SMART AQUATIC HEALTH MONITORING SYSTEM

Dissolved Oxygen Prediction via DL Model for Aquatic Health

TEAM DATA DYNAMOS - GAT11

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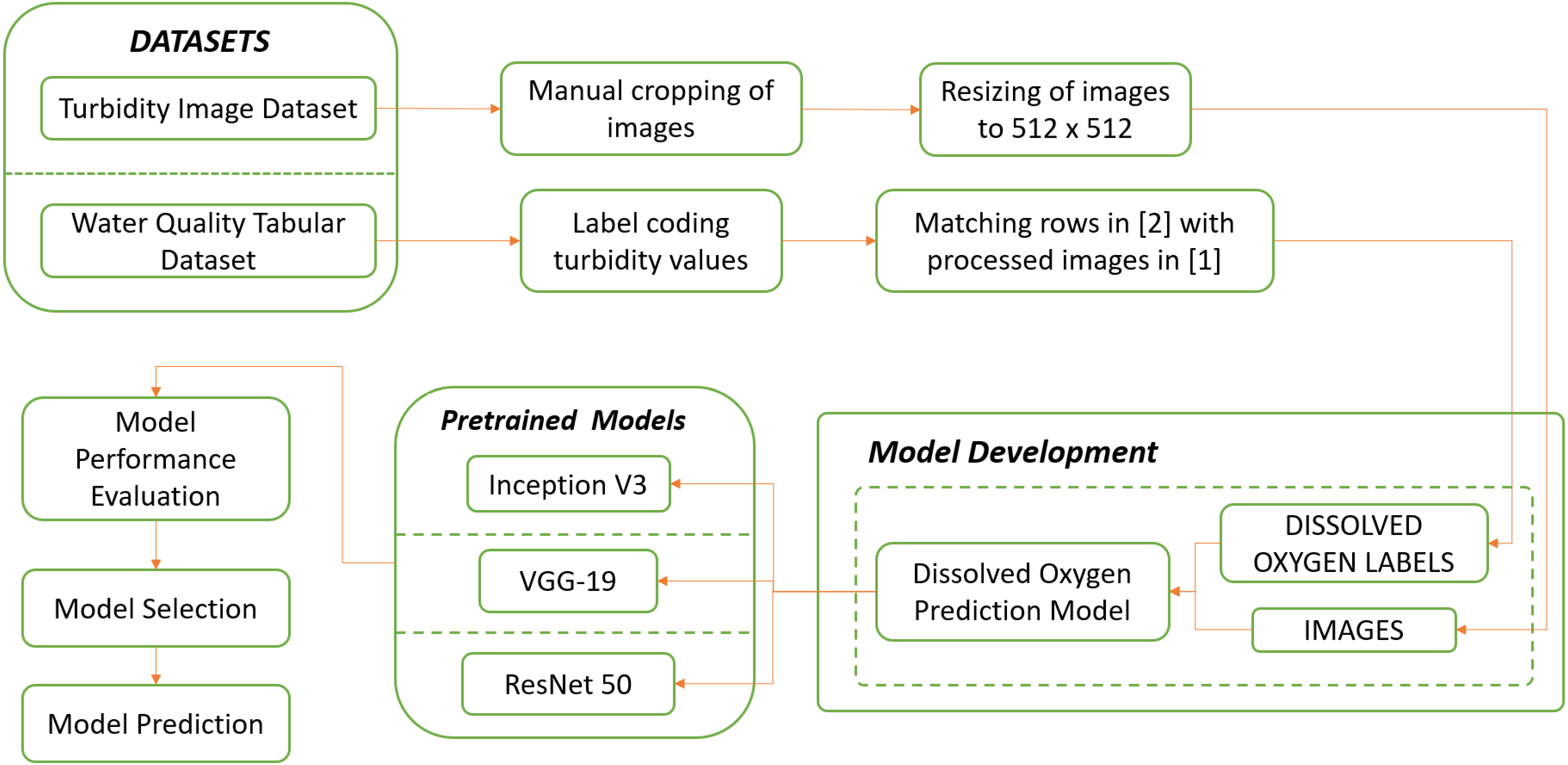
PROBLEM STATEMENT

- From aquaculture to sustenance of biodiversity to climate regulations, the Aquatic Ecosystem plays a pivotal role in human survival and prosperity.
- The existing technologies include IoT based Aquaculture health monitoring system [1], Water quality monitoring system [2] among others, most of which use multiple sensors making the monitoring systems bulkier and costlier due to integration of multiple sensors and engines for accurate data sensing.
- It is pertinent to provide quicker, easier solutions that leverage emerging ML/DL techniques to help monitor aquatic ecosystems in real time and mitigate biochemical toxicity hazards along with enabling environmentalists/scientists in developing efficient bio-safety measures for aquatic species.

Model Architecture



MODEL RESULTS

MODEL	Epochs	Batch Size	Optimisers	Accuracy	Loss
Inception V3	10	32	Adam	0.4949	1.1256
Inception V3	4	32	Adam(lr=0.002)	0.4735	1.1372
ResNet 50	6	32	Adam	0.3241	1.2906
VGG-19	4	32	Adam	0.0044	3.3871

INCEPTION V3 MODEL 1

```
model.fit(train_dataset, validation_data=val_dataset, epochs=8)
```

```
Epoch 1/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 354s 29s/step - accuracy: 0.3929 - loss: 1.4722 - val_accuracy: 0.4224 - val_loss: 1.4516
Epoch 2/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 365s 28s/step - accuracy: 0.3930 - loss: 1.4660 - val_accuracy: 0.4310 - val_loss: 1.2849
Epoch 3/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 383s 28s/step - accuracy: 0.3398 - loss: 1.3893 - val_accuracy: 0.5000 - val_loss: 1.1065
Epoch 4/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 334s 28s/step - accuracy: 0.4207 - loss: 1.1787 - val_accuracy: 0.4741 - val_loss: 1.2230
Epoch 5/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 376s 28s/step - accuracy: 0.4976 - loss: 1.1209 - val_accuracy: 0.3966 - val_loss: 1.1748
Epoch 6/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 381s 28s/step - accuracy: 0.4416 - loss: 1.1989 - val_accuracy: 0.4310 - val_loss: 1.1833
Epoch 7/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 335s 28s/step - accuracy: 0.4610 - loss: 1.1915 - val_accuracy: 0.4224 - val_loss: 1.1810
Epoch 8/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 338s 29s/step - accuracy: 0.5147 - loss: 1.1044 - val_accuracy: 0.3362 - val_loss: 1.2422
Epoch 9/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 373s 28s/step - accuracy: 0.3621 - loss: 1.2295 - val_accuracy: 0.5172 - val_loss: 1.1158
Epoch 10/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 328s 28s/step - accuracy: 0.4949 - loss: 1.1256 - val_accuracy: 0.4483 - val_loss: 1.1853
<keras.src.callbacks.history.History at 0x7b00ad869630>
```

```
Epoch 1/5
12/12 ━━━━━━━━━━━━━━━━━━━━ 361s 30s/step - accuracy: 0.2533 - loss: 2.1674 - val_accuracy: 0.4138 - val_
Epoch 2/5
12/12 ━━━━━━━━━━━━━━━━━━━━ 343s 29s/step - accuracy: 0.3211 - loss: 1.4223 - val_accuracy: 0.3879 - val_
Epoch 3/5
12/12 ━━━━━━━━━━━━━━━━━━━━ 346s 29s/step - accuracy: 0.4131 - loss: 1.2540 - val_accuracy: 0.4655 - val_
Epoch 4/5
12/12 ━━━━━━━━━━━━━━━━━━━━ 343s 29s/step - accuracy: 0.4735 - loss: 1.1372 - val_accuracy: 0.3276 - val_
```

INCEPTION V

ResNet – 50 Model

```
model.fit(train_dataset, validation_data=val_dataset, epochs=10)
```

```
Epoch 1/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 460s 38s/step - accuracy: 0.3864 - loss: 4.3605 - val_accuracy: 0.3362 - val_loss: 2.0543
Epoch 2/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 440s 37s/step - accuracy: 0.3308 - loss: 2.4900 - val_accuracy: 0.3017 - val_loss: 2.2861
Epoch 3/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 451s 38s/step - accuracy: 0.3063 - loss: 2.2406 - val_accuracy: 0.2672 - val_loss: 1.3876
Epoch 4/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 452s 38s/step - accuracy: 0.3462 - loss: 1.4433 - val_accuracy: 0.3017 - val_loss: 1.2904
Epoch 5/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 446s 38s/step - accuracy: 0.3087 - loss: 1.4803 - val_accuracy: 0.2759 - val_loss: 1.2836
Epoch 6/10
12/12 ━━━━━━━━━━━━━━━━━━━━ 498s 37s/step - accuracy: 0.3241 - loss: 1.2906 - val_accuracy: 0.2586 - val_loss: 1.2747
```

FUTUTRE SCOPE

Currently, the proposed prototype predicts aquatic health status only when the user inputs an underwater image and other required sensor data. This prototype can be further scaled by:

1) automation of sensor data and image input to the prediction model.

2) explore complex aquatic systems that affect aquatic health and try capture those complex systems in an image/video for more accurate prediction.

WOW FACTOR!

One-Click Solution for Predicting Aquatic Ecosystem Health. Our proposed model enables users to instantly predict the health status of an aquatic ecosystem by simply uploading an image as input.

This work also falls under the following Sustainable Development Goals:

1) Goal 6: Clean water and Sanitation

   The model can be used to predict water potability

2) Goal 14: Life Below Water

By predicting the ecosystem's health status, appropriate measures to overcome major issues like ocean warming, ocean acidification and coastal acidification which can adversely affect the life under water.

ABSTRACT REFERENCES

[1] Demetillo, A. T., Japitana, M. V., & Taboada, E. B. (2019). A system for monitoring water quality in a large aquatic area using wireless sensor network technology. *Sustainable Environment Research, 29*(1), 1-9.
[2] Sarwar, A., & Iqbal, M. T. (2022). IoT-Based Real-Time Aquaculture Health Monitoring System. *European Journal of Electrical Engineering and Computer Science, 6*(4), 44-50.

DATASET REFERENCES

IMAGE DATASET :

Trejo-Zúñiga, I., Moreno, M., Santana-Cruz, R. F., & Meléndez-Vázquez, F. (2024). Deep Learning-Driven of Turbidity Levels Dataset (Version 1.0) [Data set]. Zenodo.

TABULAR WATER QUALITY DATASET

https://www.kaggle.com/datasets/shreyanshverma27/water-quality-testing

THANK YOU!

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