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Underwater rgb-d imaging system with millimetric precision

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Outline

Introduction

The proposed Method

Experiments and Results

Conclusion and Future work

➤ Introduction

- **Underwater 3D sensing information classification**

- **RGB** : Camera, etc., which can capture color information.
- **XYZ** : Sonar, etc., Structured light, which can obtain depth information.

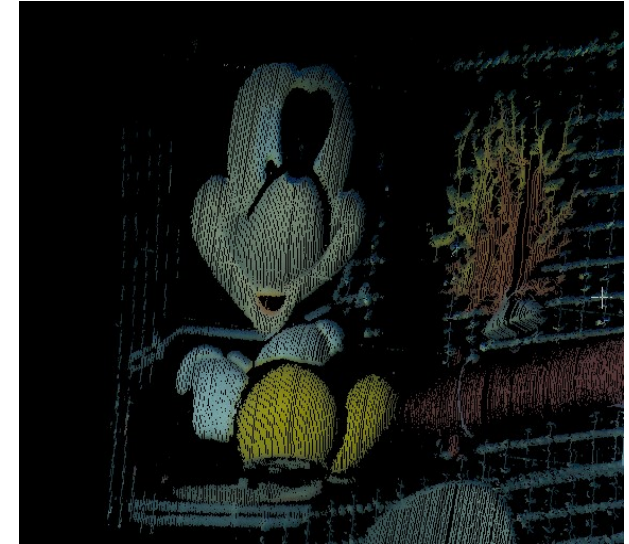
Structured light, which can obtain three-dimensional point clouds.



Underwater image (RGB)



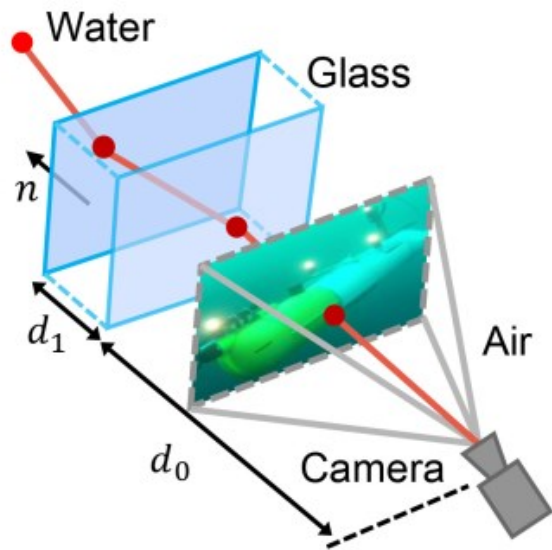
Point clouds (XYZ)



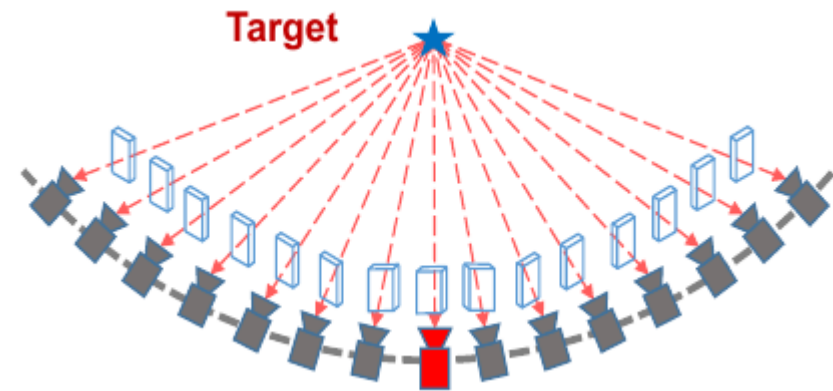
RGB Point cloud (RGB-XYZ)

➤ Contribution

- **URGB-D** : an underwater rgb-d refraction reconstruction algorithm with millimetric precision.
- **Simplified calibration process**: only requires capturing one image underwater, with the remaining calibration performed in air.
- **Prototype** : The experimental results demonstrate that our approach can recover dense RGB-D point clouds while maintaining high robustness.

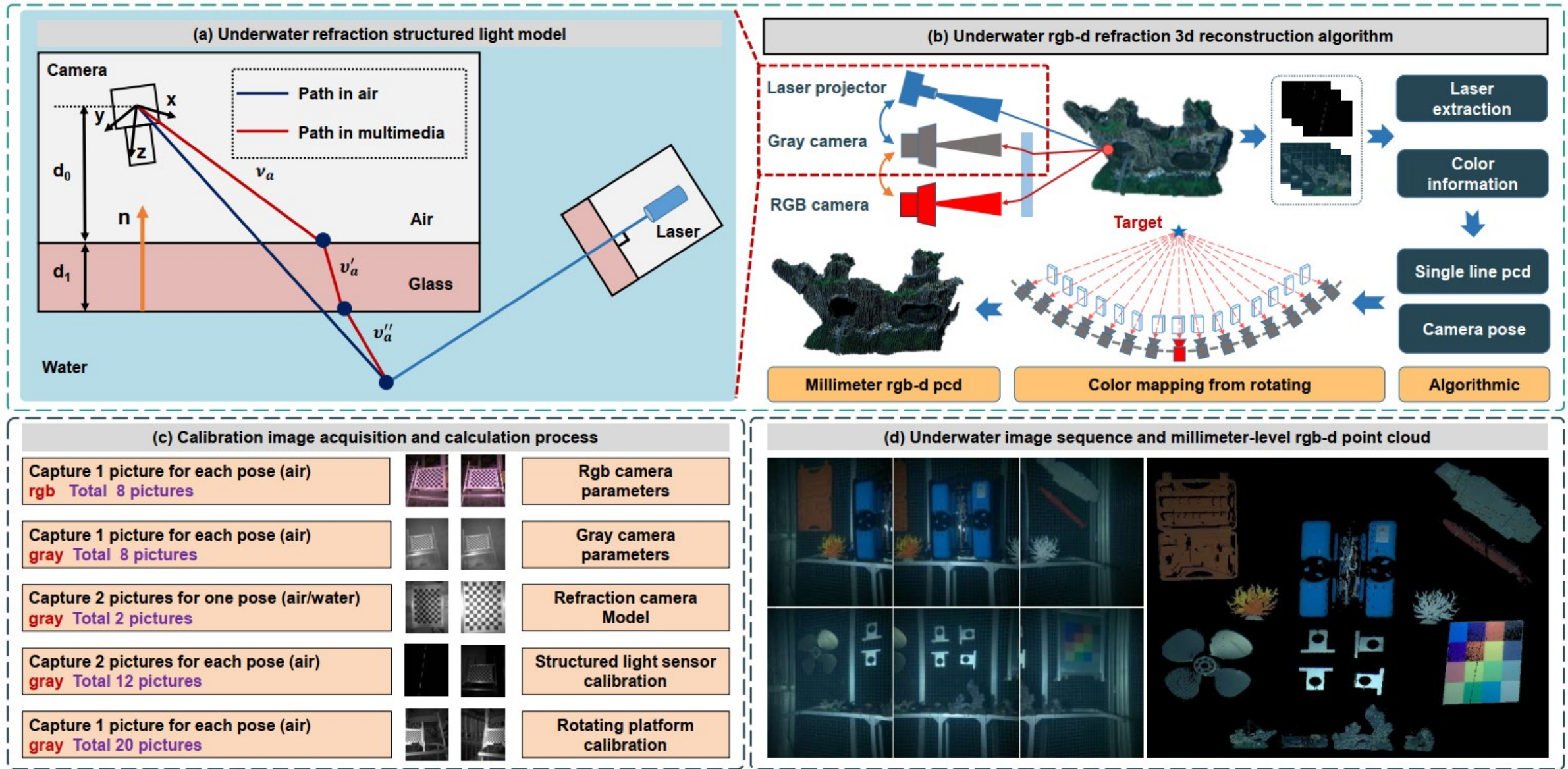


Refraction camera model



Color mapping

➤ The proposed Method

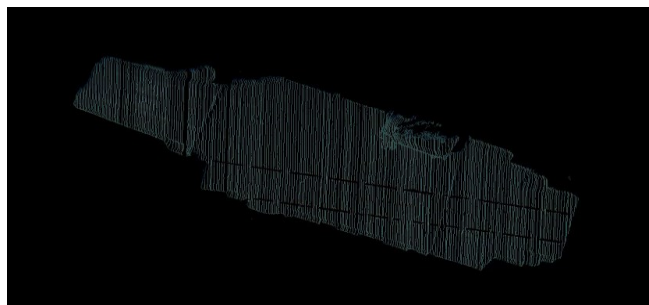
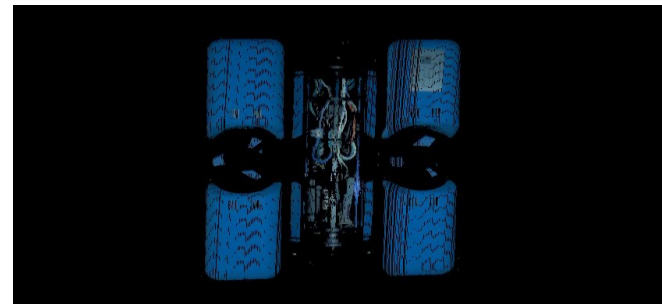
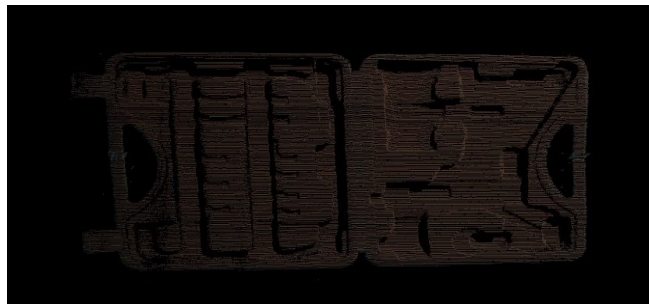


➤ Experiments and Results

Underwater Image



RGB-D Point Cloud

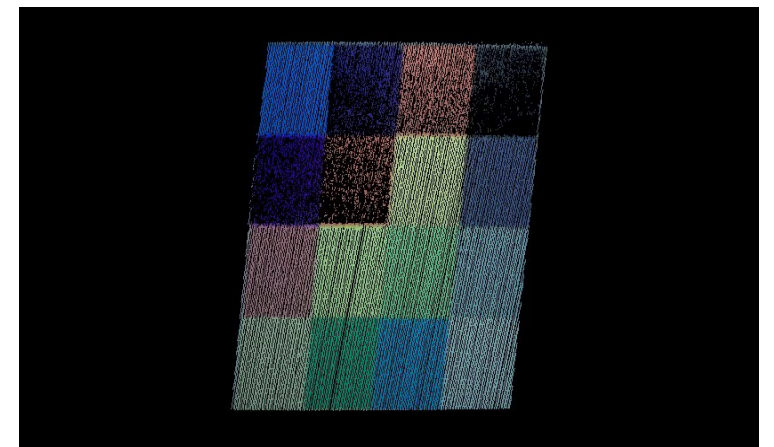
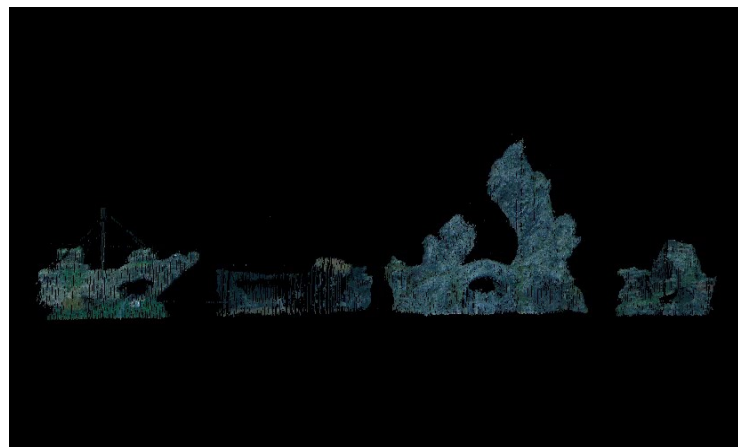
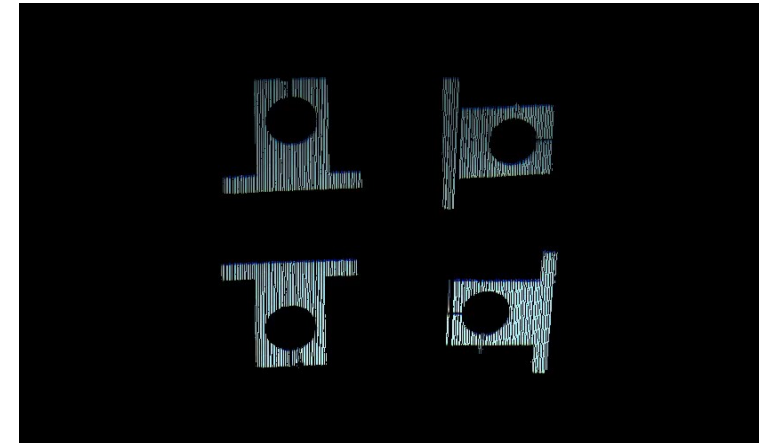
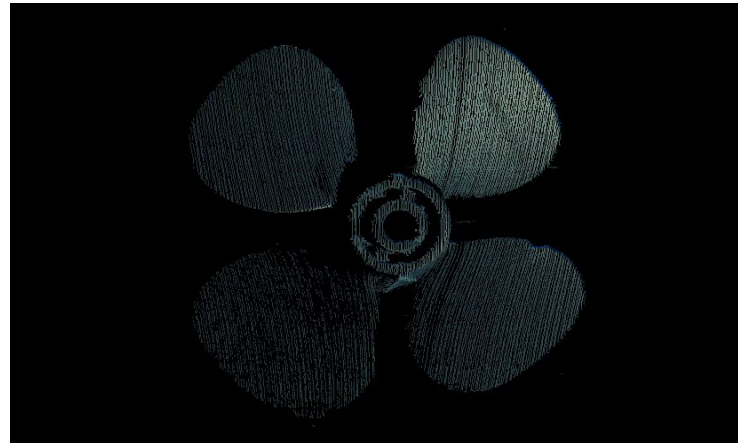


➤ Experiments and Results

Underwater Image



RGB-D Point Cloud



➤ Conclusion and Future work

- **Conclusion**

- We propose an underwater RGB-D imaging system named **URGBD**, capable of comprehensively reconstructing the three-dimensional structure and color information of underwater objects with **millimeter-level accuracy**.
- Specifically, we propose an underwater RGB-D refraction 3D reconstruction algorithm and **simplified calibration process**.
- Experimental results conducted underwater validate the performance of the proposed method, demonstrating its capability to capture finer color details and clearer geometric shapes.

- **Future work**

- In future work, we plan to introduce color correction techniques and a more refined refraction observation model to further enhance the accuracy of underwater three-dimensional reconstruction.