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# Mengkun She

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Germany

**Phone:** 017630148035

## Education

**Dec 2020 – Dec 2024  
(expected)**

Christian-Albrechts-University of Kiel / GEOMAR Hemholtz Centre for Ocean Research, Kiel

**PhD: Computer Science**

- **Scholarship:** 4-year doctoral study scholarship granted by the China Scholarship Council (CSC) (2020-2024)
- **Research topic:** Robust camera calibration and deep sea photogrammetry for ocean science application

**Sep 2017 – June 2020**

Chongqing University

**Master of Science:** Surveying and Mapping Engineering

- **GPA:** 3.48 / 4.0
- **Master Thesis:** Calibration of underwater dome port camera systems and the application to deep sea gas flow quantification
- **Honors/Awards:** Travel grant for young researchers granted by Deutsche Arbeitsgemeinschaft für Mustererkennung, DAGM

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## Research experience

**2018-2020 -Research Internship - GEOMAR Helmholtz Centre for Ocean Research, Kiel**

- **BubbleBox Project:** The BubbleBox project aims to develop a high-speed stereo camera system that can be deployed on the seafloor of the deep ocean to measure and quantify the amount of gas released from the seafloor into the water column. This project requires a background in image processing, 3D visual computing, and camera calibration. I participated in the development of the image capture software and was responsible for developing the dome port underwater camera calibration algorithm and optimizing the automated data processing pipeline to improve its robustness and measurement accuracy during my master's thesis. The system was successfully deployed in 1000 m water depth at the Cascadia margin offshore Oregon to assess methane fluxes from various seep locations. For further details on the research expedition, a short introduction video can be found at: <https://www.youtube.com/watch?v=8mAJoxXaKFo>

- **Underwater Camera Calibration:** To protect cameras from water and high pressure in the ocean, they are enclosed in a pressure housing and observe the surroundings through a glass window. Light rays are refracted when they travel through the glass interfaces. Therefore, a major aspect of underwater imaging is to properly handle refraction effects.
- **Large-scale AUV-based Visual Mapping:** To obtain accurate 3D reconstructions of the seafloor during deep-sea surveys, autonomous underwater vehicles (AUVs) are typically used. As part of my research, I am developing a complete and robust workflow for large-scale visual mapping in challenging deep-sea conditions. Specifically, I am investigating the fusion of navigational data from the AUV with image-based visual reconstruction to achieve accurate and reliable large-scale 3D reconstructions of the seafloor.
- **Light-Water Removal using Differentiable Ray-Tracing:** Ray-tracing is a technique to render faithful images from a given 3D model representation, which is heavily used in the game and movie production industry. Differentiable ray-tracing means the rendering function can be differentiated such that the parameters used to generate the images can be optimized using gradient-based optimization algorithms. In this way, if the light and the water parameters can be modeled and estimated beforehand, then using this technique can help us to recover the true representation of the seafloor (True color as if the seafloor is seen as in-air).

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## **Publications (as a main author)**

### **Topic: BubbleBox Project**

- **M. She**, T. Weiß, Y. Song, P. Urban, J. Greinert, and K. Köser, "Marine bubble flow quantification using wide-baseline stereo photogrammetry," *ISPRS Journal of Photogrammetry and Remote Sensing*, vol. 190, pp. 322–341, Aug. 2022, doi: <https://doi.org/10.1016/j.isprsjprs.2022.06.014>.

### **Topic: Underwater Camera Calibration**

- **M. She**, D. Nakath, Y. Song, and K. Köser, "Refractive geometry for underwater domes," *ISPRS Journal of Photogrammetry and Remote Sensing* vol. 183, pp. 525–540, Jan. 2022, doi: <https://doi.org/10.1016/j.isprsjprs.2021.11.006>.
- **M. She**, Y. Song, J. Mohrmann, and K. Köser, "Adjustment and Calibration of Dome Port Camera Systems for Underwater Vision," *Lecture Notes in Computer Science*, pp. 79–92, Sep. 2019, doi: [https://doi.org/10.1007/978-3-030-33676-9\\_6](https://doi.org/10.1007/978-3-030-33676-9_6).

### **Topic: Light-Water Removal using Differentiable Ray-Tracing**

- Nakath, D., **She, M.**, Song, Y., & Köser, K. (2021). In-Situ Joint Light and Medium Estimation for Underwater Color Restoration. In *International Conference on Computer Vision*. <https://doi.org/10.1109/iccvw54120.2021.00416>

### **Topic: Other**

- **(Joint first author)** Weng, X., **She, M.**, Nakath, D., & Köser, K. (2021). MaCal - Macro Lens Calibration and the Focus Stack Camera Model. In *2021 International Conference on 3D Vision (3DV)*. <https://doi.org/10.1109/3dv53792.2021.00024>

## Skills

**Programming:** C++, Python

**Skills:** Linux, Robot Operating System (ROS), CMake, PyTorch, OpenCV, Ceres-Solver (Non-linear optimizer)

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## Self assessment

### What I can't do?

Although I am currently pursuing a PhD in Computer Science, however bachelor and master background was in survey and mapping engineering, which means I may lack knowledge in certain areas of computer science outside of my specialization.

- **GUI / Web development**
- **Machtronics / Eletronics**