The Experimental Trial of 3D Modeling System for Sculptures in Archaeological Museum of Ostia

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As parts of the digital preservation of Ostia Antica, I conducted the experimental trail of 3D modeling system for sculptures in the Archaeological Museum using the SfM (Structure from Motion) software and the digital camera.

Fig.1 Photographic equipments

【The operation conditions in the museum】

- Work schedule: 11th – 13th August 2018
- Photographic equipments
  Camera: FUJIFILM Mirrorless Digital Camera X-T2
  Lens: FUJIFILM FUJINON XF23mmF2 R WR
- Camera Settings
  Aperture: f11, ISO and Shutter Speed: AUTO, Image Size: 6000 x 4000
- Shooting procedure
  I took photographs swining around a sculpture with changing the height of the camera using a tripod with wheels attached.

【The experimental trial of 3D modeling system】

- The system configuration of PC
  PC: iiyama LEVEL-15FX095-i7-RNSS
  CPU: intel (R) Core i7-8750H processor(2.2-4.1GHz / 6core / 12thread / 9Mbcache / TDP45W)
  RAM: DDR4-2400 16GB/SO-DIMM×2(total 32GB)
  GPU: NVIDIA(R) GeForce GTX 1060 6GB GDDR5
  OS: Windows 10 Home 64bit (DSP)
- The SfM software: Agisoft Metashape Standrd (64bit)
- General workflow of 3D modeling

1) loading photos into Metashape;
2) inspecting loaded images, removing unnecessary images;
3)aligning photos;
4)building dense point cloud;
5) building mesh (3D polygonal model);
6)generating texture;
7)building tiled model;
8)building digital elevation model;
9)building orthomosaic;
10)exporting results.

I conducted various experiments by changing experiment conditions. The report of contained the result of experimental conditions and the turnaround times is Table 1.

Table1 the result of experimental conditions and the turnaround times

Sculptures（inventàrio）	Number of photos	Align Photos			Build Dense Cloud				Build Mesh		Build Texture			
		Accuracy	Matching time	Alignment time	Quality	Depth filtering	Depth maps generation time	Dense cloud generation time	Quality	Processing time	Mapping mode	Blending mode	UV mapping time	Blending time
Trajan (inv. 14)	164	High	11min 25sec	2min 45sec	High	Moderate	5h 19min	1h 38min	High	9min 7sec	Generic	Mosaic	4min 48sec	49min 30sec
Antoninus Pius (inv. 16)	164	High	57min 9sec	5min 37sec	High	Aggressive	47min 32sec	1h 8min	High	8min 8sec	Generic	Mosaic	31sec	7min 14sec
Trajan (inv. 17)	126	High	8min 11sec	1min 26sec	High	Moderate	2h 59min	55min 30sec	High	13min 27	Generic	Average	6min 5sec	10min 54sec
Augustus (inv. 18)	110	Medium	4min 20sec	1min 25sec	Medium	Aggressive	5min 10sec	6min 46sec	Medium	2min 21sec	Generic	Mosaic	25sec	3min 50sec
Sabine as Ceres (inv.25)	389	Medium	26min 53sec	4min 36sec	Medium	Moderate	4h 34min	4h 47min	Medium	10min 44sec	Generic	Average	5min 20sec	16min 4sec
Lucilla (inv. 27)	342	Medium	22min 40sec	7min 32sec	Medium	Aggressive	36min 45sec	4h 5sec	Medium	2min 4sec	Generic	Mosaic	25sec	10min 17sec
Faustina the Elder (inv. 28)	178	Medium	6min 44sec	1min 46sec	High	Moderate	3h 18min	1h 29sec	High	9min 19sec	Generic	Average	4min 51sec	11min 22sec
Hadrian (inv. 32)	131	High	8min 52sec	1min 14sec	High	Moderate	3h 55min	38min 23sec	High	8min 17sec	Generic	Mosaic	4min 5sec	37min 42sec
Lucius Venus as a child (inv. 47)	390	Medium	35min 22sec	10min 9sec	Medium	Aggressive	42min 25sec	5h 30min	Medium	2min 33sec	Generic	Mosaic	26sec	12min 39sec
Female Portrait (inv. 53)	114	High	7min 8sec	41sec	High	Moderate	1h 55min	22min 9sec	Medium	7min 5sec	Generic	Average	3min 31sec	6min 16sec
Commodus as a child (inv. 79)	295	High	3h 13min	11min 12	High	Aggressive	2h 54min	5h 56min	High	7min 18sec	Generic	Mosaic	3min 21sec	1h 3min
Crispina (inv. 80)	537	High	1h 13min	8min 21	Medium	Moderate	11h 52min	10h 27min	Medium	2min 0sec	Generic	Average	1min 12sec	8min 14sec

【Results of the experimental trial】

● The cases of failure

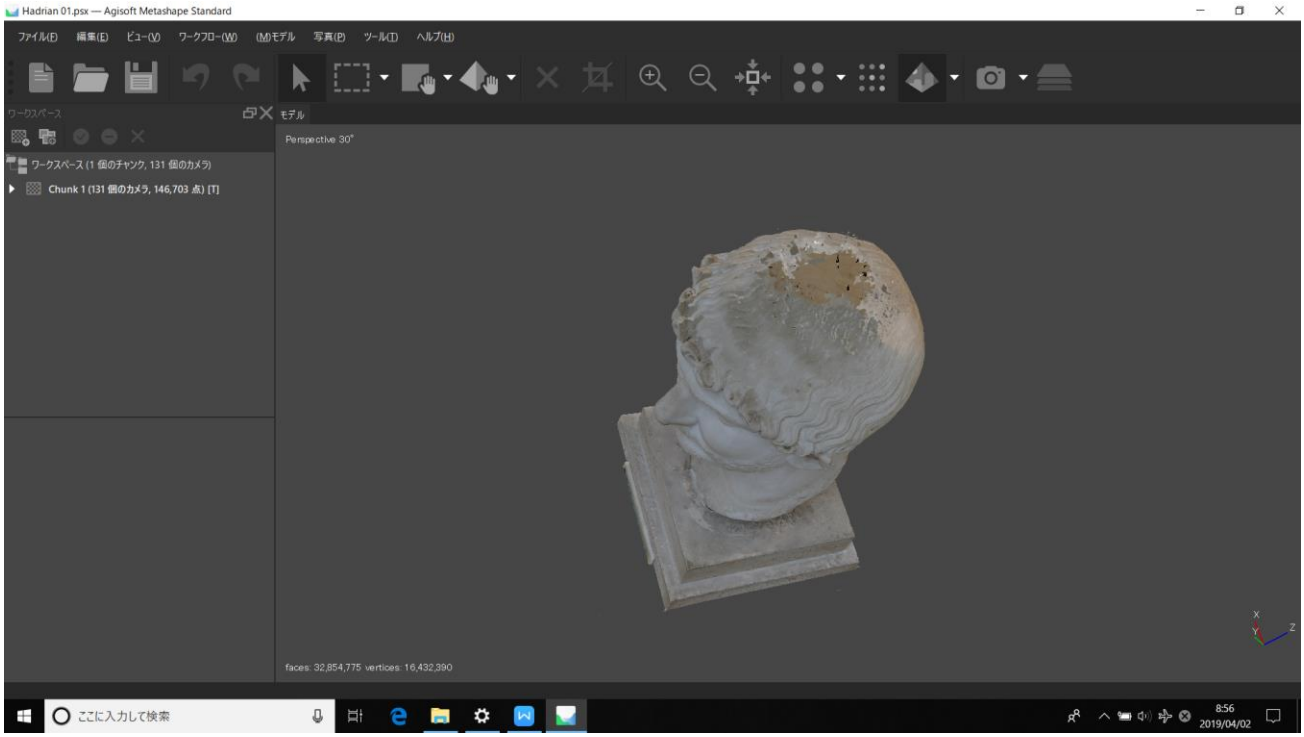

Fig. 2. Failure resulting from overexposure

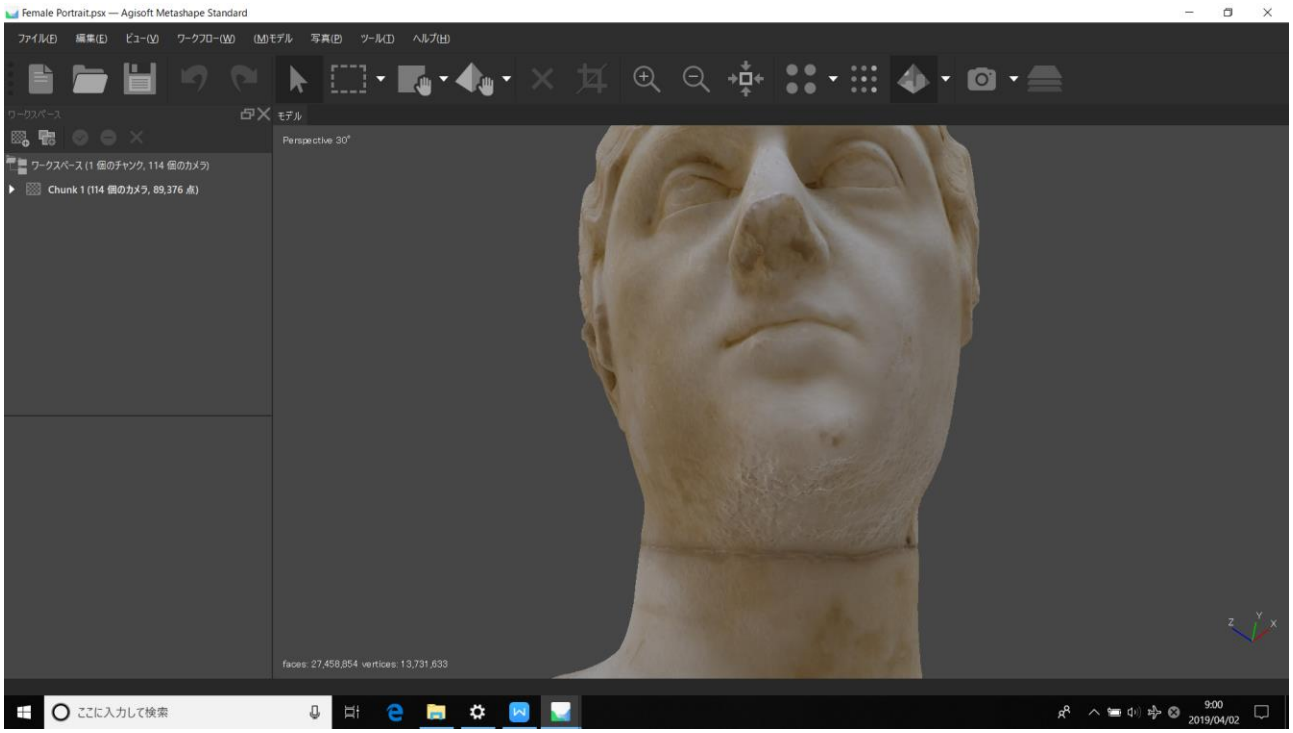

Fig. 3. Failure resulting from blurred photos

● The cases of success

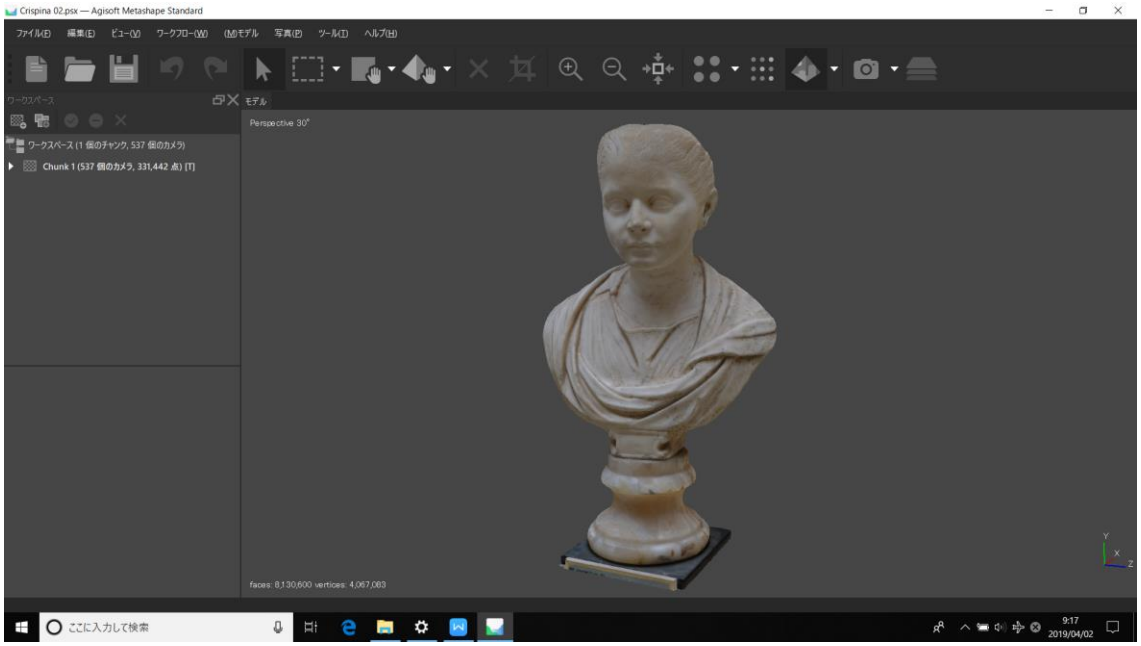

Fig. 4. Success resulting of 3D model

【Key points to make an elaborate 3D model】

1)Anchor the camera firmly to tripod and take in-focus photographs

2)About photographing at the top of the head of sculptures, pay attention to white balance and take photos in a bit of underexposed image.

3) About photographing at the drape of the cloth, focus particularly on deepest parts.

【Issues for the future project】

• I try to take photos of sculptures in the museum for making 3D models as much as I can in 2019.

• We try to make our own attractive 3D database to understand excavated artifacts for the general public as a way of tourism promotion activities.