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पृथ्वी विज्ञान मंत्रालय
Ministry of Earth Sciences



Automated Identification of Deep sea resources based on Morphology based groups using Hierarchical Deep Learning Framework

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Accurate identification of deep sea fish species is essential for marine biodiversity assessment, fisheries research, and effective resource management. However, conventional identification relies heavily on expert knowledge and morphological examination, which can be challenging when species exhibit highly similar visual characteristics. This study presents a web based deep learning framework for automated identification of deep sea marine fishery resources from images. A dataset comprising 42 fish species was organized into approximately five morphology based groups, including eel type, cusk eel, normal shaped, laterally compressed and round elongated fishes. This hierarchical organization reduces the classification complexity by first considering broad morphological characteristics before performing species level classification within each group. To improve the quality and consistency of the input images, U²-Net-based pre-processing was employed to isolate the fish from complex backgrounds. The resulting images were used to train EfficientNetV2 based deep learning classifiers, which automatically learn discriminative visual features for species recognition. A web based application was subsequently developed to provide an accessible interface for uploading fish images and obtaining predicted species along with associated information from the species metadata. In addition, a visual feature representation and cosine similarity based comparison were incorporated into the experimental prediction pipeline to investigate feature level similarity between images. Initial evaluation using training images and additional externally collected images demonstrated promising species level recognition performance, including good prediction results on approximately 5% external images not used during training. The proposed framework provides an integrated approach combining morphology aware classification, deep feature learning, image preprocessing and web based deployment for automated deep sea fish identification. The system also provides a foundation for extending the framework toward object detection, individual fish counting and approximate fish length estimation in images containing multiple fish.

Keywords: Deep sea, fish identification, Deep learning, Transfer learning, Hierarchical classification, Marine biodiversity