



PRAGMA 39 - Artificial Intelligence (AI) and High Performance Computing (HPC) for Sustainable Future

Artificial Intelligence on Nature Research

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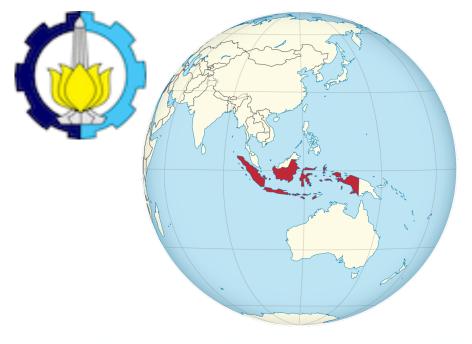
Institut Teknologi Sepuluh Nopember (ITS) is a leading university in the field of science and technology in Indonesia

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

Area

- City 326.81 km² (126.18 sq mi)
- Urban 911 km² (352 sq mi)
- Metro 5,925 km² (2,288 sq mi)





Α Insurance Risk identification Personalised pricing Client support Application Cybersecurity Incident detection Accelerated incident response **Fields Smart Homes** Personal assistants Automatic goods ordering Home security Temperature and light control

Defence

 Unmanned Aerial Vehicles (UAVs) Civilian detection Autonomous decision making Target identification · Diagnosis and maintenance of weapons systems · War gaming, simulation and training

Social Networks

 Photo recognition Newsfeed personalisation Friendship suggestions · Augmented reality filters Chatbots · Automated video/music synchronisation

Real Estate

 Targeted advertising Market analysis Client segmentation

Agriculture

 Robot harvesters Computer vision to monitor crop and soil health Predictive analysis for environmental impacts on crops

Healthcare

- · Autonomous surgical robots · Automatic disease identification and diagnosis · Personalised treatment Drug discovery · Identifying candidates for clinical trials · Epidemic outbreak prediction Automation of routine tasks like X-Rays, CT scans, data entry Health monitoring/wearable health trackers
- Virtual doctors



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· Commercial flight autopilot

Weather detection

Politics & Government

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Anticipating infrastructure failures and maintenance

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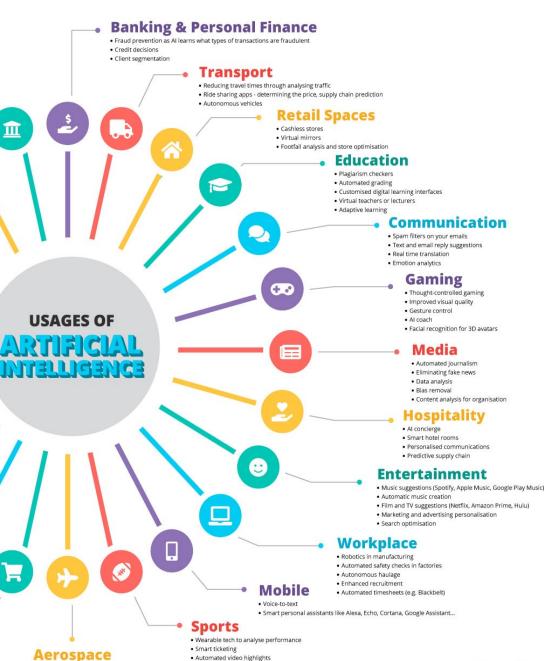
Targeted campaigning

Events

Facial recognition to scan attendees

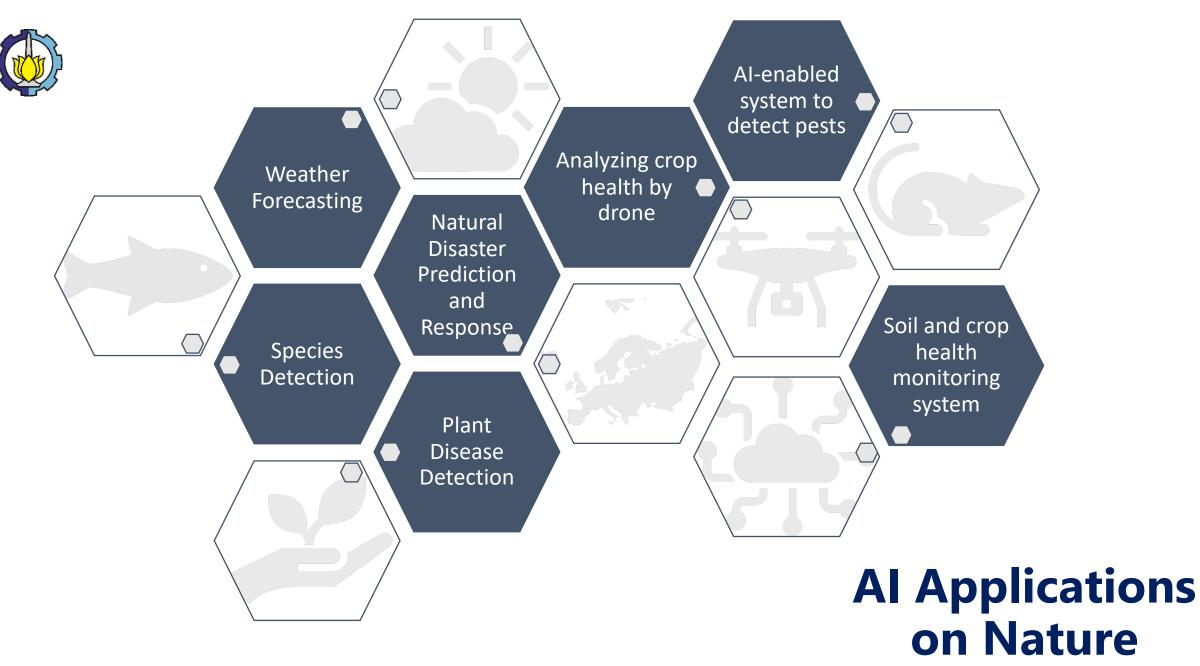
· Personalised recommendations Sales chatbots

· Public opinion monitoring

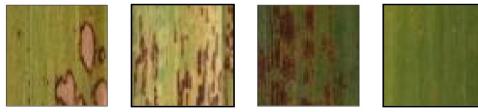


Computer vision referee

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







Classification

Plant Leaf Classification



່ Fish body part detection

(b)

Fish species classification

(a)

(e)

(c)

(h)

Freshness of fish classification



Peatland Cover Classification



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

Our AI Research on Nature

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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

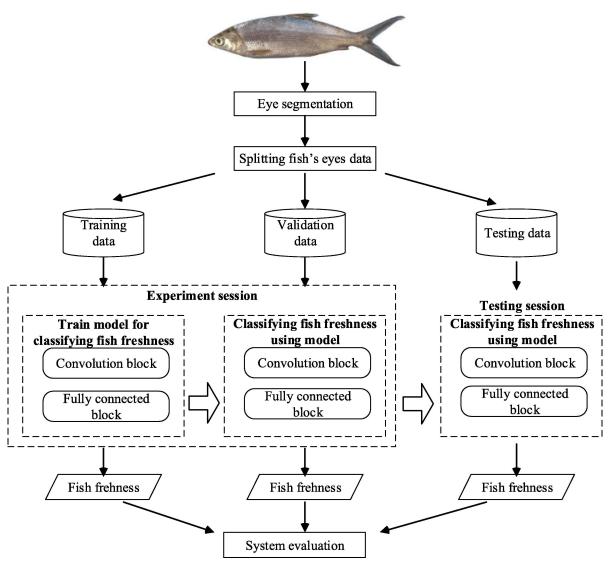
We create dataset that consists of 4392 images with highly fresh fish (day 1 and 2), fresh fish (day 3 and 4), and not fresh fish (day 5 and 6)

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**.

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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

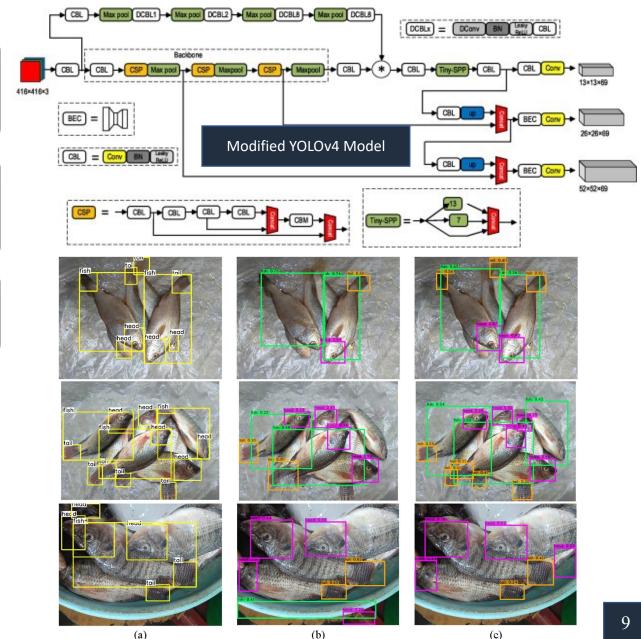
It also can be used to calculate the number of fish automatically in the fishing industry.

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.**

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Multi-level residual network VGGNet for fish species classification

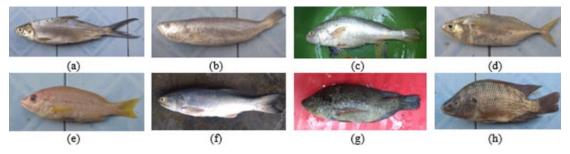
Fish species manual classification is challenging, time-consuming, and requires experience, especially when encountering similar fish species

We proposed the MLR-VGGNet model for fish species classification

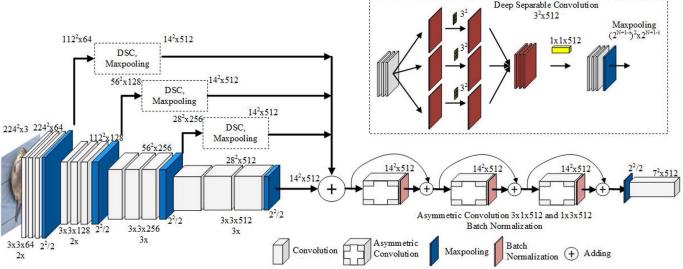
- A Multi-Level Residual strategy
- Depthwise Separable Convolution to combine low and high-level features
- Employing Asymmetric Convolution, Batch Normalization, and Residual features

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.

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)





Automatic Peatland Cover Classification



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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

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





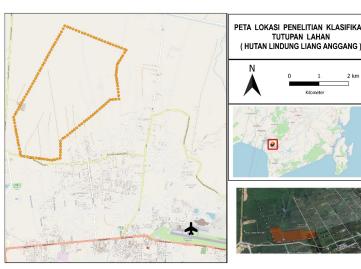
Bare land



Medium vegetation



High vegetation



Integration of Convolutional Neural Network Features for Peatland Cover Classification Using UAV Imagery Pre-Processing Cropping Data Splitting We integrate the features of ResNet 50 and Data (5 - fold)DenseNet model to improve the performance of Labelling model We also use Pruning Filter with Attention Mechanism (PFAM) for reducing the number of **Training Data Testing Data** parameter the iterative **Experiment Session Testing Session** training scheme. ResNet 50 + ResNet 50 + DenseNet+PF DenseNet+PF Prune selected Select filters with AM AM Initialize network filters ➤ Compact network small correlations

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

simultaneously

System Evaluation



(BUC) = N(B) CH2 - THANK YOU -