Artificial Intelligence on Nature Research

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Institut Teknologi Sepuluh Nopember (ITS) is a leading university in the field of science and technology in Indonesia

At the international level, ITS was ranked as the 3rd best university in Indonesia according to the Times Higher Education (THE) World University Ranking in 2019 and 2020. Moreover, ITS was ranked 201+ at the Asia Pacific level.

Main Campus with the area of 187 Ha and located at the Surabaya city

1072+ academic staffs

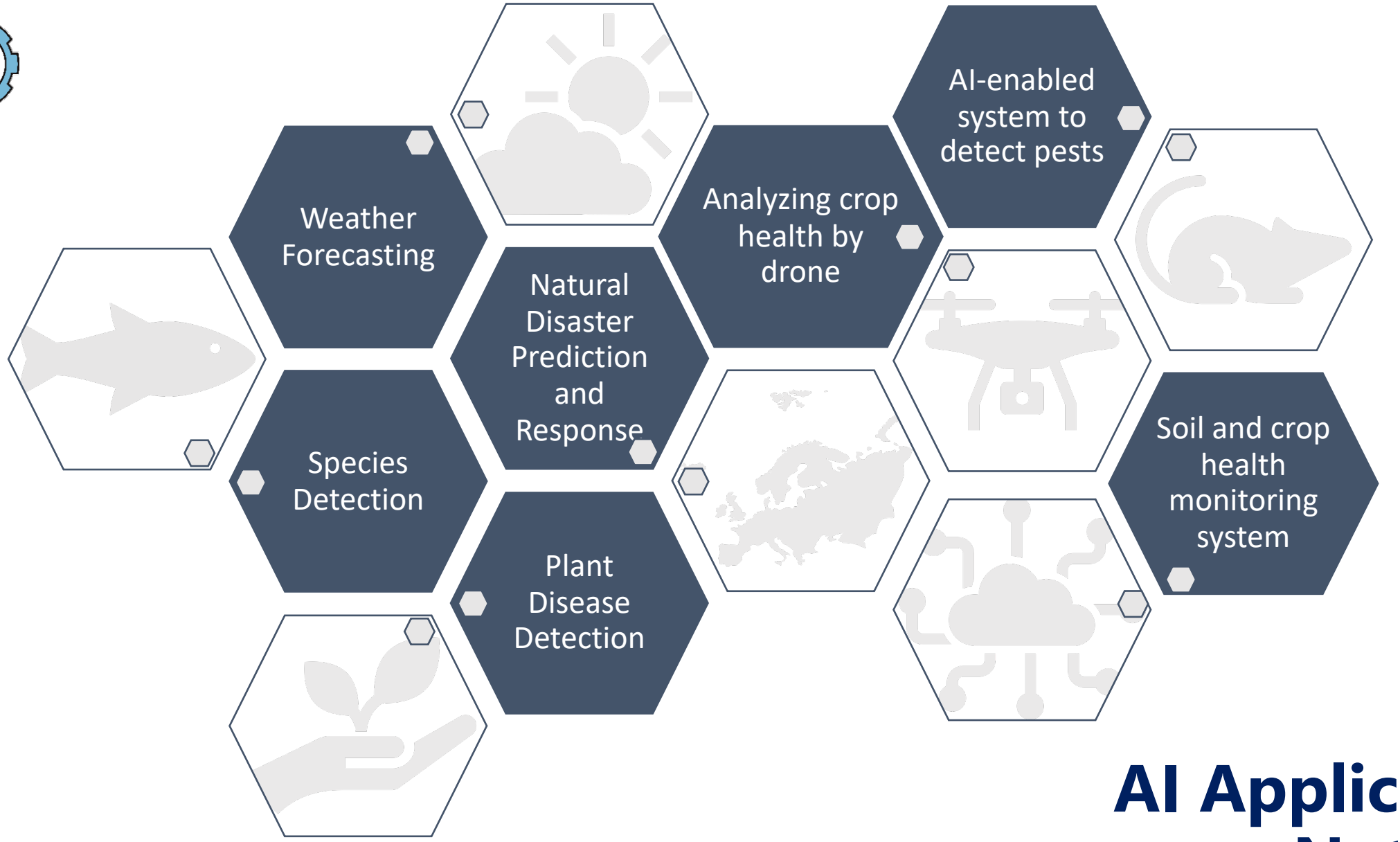
around 22,000 students

- Surabaya is the capital city of the Indonesian province of East Java and the second-largest city in Indonesia
- The city has a population of 2.87 million within its city limits and 9.9 million in the extended Surabaya metropolitan area, making it the second-largest metropolitan area in Indonesia

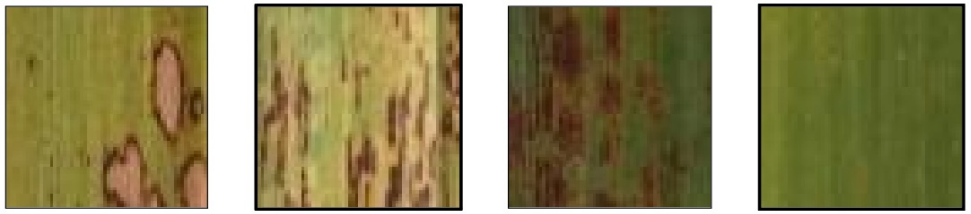
Area

- City 326.81 km^2 (126.18 sq mi)
- Urban 911 km^2 (352 sq mi)
- Metro 5,925 km^2 (2,288 sq mi)

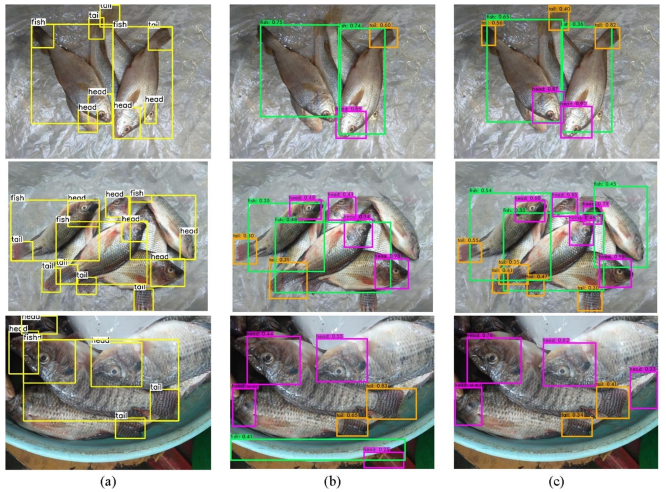
AI Application Fields



AI Applications on Nature

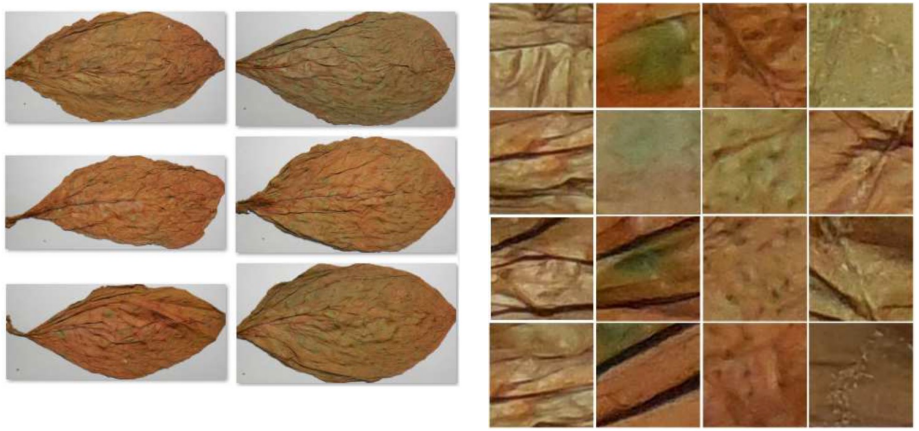


Sugarcane spot diseases detection (ring spot, rust spot, yellow spot)



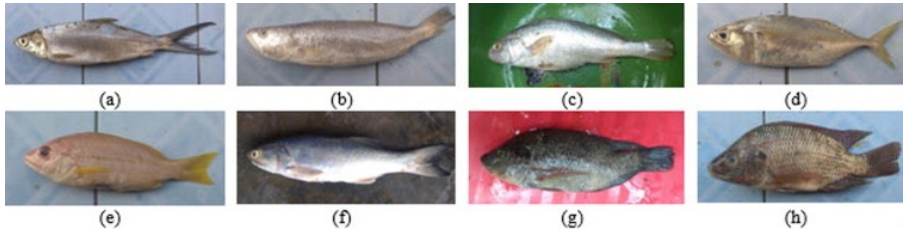
Fish body part detection

Peatland Cover Classification

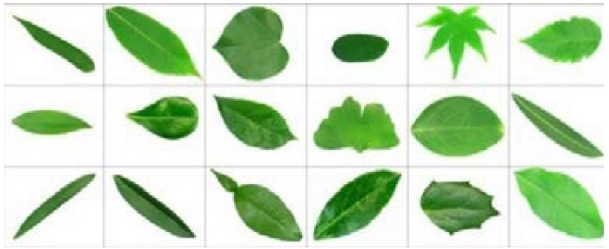


Air-Cured Tobacco Leaf Pests Classification

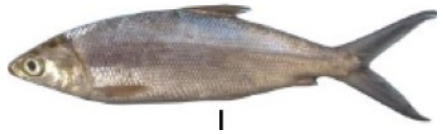
Land Cover Segmentation From Remote Sensing Imagery in Tropical Rain Forest Areas



Fish species classification



Plant Leaf Classification



Freshness of fish classification

Our AI Research on Nature

Automatic Detection of Fish Freshness and Species

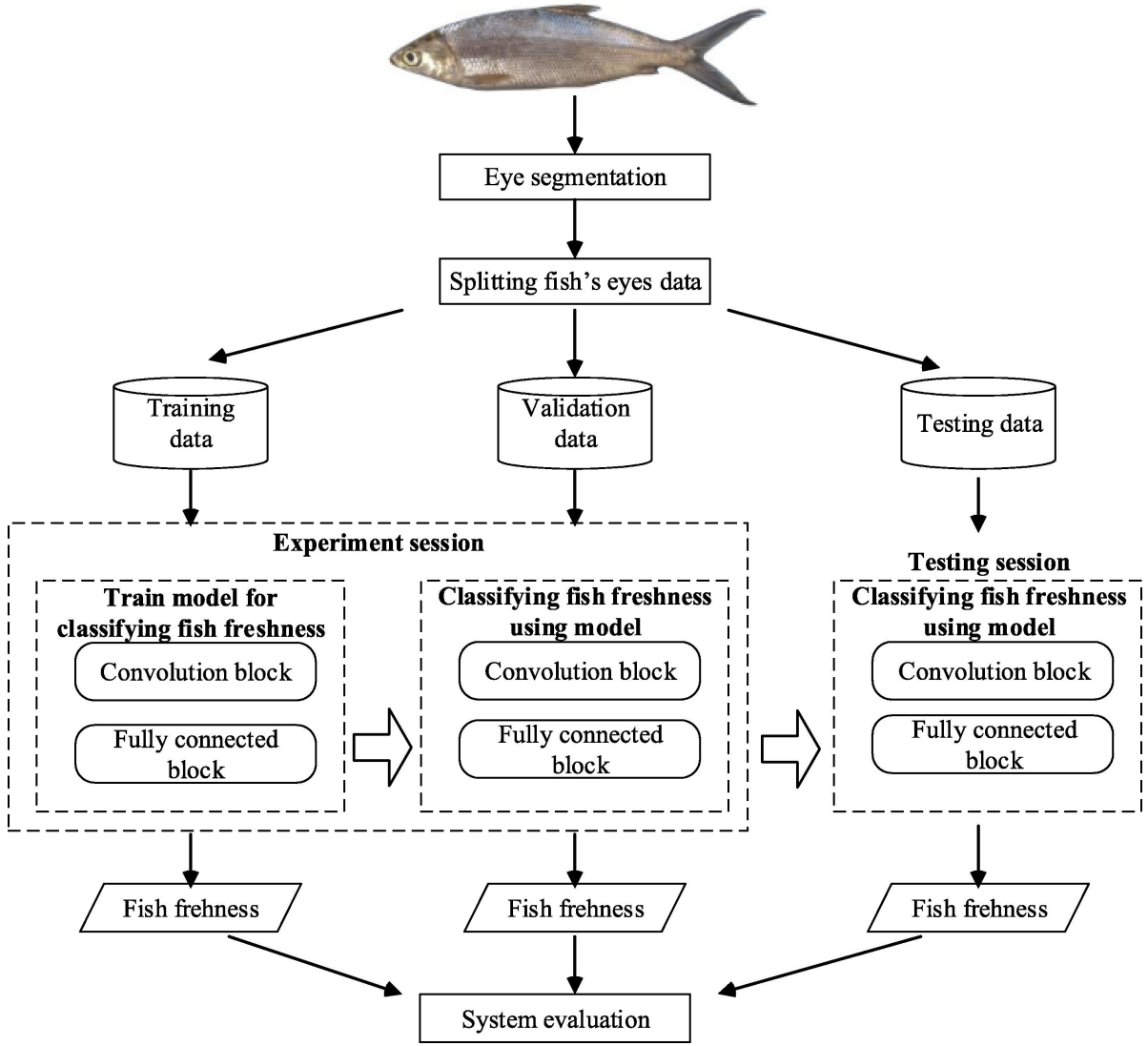
MobileNetV1 Bottleneck with Expansion (MB-BE) model for classifying the freshness of fish eyes

The differences of fish freshness showed that the visual appearance of eye both fresh and not fresh fish are different

We create dataset that consists of 4392 images with highly fresh fish (day 1 and 2), fresh fish (day 3 and 4), and not fresh fish (day 5 and 6)

We proposed a **MobileNetV1 Bottleneck with Expansion (MB-BE) model** for freshness of fish eyes classification

- Depthwise Separable Convolution (DSC) Bottleneck with Expansion for feature learning
- Residual Transition for connecting feature maps



Prasetyo, E., Purbaningtyas, R., Adityo, R. D., Suciati, N., & Fatichah, C. (2022). Combining MobileNetV1 and Depthwise Separable convolution bottleneck with Expansion for classifying the freshness of fish eyes. **Information Processing in Agriculture, 9(4), 485-496**.

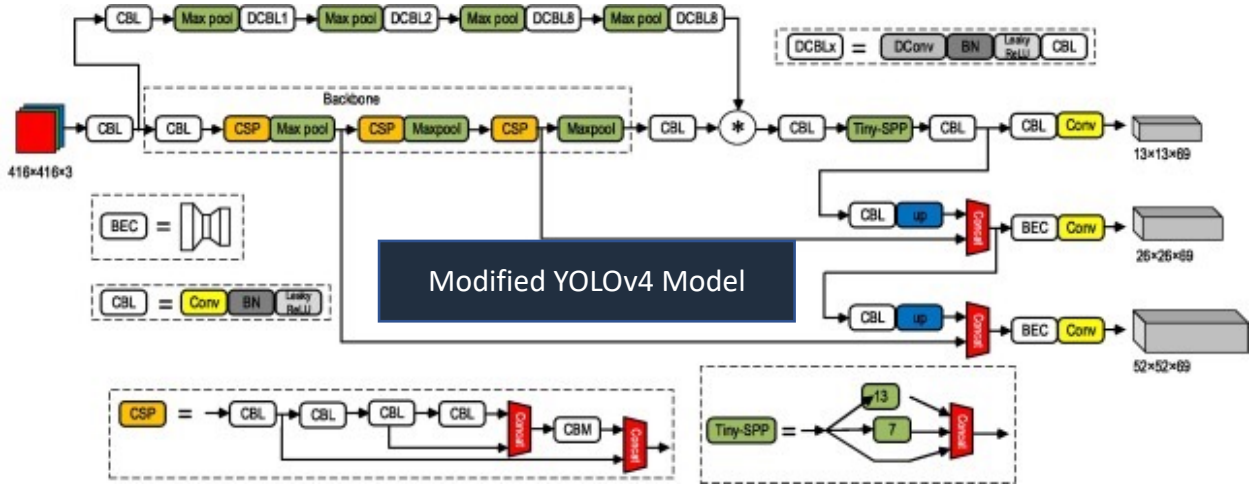
Yolov4-tiny with wing convolution layer for detecting fish body part

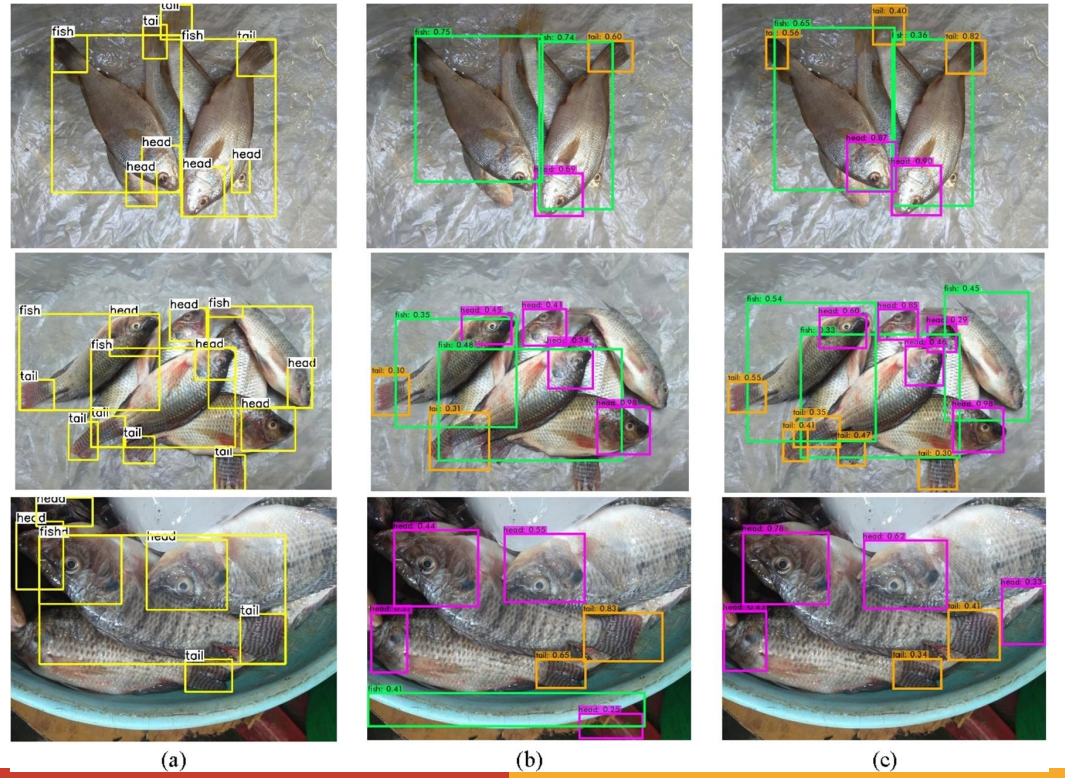
Detection of a fish's eye, tail and body is the initial process in the vision system for determining the freshness and species of fish

It also can be used to calculate the number of fish automatically in the fishing industry.

We modified the Yolov4-tiny object detector for accurate fish part detection

- A wing convolution layer (WCL),
- Tiny spatial pyramid pooling (Tiny-SPP)
- Bottleneck and expansion convolution (BEC) for resource efficiency
- An extra branch for small object detection





Prasetyo, E., Suciati, N., & Fatichah, C. (2022). Yolov4-tiny with wing convolution layer for detecting fish body part. **Computers and Electronics in Agriculture, 198, 107023.**

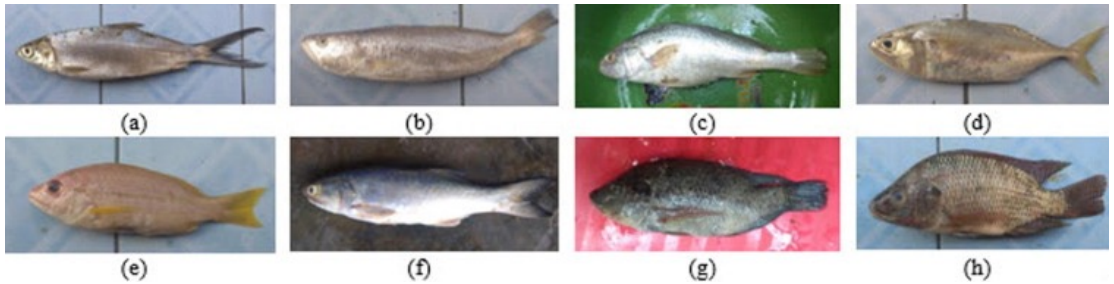
Multi-level residual network VGGNet for fish species classification

Fish species manual classification is challenging, time-consuming, and requires experience, especially when encountering similar fish species

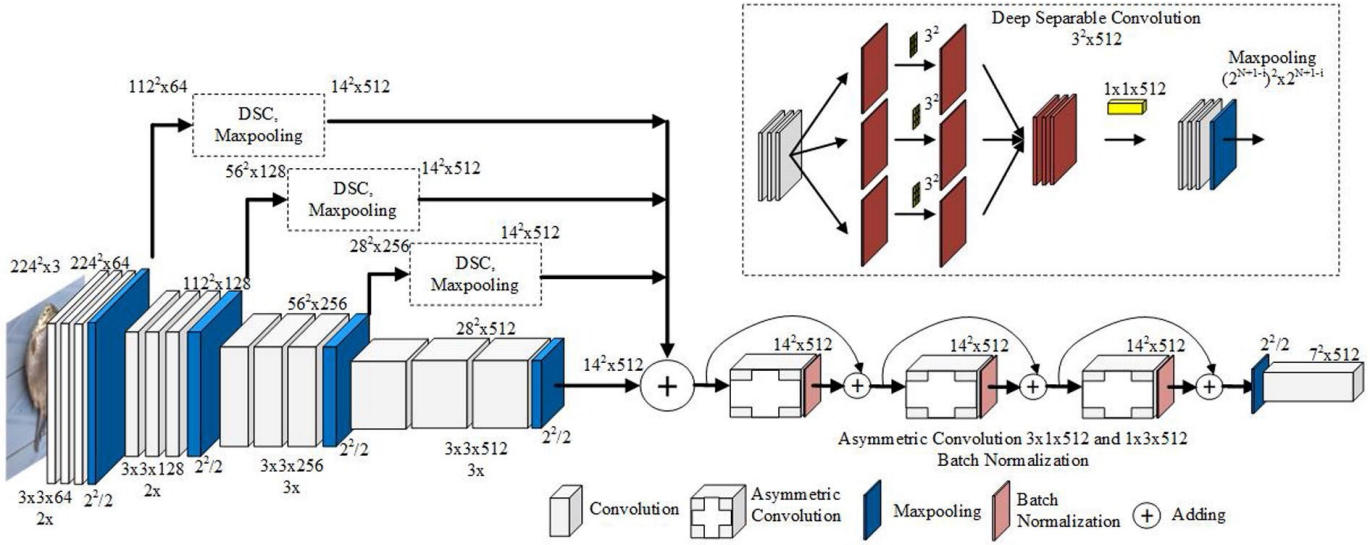
We proposed the MLR-VGGNet model for fish species classification

- A Multi-Level Residual strategy
- Depthwise Separable Convolution to combine low and high-level features
- Employing Asymmetric Convolution, Batch Normalization, and Residual features

Fish-gres dataset



Chanos Chanos (500 images), Johnius Trachycephalus (240 images), Nibea Albiflora (252 images), Rastrelliger Faughni (544 images), Upeneus Moluccensis (577 images), Eleutheronema Tetradactylum (240 images), Oreochromis Mossambicus (331 images), and Oreochromis Niloticus (564 images)



Prasetyo, E., Suciati, N., & Fatichah, C. (2022). Multi-level residual network VGGNet for fish species classification. **Journal of King Saud University-Computer and Information Sciences, 34(8), 5286-5295**.

Automatic Peatland Cover Classification

Integration of Convolutional Neural Network Features for Peatland Land Cover Classification Using UAV Imagery

Vegetation density represent the level of damage of peatland

Peatland cover is divided into three classes, namely bare, medium vegetation and high vegetation

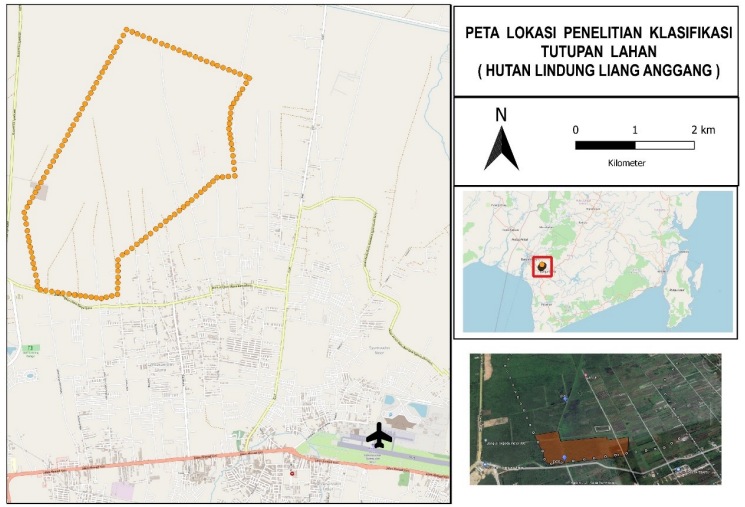
Vegetation density information can be obtained by remote sensing using satellite or Unmanned Aerial Vehicle (UAV)

This study uses UAV image data taken from the Liang Anggang Protected Forest area, Kalimantan

Bare land

Medium vegetation

High vegetation

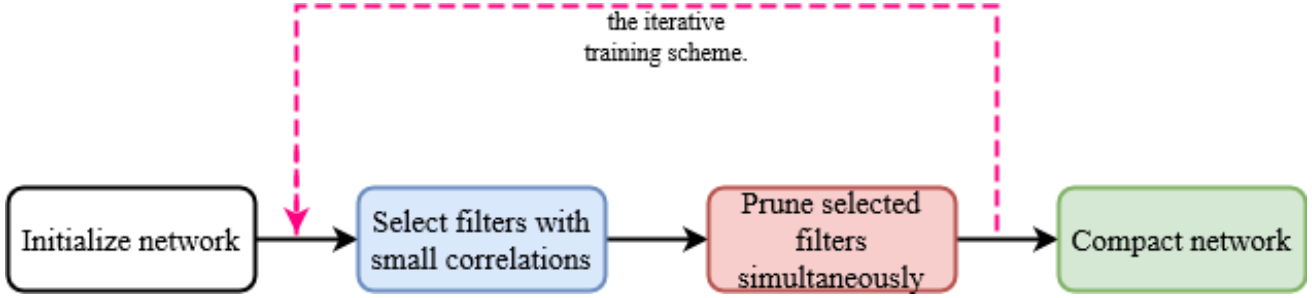


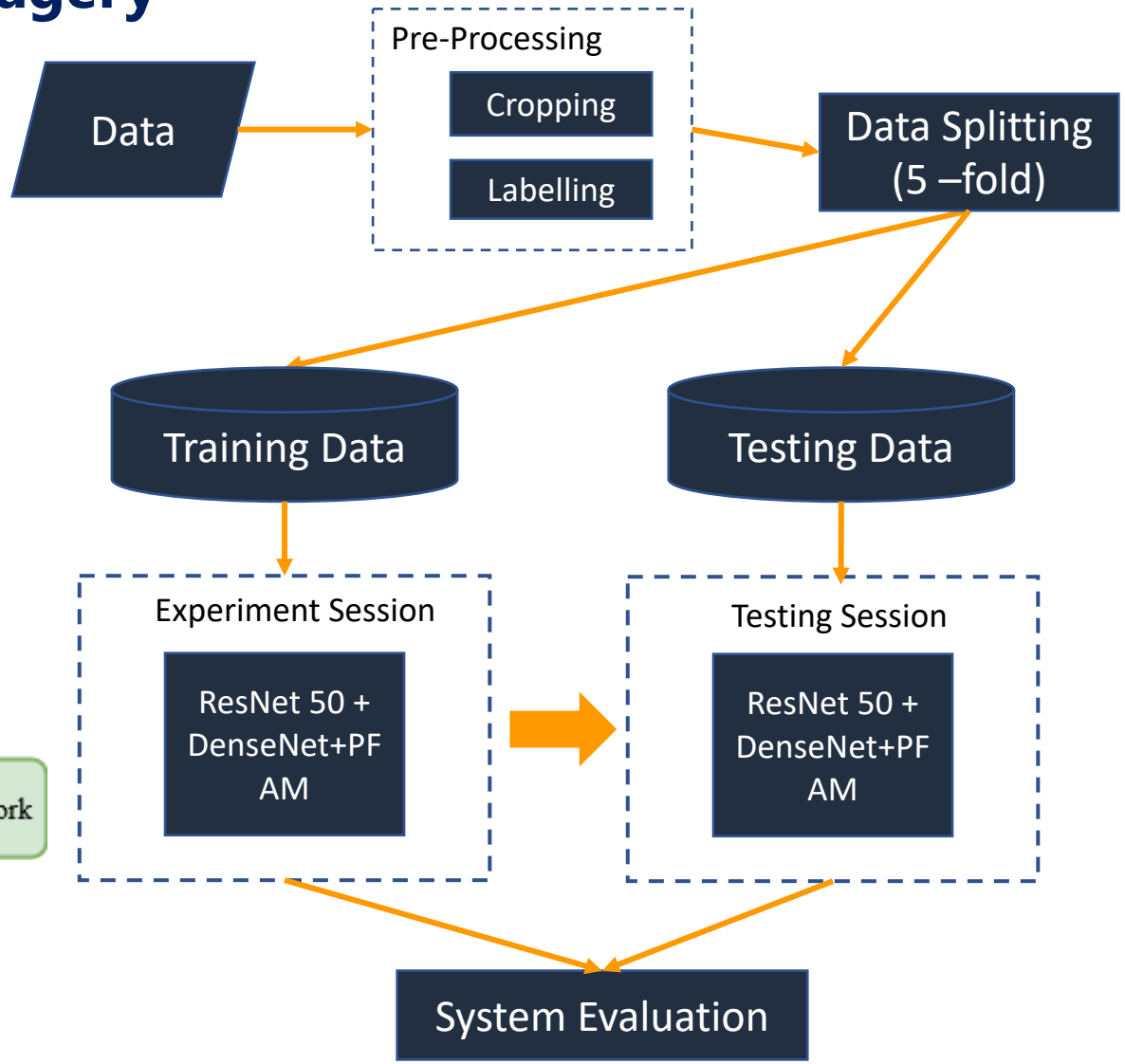
Maulidiya, E., Fatichah, C. & Suciati, N., (2023). Integration of Convolutional Neural Network Features for Peatland Land Cover Classification Using UAV Imagery. Thesis.

Integration of Convolutional Neural Network Features for Peatland Cover Classification Using UAV Imagery

We integrate the features of ResNet 50 and DenseNet model to improve the performance of model

We also use Pruning Filter with Attention Mechanism (PFAM) for reducing the number of parameter





Maulidiya, E., Fatichah, C. & Suciati, N., (2023). Integration of Convolutional Neural Network Features for Peatland Land Cover Classification Using UAV Imagery. Thesis.


- THANK YOU -