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Feature Recognition and labelling for Photogrammetry Calibration of the Super-Kamiokande Detector

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The Super-Kamiokande detector is a 40m tall cylindrical tank with a 40m diameter, filled with ultrapure water. It makes detailed measurements of solar, atmospheric, and accelerator neutrinos. About 11,000 PMTs (photomultiplier tubes) facing inwards are set up on the detector wall to record neutrino interaction events. The use of the accurate location of photomultiplier tubes (PMTs) on the detector wall will improve the accuracy of particle detection in the experiment. Over 15000 images (57GB) of SuperK were taken in with an underwater drone to reconstruct the locations of the PMTs using photogrammetry. For reconstruction, we first need to find PMT in an image then assign an ID to each PMT. In this study, we determined the location of the bolts surrounding each PMT using image processing techniques. Further processing was done on bolts to eliminate false bolts. After this, we performed pattern matching between images of detector wall and the image obtained from a perspective projection of PMTs in SK-detector to find an ID for each PMT. In this talk, I will present the methods used in our study for detecting and labeling PMTs in our image set.

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