Foods 2024 Conference

The 5th International Electronic Conference on Foods

28–30 October 2024 | Online

MDPI

Artificial Intelligence in Food Safety Assessment and Monitoring: A Comprehensive Review

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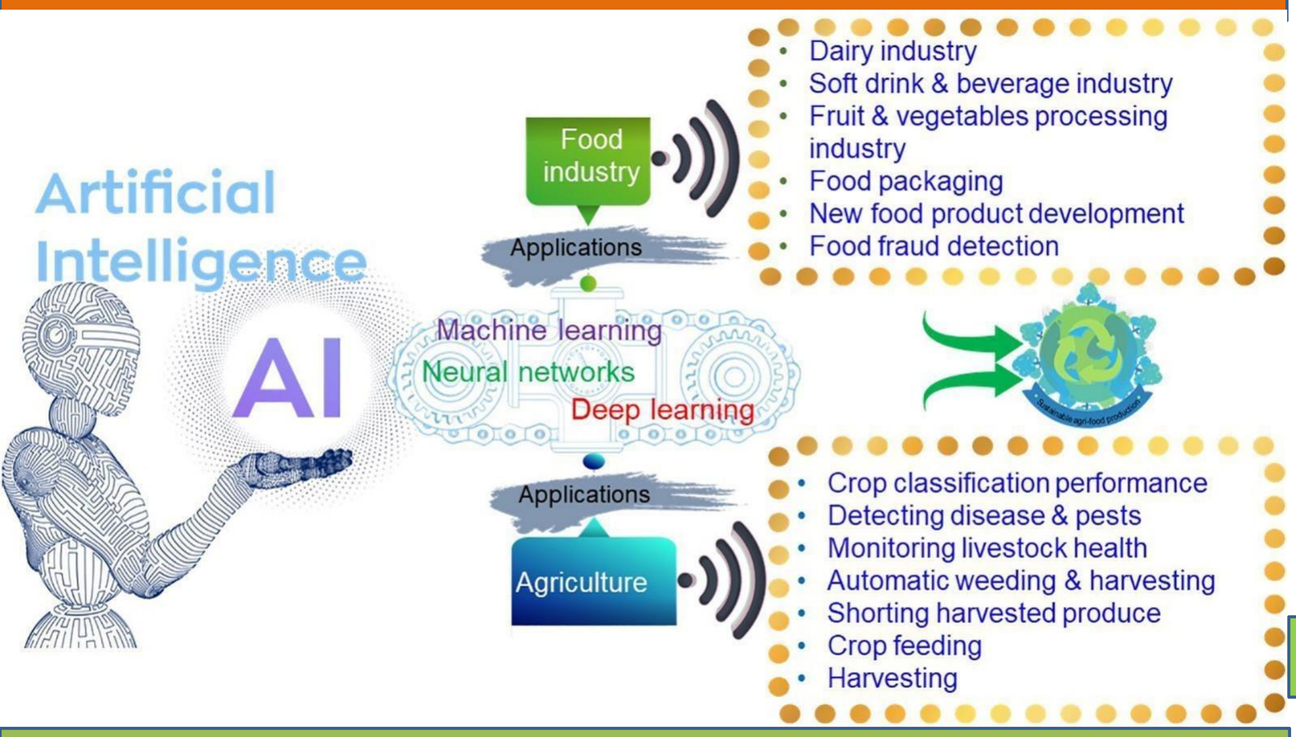
Introduction to AI & ML

- AI, or artificial intelligence, refers to the simulation of human intelligence processes by machines, especially computer systems
- Machine learning (ML) is a subset of artificial intelligence that focuses on the development of algorithms that allow computers to learn from and make predictions or decisions based on data.
- AI is increasingly transforming the food industry in several ways, enhancing efficiency, quality, and customer experience.
- AI and ML are driving innovation and efficiency in the food industry, benefiting producers, retailers, and consumers alike.



AI and ML Techniques for Fraud Detection in the Food Industry

Anomaly Detection Technique: Clustering Algorithm	Supervise Learning Technique: Decision trees,Neural Networks	Natural Language Processing Technique: Sentiment Analysis & text clasification
Image Recognition Technique: Convolutional Neural Network	Time Series Analysis Technique:ARIMA Model & LSTM Network	Network Analysis Technique: Graph Analytics

Case Study: Fraud Detection in the Food Industry – Olive Oil Adulteration

- Olive oil is a popular and valuable product, but it is also susceptible to fraud.
- Adulteration : mixing lower-quality oils with pure olive oil is a significant concern that affects consumers and reputable producers

Objective

To develop a robust system for detecting adulteration in olive oil using advanced machine learning techniques and data analytics.

Methodology

Data Collection

Supplier Data: Historical data on suppliers, including sourcing practices and past audits.

Product Data: Information on olive oil batches, including chemical composition, price, and labeling.

Machine Learning Techniques

Supervised Learning: The company used historical data to train a classification model (e.g., Random Forest) to identify characteristics of pure olive oil versus adulterated samples.

Anomaly Detection: Unsupervised learning algorithms (e.g., Isolation Forest) were applied to detect outliers in the chemical profiles of olive oil batches.

Image Recognition: Computer vision techniques were employed to analyze product labels and packaging for inconsistencies and mislabeling.

Model Development

Feature Engineering: Key features included chemical markers such as free fatty acid content, peroxide value, and spectroscopic data.

Model Training: Models were trained using labeled datasets, where batches were marked as pure or adulterated based on previous test results.

Deployment

Real-time Monitoring: A system was implemented to monitor incoming olive oil batches using sensors that provided real-time analysis of chemical properties.

Alert System: An alert mechanism was established to flag any batches that exhibited characteristics indicative of adulteration.

Result

Increased Detection Rates: The implementation of AI and ML techniques resulted in a significant increase in the detection of adulterated olive oil. The company identified 15% of incoming batches as potentially adulterated within the first month of deployment.

Cost Savings: By preventing the distribution of fraudulent products, the company saved an potential losses from returns and legal actions.

Improved Supplier Transparency: The system encouraged suppliers to adhere to higher quality standards, knowing that their products would be subject to rigorous testing.

Conclusion

AI holds tremendous potential to revolutionize food safety by improving quality control, risk assessment, traceability, monitoring, personalized nutrition, and regulatory compliance across the food supply chain. By leveraging the power of AI, food manufacturers, regulators, and consumers can work together to ensure a safer and more secure food system for all.

References

[1] George, T. , Rufus, E. , & Alex, Z. C. (2017). Artificial neural network based ultrasonic sensor system for detection of adulteration in edible oil.

Journal of Engineering Science and Technology, 12, 1568–1579.

Future Work

Integrating AI and machine learning into the supply chain effectively detect and prevent fraud. By utilizing data analytics and real-time monitoring, the company improved product integrity, consumer trust, and overall profitability. This approach can serve as a model for other sectors within the food industry facing similar challenges.