

AI-Driven Solutions for Automated Fish Freshness Classification Using CNN Architectures

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Ensuring fish freshness is essential for market value, consumer health, and seafood quality. In Sri Lanka, traditional sensory-based methods for assessing freshness are subjective and often inaccessible to small-scale fishermen due to high costs and resource limitations. This study addresses these challenges by employing Convolutional Neural Networks (CNNs) to automate fish freshness classification using image data from the Mannar coastal region. The approach involved capturing images of whole fish, fish eye, and fish gill, followed by preprocessing steps like labeling, resizing, and augmentation. Separate custom CNN models were developed for each dataset, with the gill dataset achieving the highest performance at 98.26% accuracy, along with excellent precision, recall, and F1-scores. Furthermore, advanced pre-trained models, including VGG16, ResNet50, MobileNetV2, InceptionV3, Xception, and DenseNet121, were evaluated on the gill dataset. Among 6 pre-train models DenseNet121 is the best-performing model for gill dataset due to its high accuracy, precision, recall, and F1-score, as well as its stable learning curve. These findings highlight the potential of CNN-based and pre-trained models to provide scalable, cost-effective solutions for fish freshness assessment, promoting sustainable seafood practices, empowering small-scale fishers, and enhancing food safety standards.

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