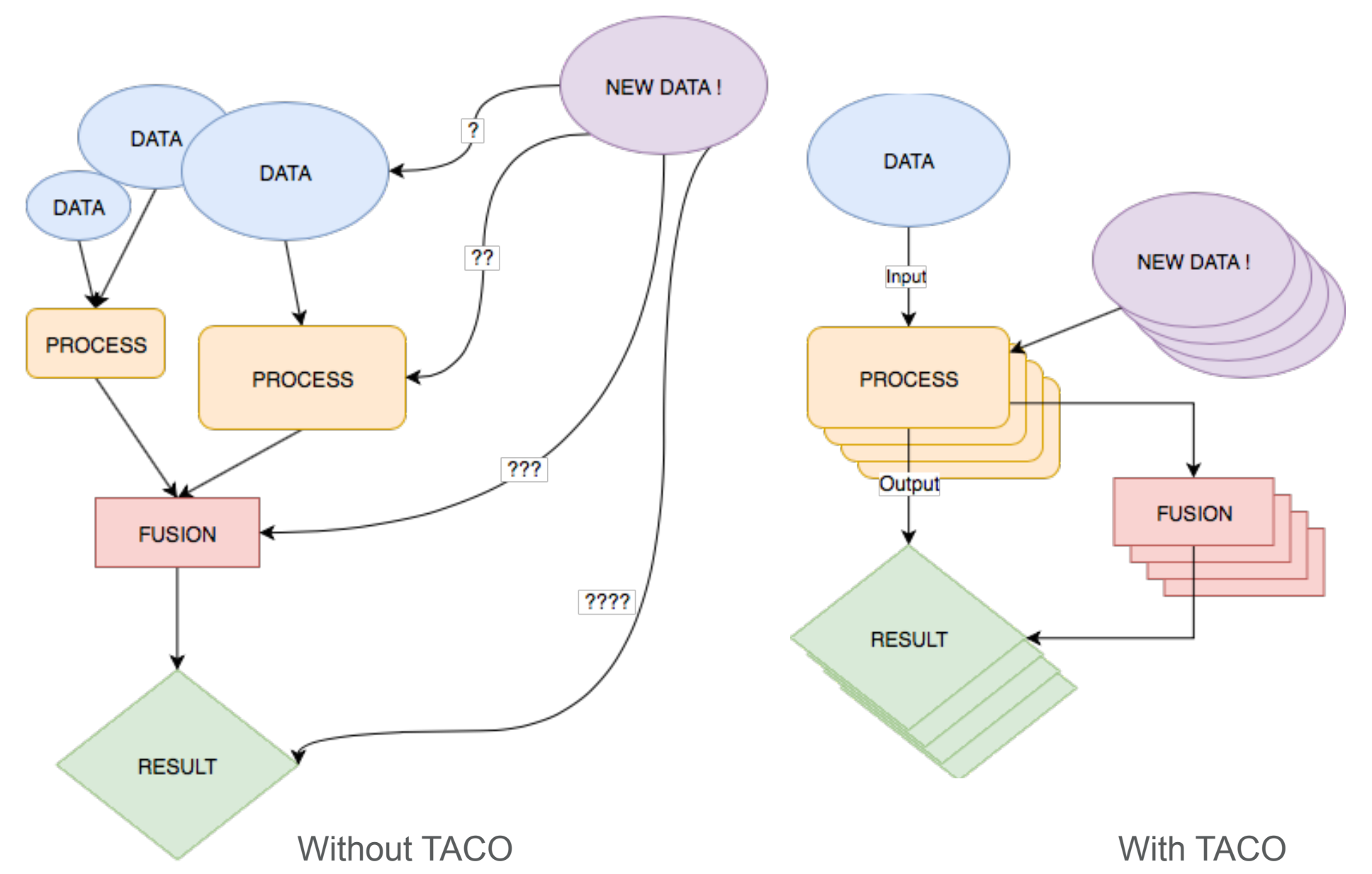
While optimizing strategy and tuning of processing to compromise between accuracy and computation time, for specific fusion scenario such as :

- multi-sensor
- multi-focal
- multi-temporal
- multi-scalar
- multi-spectral
- large and complex data acquisition canvas

FUTURE WORKS :

- Import projects from MicMac, Open-MVG and PhotoScan
- Automatic bad or unconnected images removal
- Support of spherical images
- Enhanced features extraction (MSD or MI)
- Automatic GCP's extraction and coded targets support
- Automatic orthophotomosaic generation, including multiband support
- Support Alembic format for dynamic point-cloud instantiations

Complexity multimodal data fusion and management :



Dataset	Nb. of images	Running time (min)*	Sparse cloud (k)points	Dense cloud (M)points	ER2 (px)
Facade	8	2	102	2.35	1.08
Fragment	21	4	60	1.34	0.47
Portal	26	7	94	3.13	1.01
Artefact	40	7	108	2.68	0.93
Painting	65	7	127	1.76	0.74
Excavation	95	43	641	1.34	0.49
Temple	134	120	1850	40.4	0.74
Building	181	170	224	1.14	0.73
Statue	273	390	1468	5.62	1.26

* Processed on Dell Power Edge R940 with a Intel Xeon CPU delivering 144 cores of 3.0GHz, 256GB of RAM and 4TB SSD storage

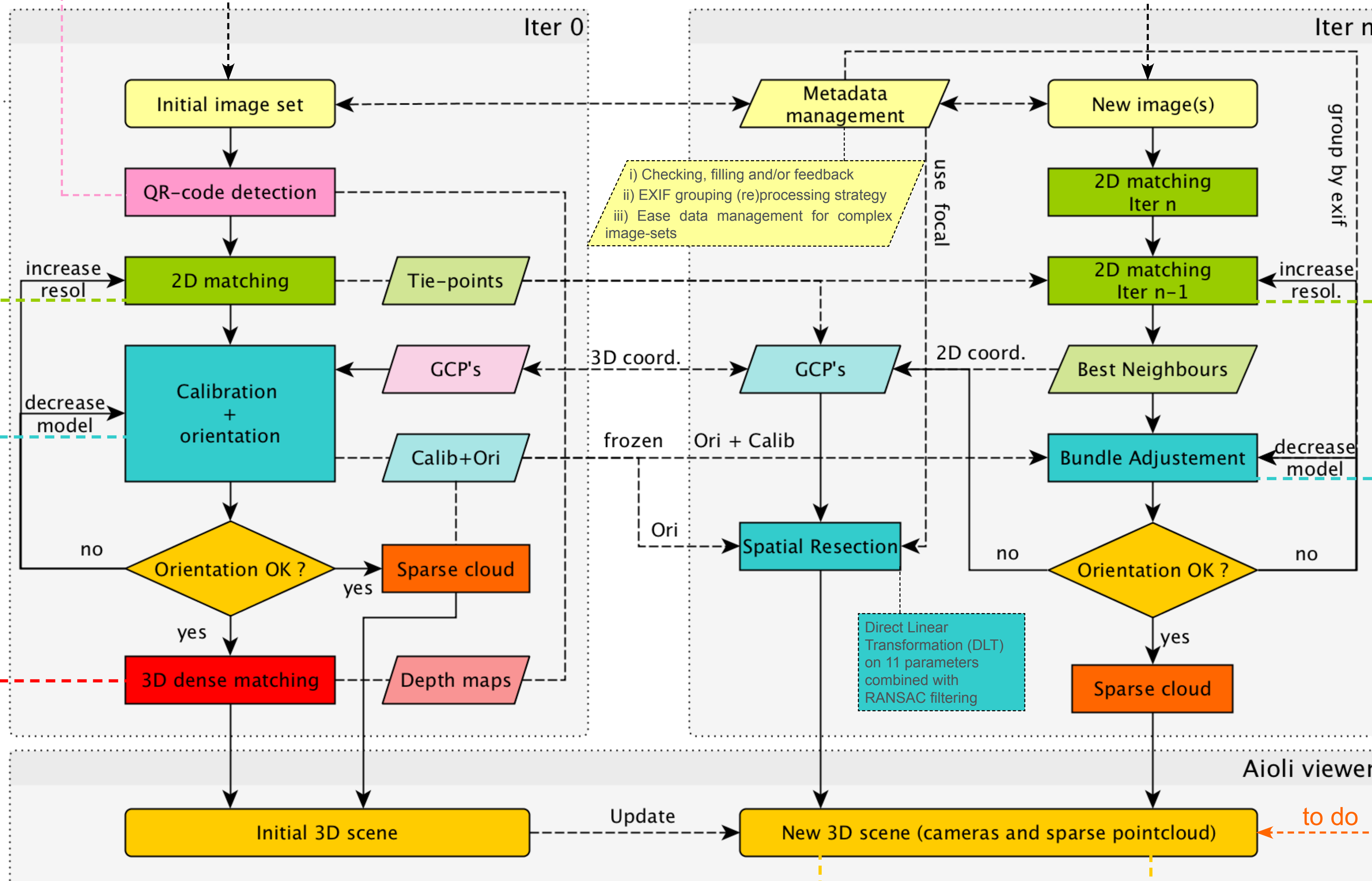
Dataset	Add. images	Nb. Iter	New camera	New focal	ER2 (px)
Facade	+107	12	1	6	1.54
Portal	+4	4	4	4	Nc.
Painting	+6	3	1	2	0.80
Building	+1	71	1	1	Nc.
Statue	+259	3	1	1	1.65

A robust initial iteration
Initialisation with the highest degree of exigency and incrementally compromising on key parameters

Iterative multiresolution approach to optimize tie-points

Combining velocity of trifocal tensor and the reliability of bundle block adjustment and self-calibration

Medium density point cloud (i.e. 1pt/16px) performed by multi-view stereo 3D dense matching



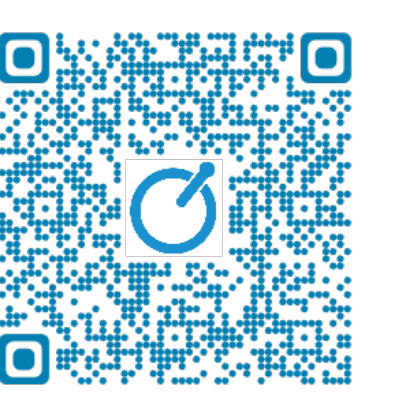
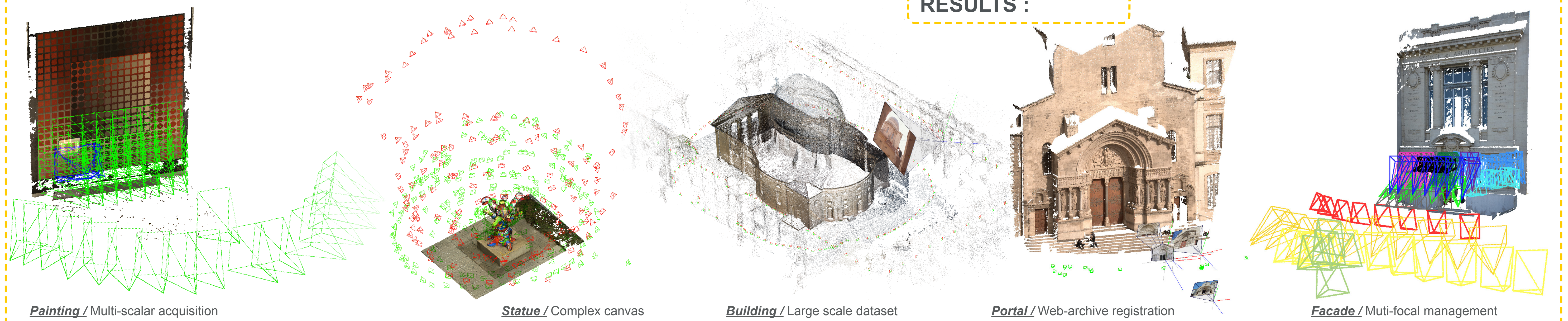
A versatile and iterative spatial co-registration
Best strategy to align high-deviation and/or low-overlap images

Incremental sub-sampling guided with best-neighbours pre-selection

Alternate between BBA and SR by freezing results from past iterations

Global refinement of the scene through iterations toward possible gain of accuracy, resolution or completion

RESULTS :



Get the paper