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Facilitating Access to the Field of Geometry and Reflectance Acquisition

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Introduction

- Digital exhibition of reconstructed cultural heritage artifacts can greatly benefit from photo-realistic object representation.
- It is necessary to capture both geometry and reflectance properties to achieve this.
- Research recently shifted towards simultaneous geometry and reflectance acquisition.
- This requires complex, expensive hardware.
- Respective processing pipelines have many stages to be implemented consecutively. It is hardly possible to enter at an arbitrary stage.
- This field is thus hard to enter for new researchers.

Contributions

- We sketch our processing pipeline.
- We provide datasets acquired with a state-of-the-art device.
- This includes raw scanner output and all intermediate processing results.
- Others can use this data to work at an arbitrary pipeline stage and to gain experience in this field more easily.

Acquisition Hardware

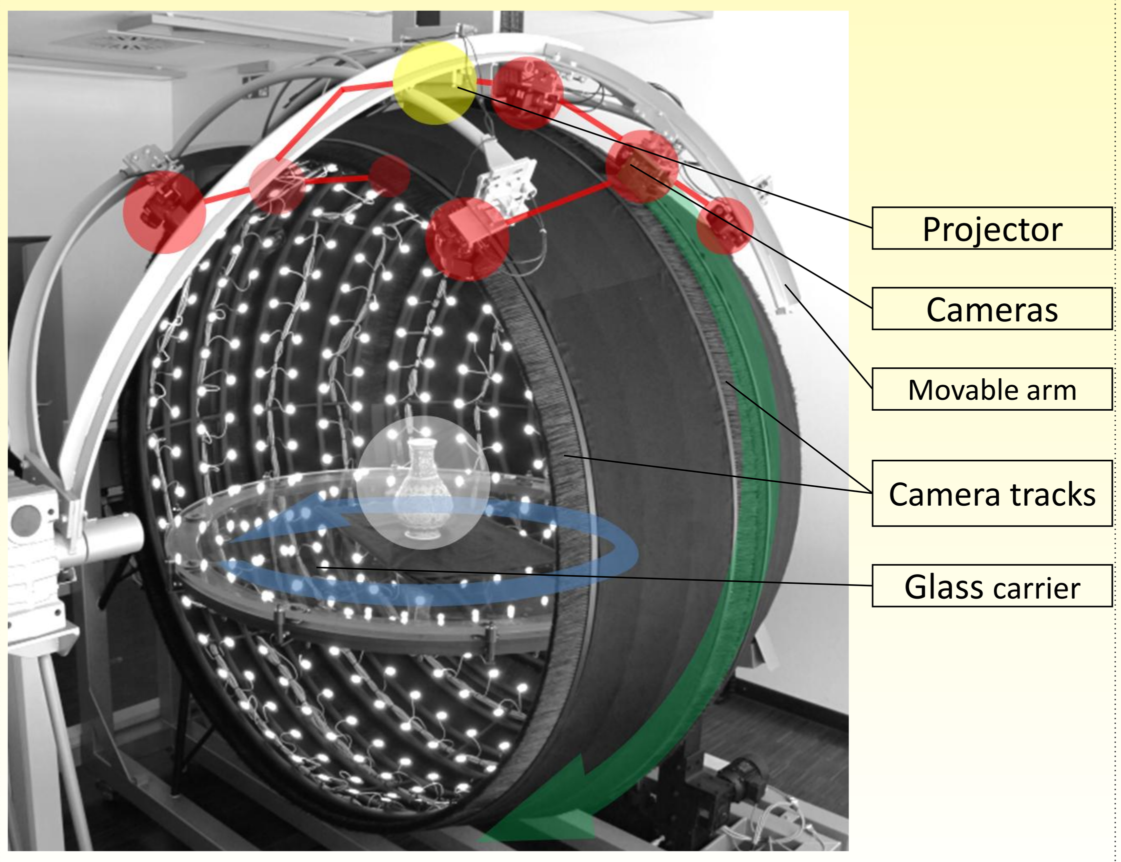

Figure 1: Our acquisition hardware (OrcaM)

- 633 individually controllable LEDs.
- 7 cameras and 1 projector on an arm movable up to 210°.
- Turnable and height-adjustable glass carrier enables inspection of the object bottom.
- Sphere can be dismantled into 4 separate parts.
- Brushes between the segments shield the interior from light.

Datasets

- We provide scans of 6 different objects (Figure 2).
- The objects were covered from 14 to 20 different scanner/object positions, which results in 98 to 140 camera positions.
- We acquired and provide the following raw data (Figure 3): Fringe images (geometry reconstruction), reflectance images (appearance reconstruction) and a shadow-free color image (can aid in appearance or diffuse color reconstruction).

Figure 2: The corresponding objects from our datasets

Figure 3: Exemplary raw data (left to right): Fringe image, shadow-free image, reflectance image

Pipeline and Intermediate results

- Phase computation (phase shifted structured light for correspondence generation): For each camera we provide two phase functions, two phase masks and the raw fringe images.
- Device calibration: Pinhole cameras and projectors, point lights; We provide intrinsic/extrinsic parameters, light positions/intensities/colors.
- Point triangulation: We provide a high-resolution point cloud for each camera.
- Mesh extraction: Point clouds are large and inefficient (>10GB), we thus extract a mesh. We provide a version with holes (no measurements) and a version with closed holes. The latter is parameterized.
- Normal map/texture estimation: Our mesh is simplified, high frequency details are stored in a normal map/texture.
- Reflectance estimation: From each camera position, we capture 19 reflectance images. We fit the ward model to aggregated reflectance data (per surface point) and provide diffuse/specular color and the surface roughness.
- Data can be downloaded from http://av.dfki.de/orcam-dataset

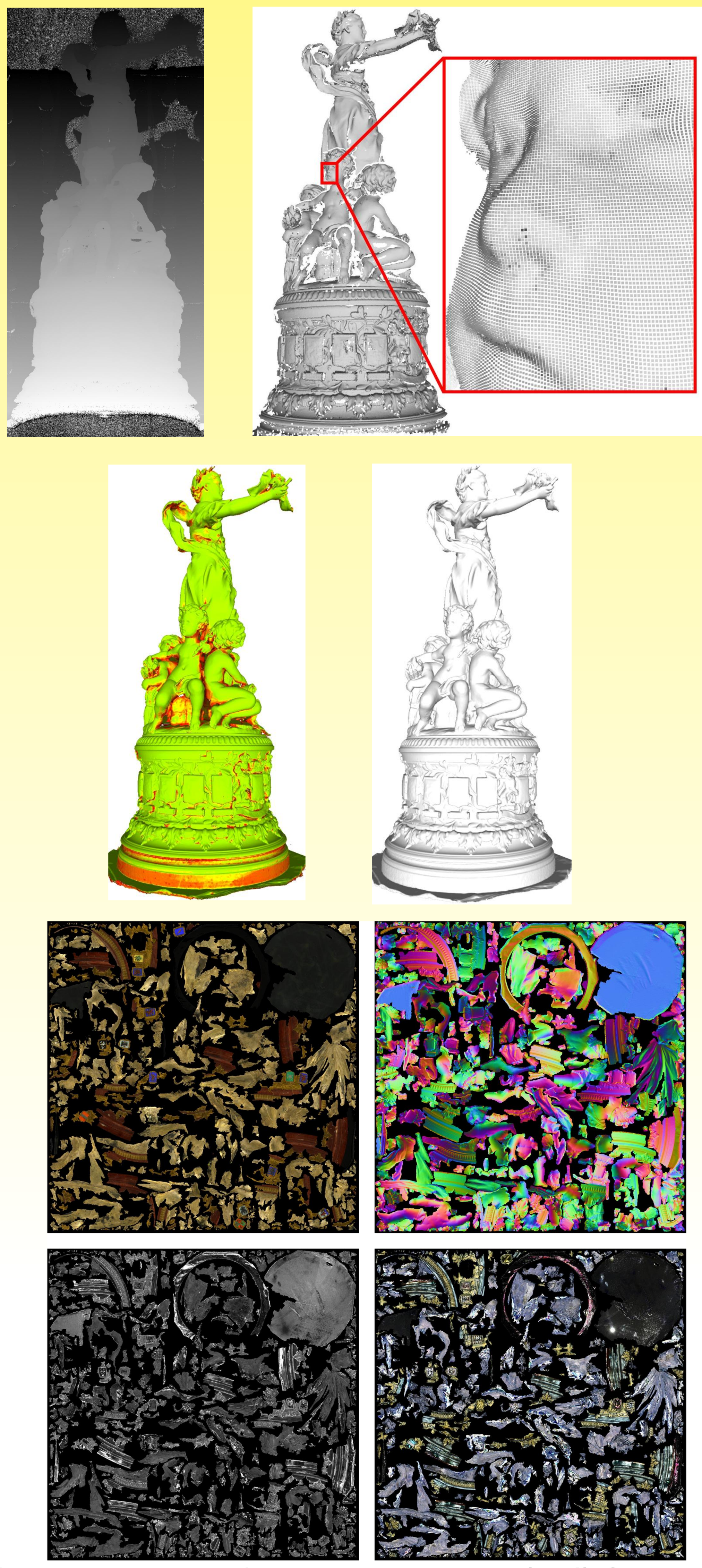

Figure 4: Intermediate processing results (left to right): 1 out of 2 phase functions, point cloud, mesh with holes, mesh with closed holes, diffuse color map, normal map, surface roughness map, specular color map

GRAPHICS AND CULTURAL HERITAGE

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