Background section

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For the past 15 years there has been a rapid rise in the use of hyperspectral cameras mounted on unmanned underwater vehicles (UUVs) for taxonomy of marine organisms. Specifically, UUV-mounted hyperspectral cameras have been used for mapping of shallow-water habitats (Mogstad, 2019), in situ classification of deep-sea megafauna (Dumke, 2018) and identification of coralline algae (Mogstad, 2017).

However, the problem with hyperspectral cameras is georeferencing the acquired data due to loss of geometric information. For marine biologists, visual inspection is still an important tool for validating algorithm results and ground truthing and therefore proper georeferencing is needed. Previous work has so far focused on georeferencing by using navigation data and ignoring the bathymetry of the seabed.

This study provides a method for acquiring navigation data, mapping the seabed bathymetry and georeferencing hyperspectral data. Using visual simultaneous localization and mapping (SLAM), the odometry of a UUV-mounted red-green-blue (RGB) camera is found for the purpose of acquiring navigation data and mapping the bathymetry of the seabed. Georeferencing is then performed by projecting the hyperspectral camera data onto the bathymetric map. By projecting the hyperspectral camera data onto the bathymetric map three dimensional shapes are preserved and visual interpretability increased.

This paper gives a basic introduction to underwater optics before the underwater visual SLAM and projection problem is formulated. Then, the algorithmic results are compared to the traditional method of georeferencing before, lastly, shortcomings and possible improvements are discussed.