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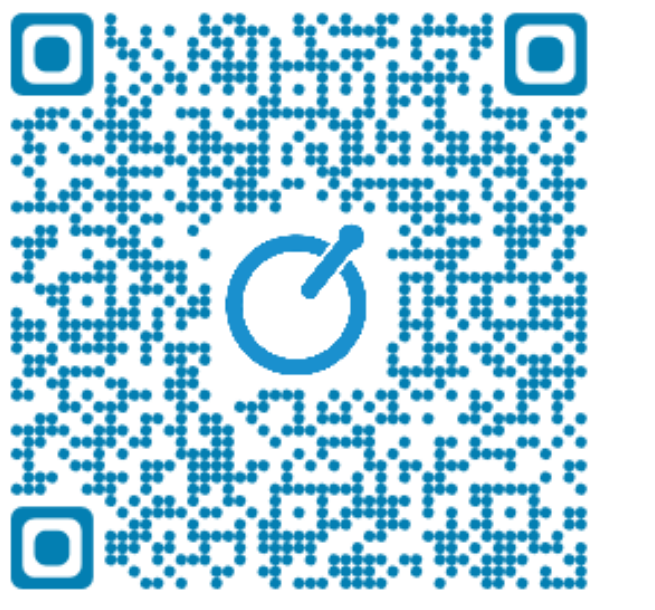
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A FULLY AUTOMATED INCREMENTAL PHOTOGRAMMETRIC PROCESSING DEDICATED FOR COLLABORATIVE REMOTE-COMPUTING WORKFLOW



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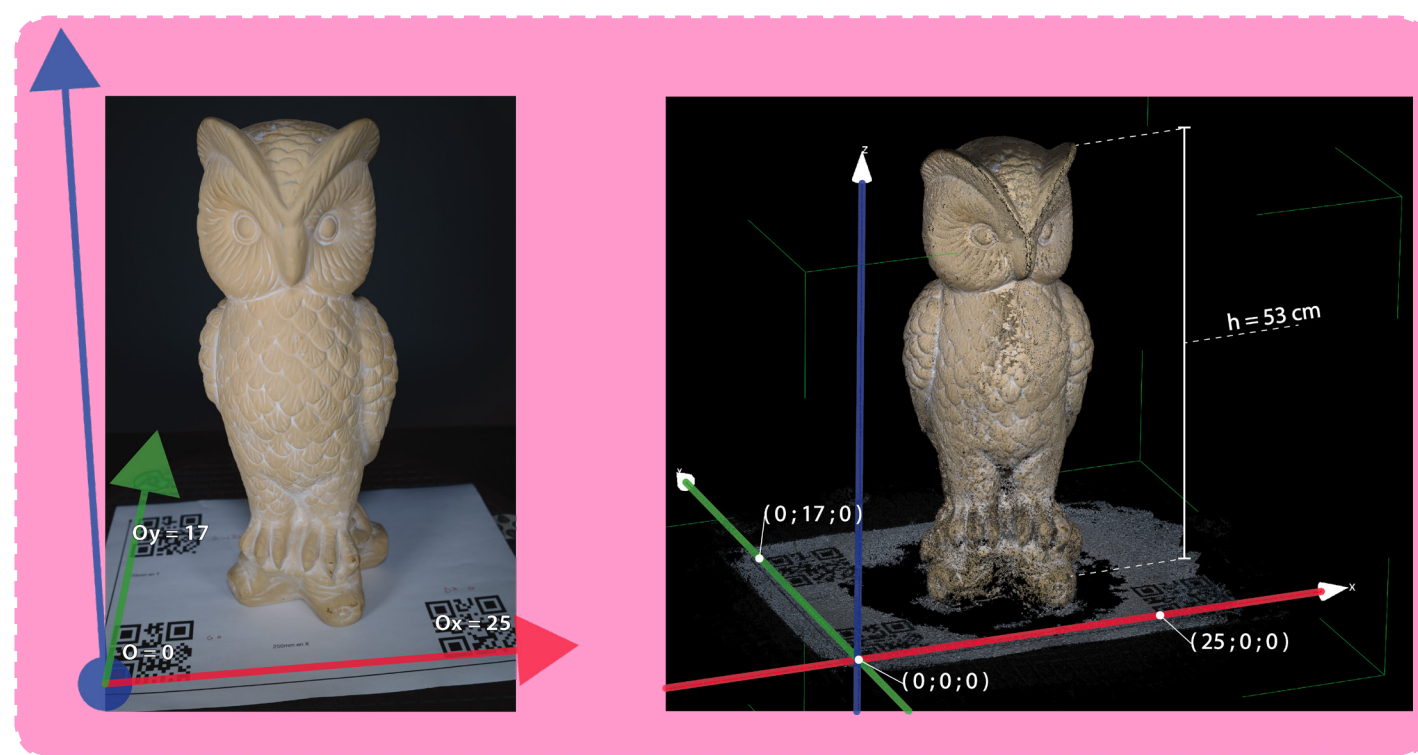
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ABSTRACT :

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

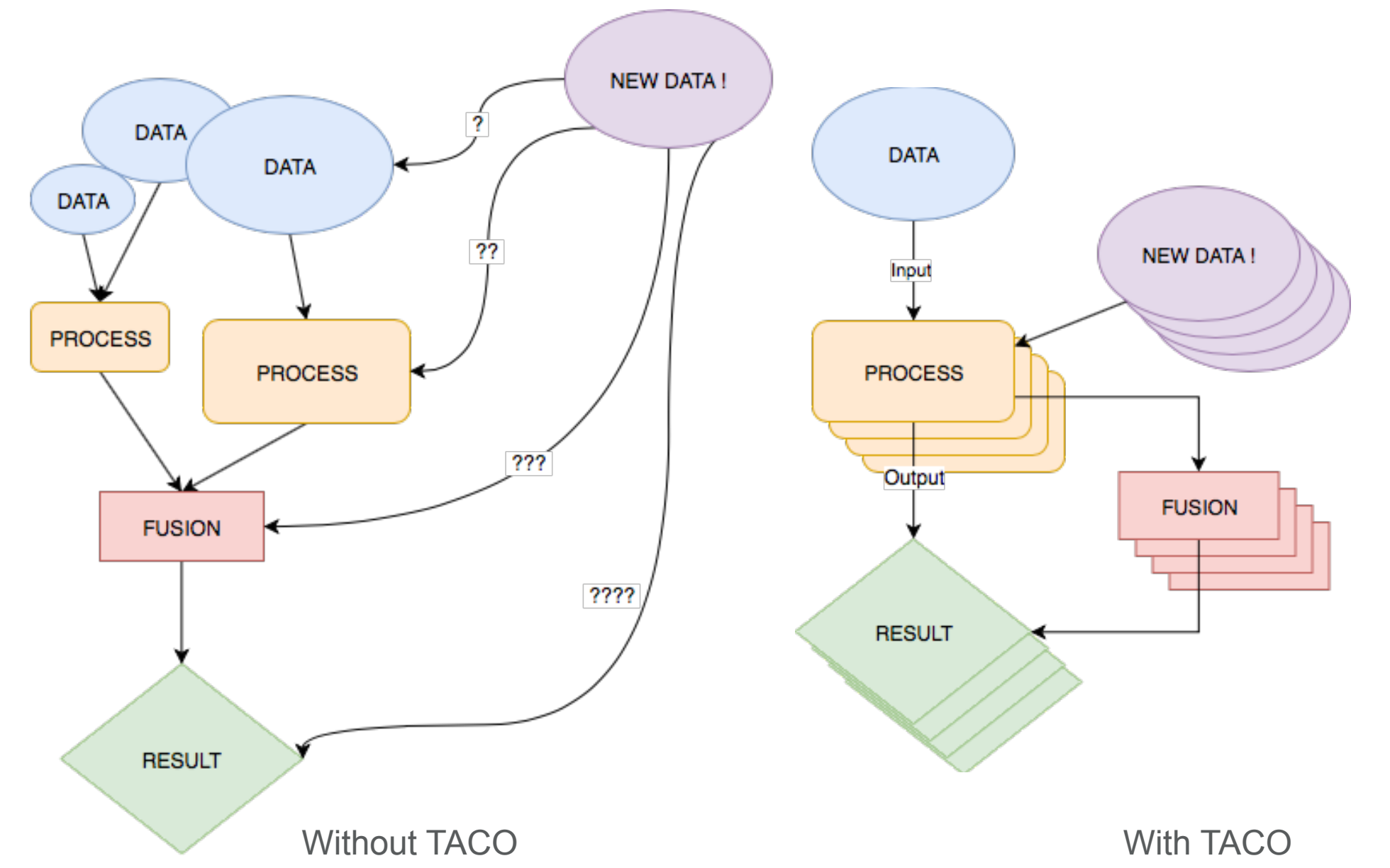
While optimizing strategy and tuning of processing to compromise between accuracy and computation time, for specific fusion scenario such as :

- 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

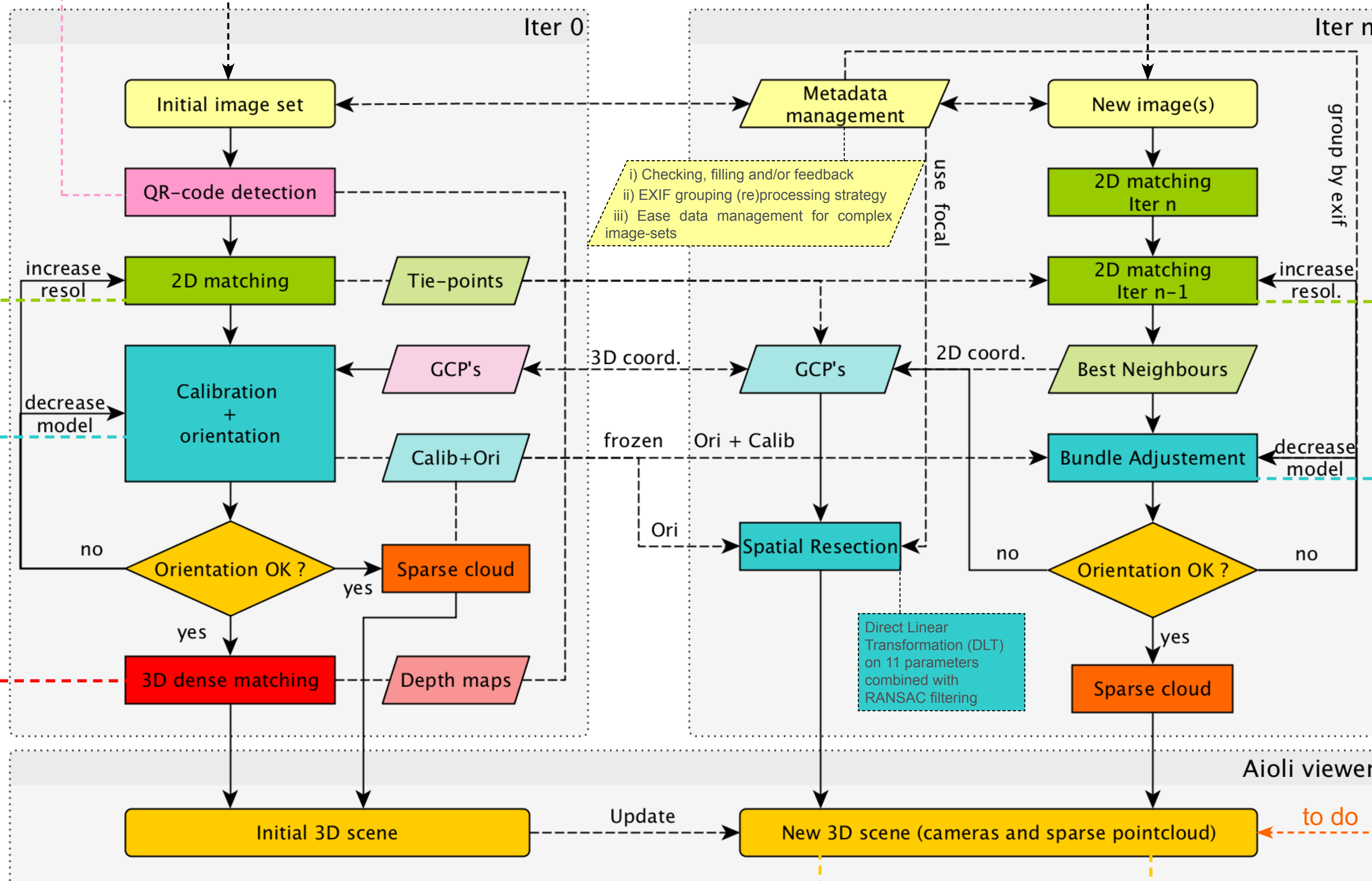
Dataset	Add. images	Nb. Iter	New camera	New focal	ER2 (px)
Facade	+107	12	1	6	1.54
Portal	+4	4	4	4	Nc.
Painting	+6	3	1	2	0.80
Building	+1	71	1	1	Nc.
Statue	+259	3	1	1	1.65

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



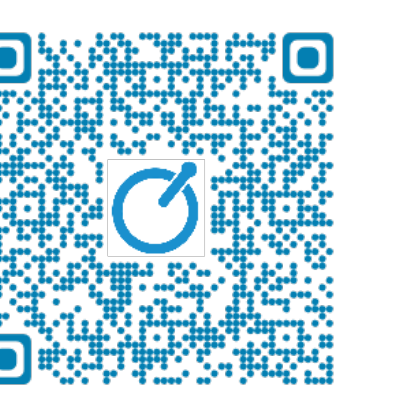
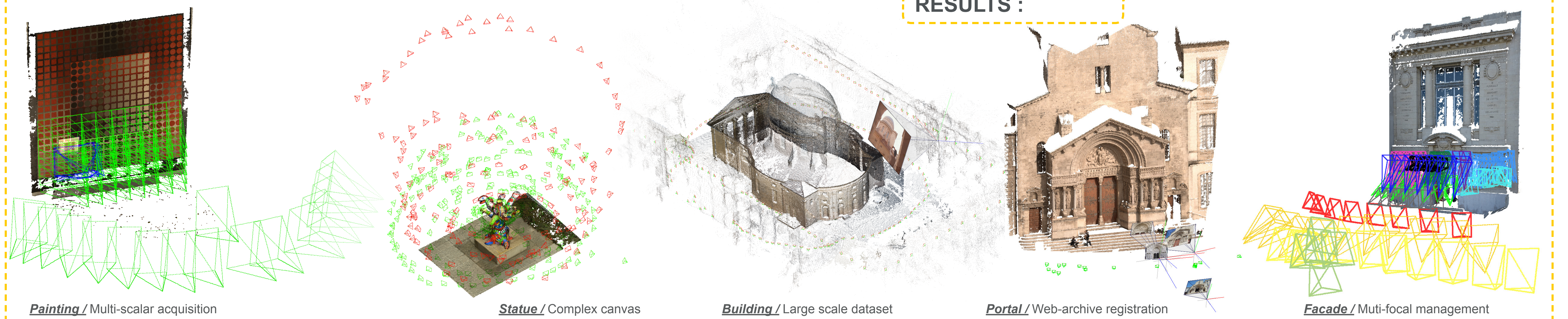
A versatile and iterative spatial co-registration
Best strategy to align high-deviation and/or low-overlap images

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 :



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