A Comprehensive Deep Learning-Based Approach for Detecting and Diagnosing Fish Diseases Using Advanced Convolutional Neural Network Architectures to Enhance Aquatic Health Monitoring and Management Systems

Under the guidance : Mr.Subba Rao MV, M.Tech, (P.hd)
- Assistant Professor

Department : INFORMATION TECHNOLOGY

Team members:

21PA1A1292 - Penumatsa Oliva

21PA1A12A6 - S Venkata Siva rama krishna

21PA1A12C4 - V Naga Sai Nikhilesh

22PA5A1208 - Kotichukkala Vishnu

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Problem Statement

Traditional diagnostic methods for fish disease detection, such as visual inspection, microscopy, and lab tests, are subjective, labor-intensive, and costly. Visual inspection relies on expert judgment and is prone to inaccuracies, while lab-based approaches like PCR are precise but require specialized equipment and expertise.

Additionally, existing machine learning techniques often depend on handcrafted features and limited datasets, which reduce accuracy and generalizability. Variations in fish species, environmental conditions, and disease manifestations further complicate detection. There is a need for an automated, scalable, and accurate solution to detect fish diseases efficiently and reliably across diverse aquaculture environments.

OBJECTIVES

- CNNs can analyze high-resolution fish images, identify subtle disease patterns, and provide real-time diagnostic support.
- The proposed system leverages advanced CNN architectures, preprocessing techniques, and data augmentation to enhance accuracy and adaptability.
- By offering a scalable and automated solution, this approach aims to revolutionize fish disease monitoring and management in aquaculture practices.

Literature Survey Table

Author(s)	Method	Techniques	Drawbacks	Gaps	Proposed Solution
K. L. Lalasa et al.	Detect illegal fishing patterns.	Neural networks, clustering, AIS, radar.	Low accuracy in detecting complex patterns.	Lacks advanced pattern recognition.	Use CNNs to detect complex fish disease signs.
Li et al.	Underwater fish detection.	Improved YOLO v5 with Res2Net, attention.	No focus on fish health or diseases.	Doesn’t handle disease detection.	Train CNNs on disease-specific fish data.
Knausgård et al.	Fish detection and classification.	YOLO, CNN, transfer learning.	Reduced accuracy on small datasets.	Limited dataset and no disease focus.	Use large, annotated datasets for diseases.

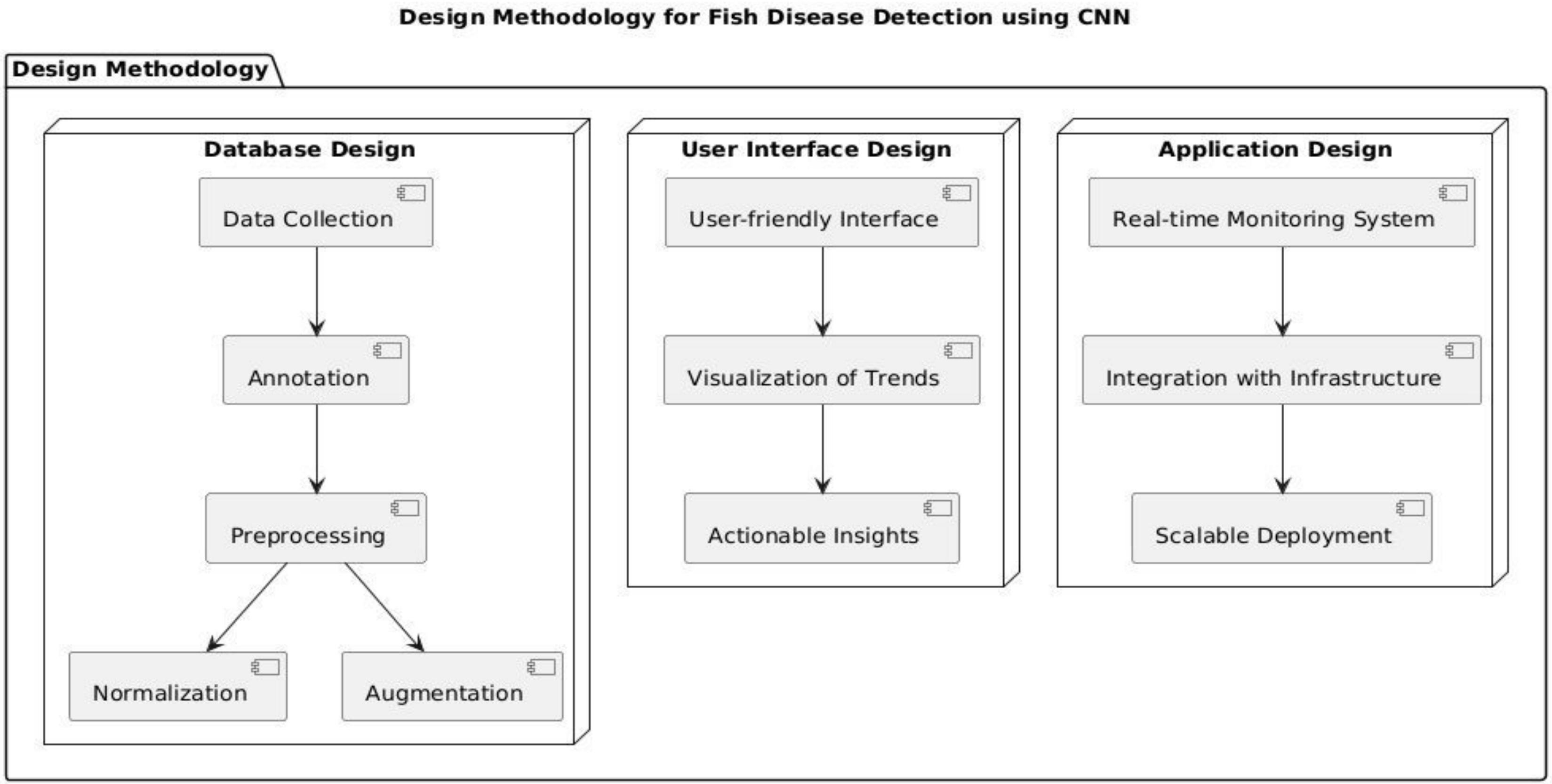
Design Methodology

1. Database Design :-
   In our project we are using datasets from various sources and the process goes on like this with the data.
   - Data collection from diverse aquaculture facilities.
   - Annotation with disease labels.
   - Preprocessing: normalization, augmentation.

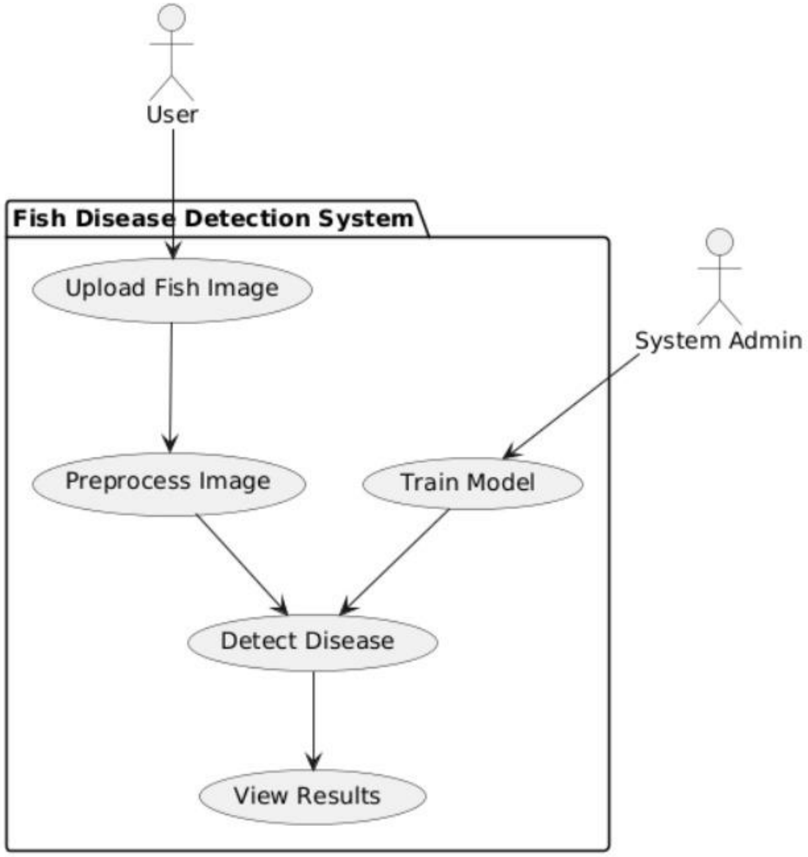
2. User Interface Design :-
   We want to design a friendly user interface where the practitioner can use it easily. The user interface will take the image as input and gives some insights and disease detection trends.

3. Application Design :-
   Our application will focus on the real-time monitoring of fish disease and it will be integrated with the current infrastructure.

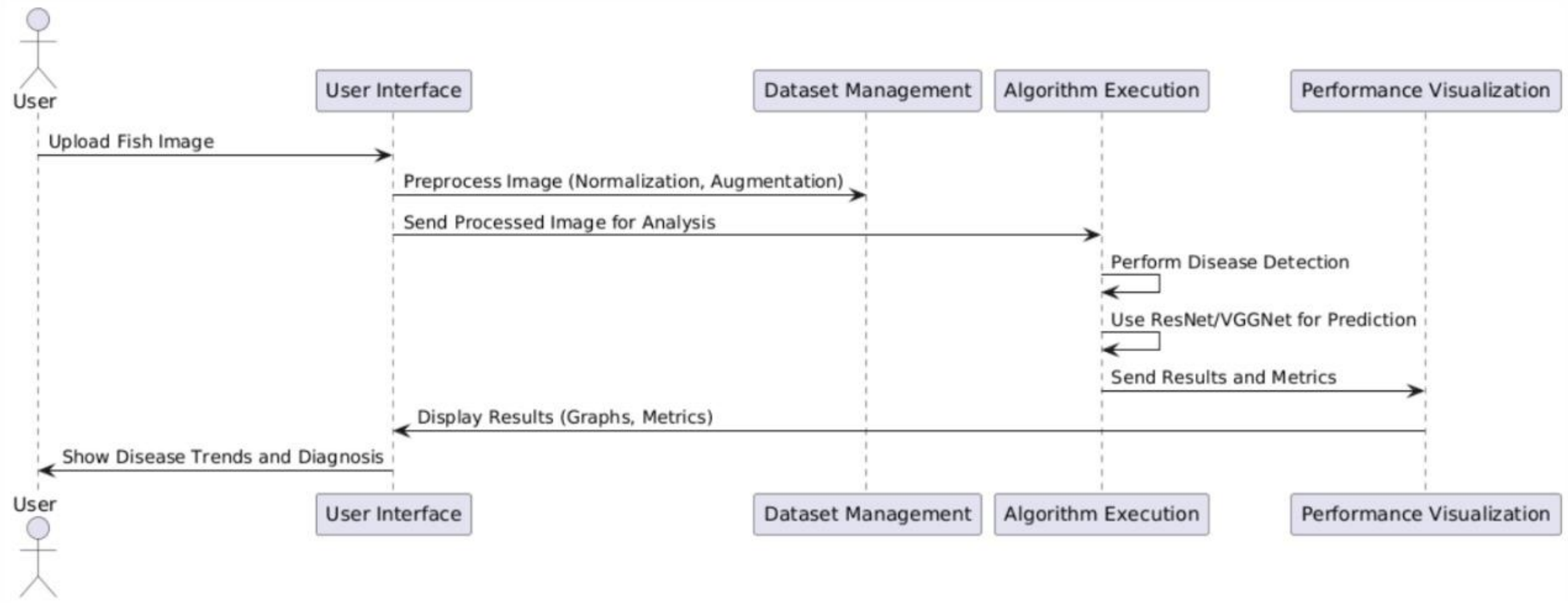
Design Methodology Diagram



UML Diagram (USE - CASE Diagram)



UML Diagram(Sequence Diagram)



Tech Stack

-> Algorithms/Techniques:

1. Data Collection:
    - Gather annotated fish images covering various diseases and species.
2. Data Preprocessing:
    - Image normalization, noise reduction, and augmentation.
3. CNN Architecture Selection:
    - Implement pre-trained architectures like ResNet and VGGNet.
4. User Interface:
    - We are using streamlit to design user interface

Module Description

Module 1: user upload Interface

- Features: Images upload

Module 2: Dataset Management

- Features: Augmentation & Preprocessing.

Module 3: Algorithm Execution

- Features: Training and Testing Models.

Module 4: Performance Visualization

- Features: Graphs, Metrics.

Framework Selection

Python-based Framework:

- Tools: Streamlit

Summary:

- We are trying to developed a robust CNN model achieving > 80% accuracy.
- Effective preprocessing techniques for enhanced model performance.
- User-friendly system for real-time disease detection.

Advancements:

- Expand datasets to include more species and disease conditions.
- Integration with IoT and edge computing for scalable solutions.

References

1. Lalasa, K. L., Srija, R. J. V., & Kumar, K. P. (2024). Maritime security - illegal fishing detection using deep learning. 2024 International Conference on Knowledge Engineering and Communication Systems (ICKES), Chikkaballapur, India, 1–5. https://doi.org/10.1109/ICKECS61492.2024.10617407

2. Li, L., Shi, G., & Jiang, T. (2023). Fish detection method based on improved YOLO v5. Aquaculture International, 31(6), 2513–2530. https://doi.org/10.1007/s10499-023-01095-7

3. Knausgård, K. M., Wiklund, A., Sørdalen, T. K., Halvorsen, K. T., Kleiven, A. R., Jiao, L., & Goodwin, M. (2022). Temperate fish detection and classification: A deep learning-based approach. Applied Intelligence, 52(6), 6988–7001. https://doi.org/10.1007/s10489-021-02980-9

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Conclusion

We are trying to develop a CNN-based model to analyze fish images for disease detection along with the some other features. The system processes annotated fish images, employing advanced CNN architectures like ResNet and VGGNet to identify disease patterns with high accuracy. By integrating preprocessing and data augmentation techniques, the model improves robustness and adaptability to real-world variations, enabling real-time detection and timely disease management in aquaculture.

__THANK YOU