Abstract

Integrated Sensor System for Real-Time Monitoring and Detection of Fish Quality and Spoilage †

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Abstract: The increasing demand for high-quality and safe seafood necessitates the development of efficient monitoring systems to ensure the freshness and safety of fish products. In this research, we present an innovative approach utilizing a sensor array consisting of MQ137, MQ135, MQ3, MQ9, TGS 2610, TGS 2620, TGS 2600, and TGS 822 sensors. These sensors, sensitive to various gases associated with fish spoilage, are integrated into a comprehensive system for fish quality monitoring and spoilage detection. The developed system includes an array of chemical gas sensors, a data acquisition system, a processing unit for handling data, and a machine learning model for classification. The chemical gas sensor array enables the real-time detection of the volatile compounds released during the spoilage of fish. The data acquisition system collects and processes information from the sensor array, while the data processing system extracts relevant features for subsequent analysis. A pattern recognition system, employing a robust LDA-XGBoost model, was employed to differentiate between fresh and spoiled fish. The experimental results demonstrate the system's high accuracy in classifying fish quality, achieving an impressive classification accuracy of 96.12%. The integration of various sensors ensures sensitivity to a broad spectrum of chemical compounds associated with fish spoilage, enhancing the system's reliability. The proposed sensor-based approach provides a cost-effective, rapid, and accurate solution for fish quality monitoring, offering potential applications in the seafood industry to ensure the delivery of safe and fresh products to consumers.

Keywords: fish; sensors; XGBoost; volatile organic compounds; food quality

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