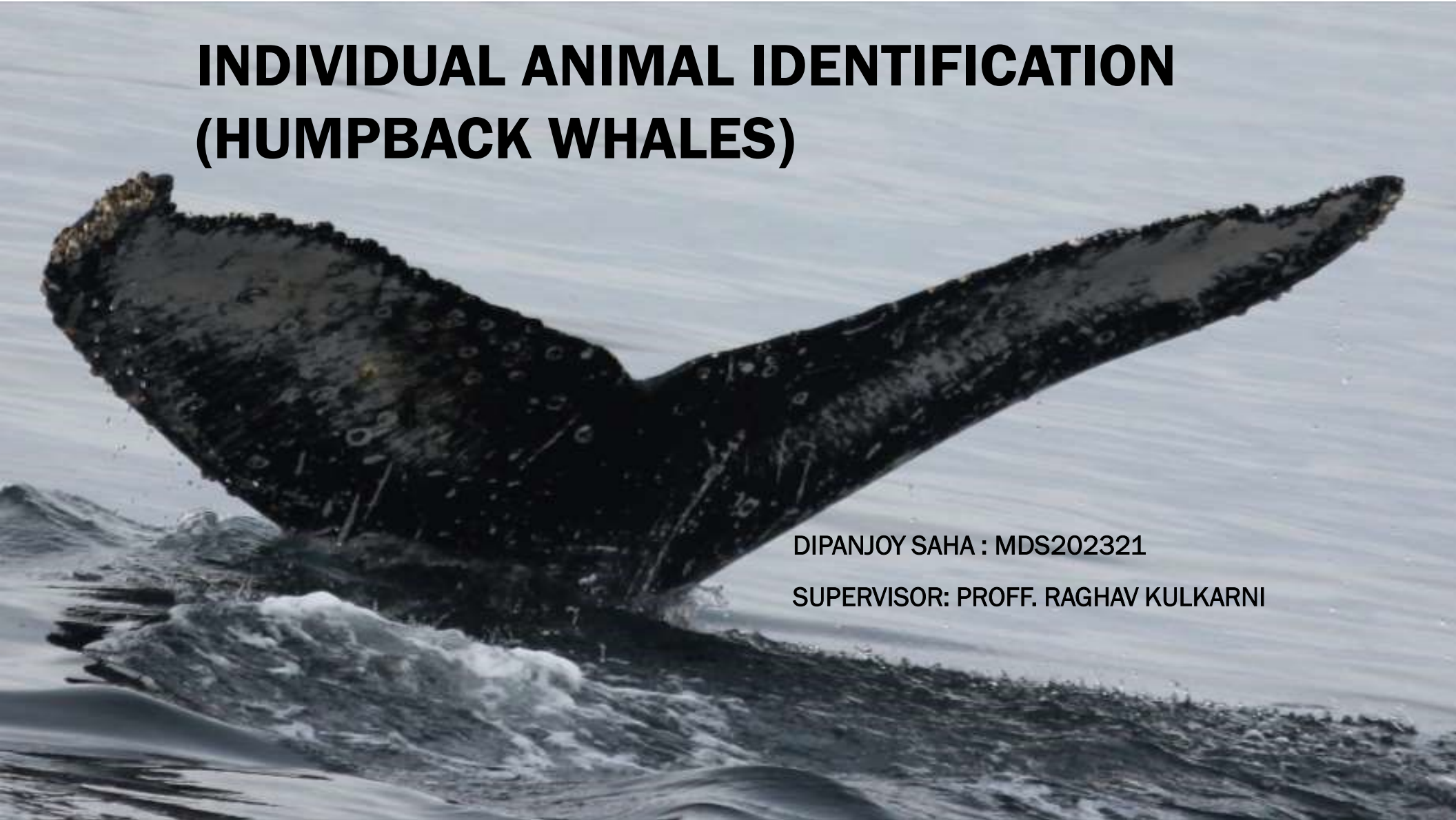


# **INDIVIDUAL ANIMAL IDENTIFICATION (HUMPBACK WHALES)**

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## INTRODUCTION : SPECIAL CASE : WHALES TAILFIN RECOGNITION

- Whale tail patterns are unique like fingerprints.
- Aim: Identify individual humpback whales from images.
- Dataset: Provided by Kaggle (train images + whale IDs).

A large whale is breaching the ocean surface, creating a massive splash. The whale's back and tail are visible above the water, and the surrounding water is dark blue with white foam from the splash. The title 'PROBLEM STATEMENT' is overlaid on the top left of the image.

# PROBLEM STATEMENT

- Classification problem with highly imbalanced classes.
- Some whale IDs appear only once or twice.
- New/unseen whales also appear during testing.



## APPROACH OVERVIEW

Label: 2811



Label: 2246



Label: 393



Label: 0



Label: 0



Label: 0



Label: 2551



Label: 0



Label: 1135



1. Preprocess image data.
2. Handle label encoding and rare classes.
3. Use transfer learning (EfficientNetB0).
4. Apply image augmentation and regularization.
5. Fine-tune the model and predict on test images.

The background of the slide is a photograph of a whale breaching the ocean surface. A dark, sleek whale is seen from below, its body arched as it moves out of the water. The ocean surface is choppy with small waves. At the top of the slide, there is a horizontal bar composed of three segments: a dark grey segment on the left, a light blue segment in the middle, and a medium grey segment on the right.

## **DATA PREPROCESSING**

- Used ImageDataGenerator for memory efficiency.
- Filtered rare whale IDs as "new\_whale".
- Resized all images to 224x224.
- Split training data into 80% training / 20% validation.



## MODEL ARCHITECTURE

- **Base Model:** EfficientNetB0 (pre-trained on ImageNet).
- **Added Layers:**
  - GlobalAveragePooling2D
  - Dense layer with L2 regularization
  - Dropout layers for regularization
- **Output Layer:** Softmax over whale ID classes



A photograph of a whale's tail fluke, likely a humpback whale, emerging from the blue ocean. The tail is white with dark, irregular markings along the edges and some spots on the surface. The background is a deep blue sea with some white foam from the water's surface.

## TRAINING STRATEGY

- Used EarlyStopping, ModelCheckpoint, and ReduceLROnPlateau callbacks.
- Stage 1: Train only top layers (base frozen)
- Stage 2: Unfreeze and fine-tune base model
- Batch size: 32, Image size: 224x224, Epochs: 10+10

An aerial photograph of a large, dark, V-shaped landmass, possibly a volcanic island or a large atoll, situated in the middle of a vast, blue ocean. The landmass has a rugged, dark surface with some lighter patches. A horizontal bar, consisting of a grey segment on the left, a blue segment in the middle, and a grey segment on the right, is positioned at the top of the image, partially obscuring the sky. The title 'PERFORMANCE METRICS' is centered over the image.

## PERFORMANCE METRICS

- Accuracy monitored on validation set.
- Training and validation curves plotted to visualize performance.
- Model checkpointing ensured best model retained.





## TEST PREDICTION

- Preprocessed test images with the same pipeline.
- Predicted probabilities for each class.
- Used argmax to select top class.
- Converted labels back to original whale IDs.



# SUBMISSION

- Final predictions saved in submission.csv
- Format:

Image,Id

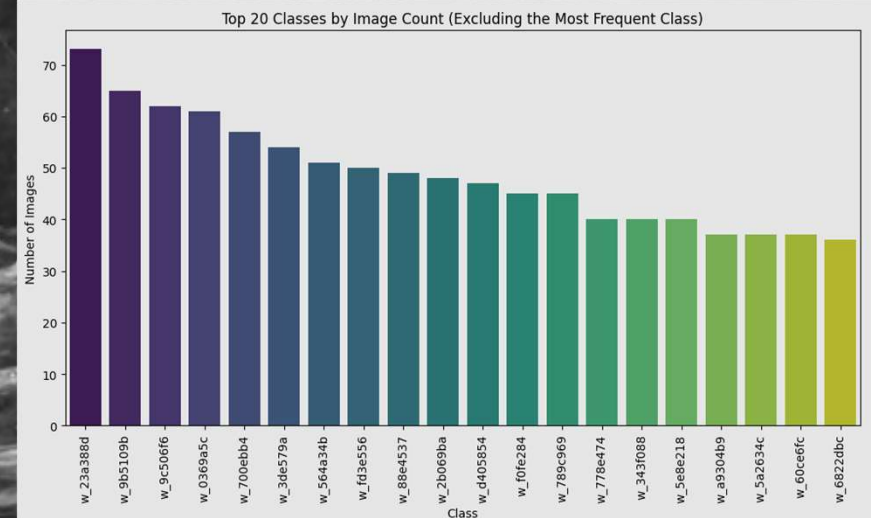
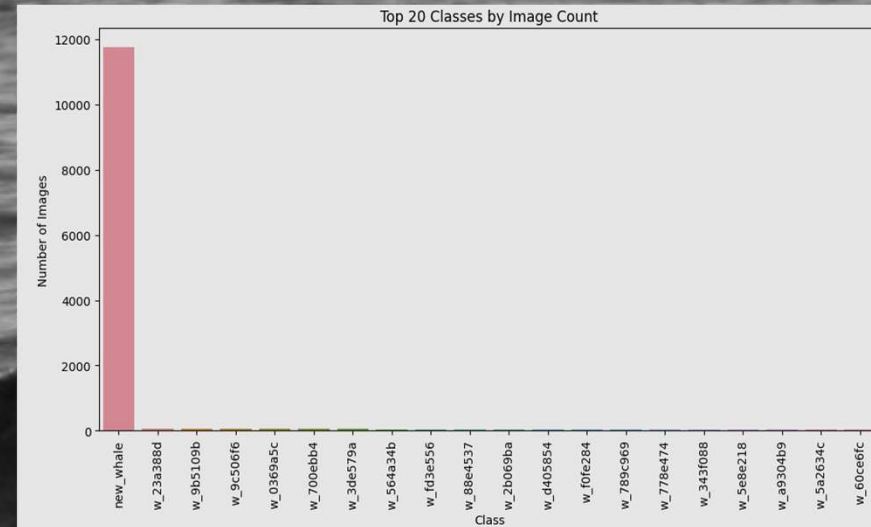
img1.jpg,w\_1234

img2.jpg,w\_5678.



# RESULTS & REFLECTION

- EfficientNetB0 provided strong feature representations.
- GlobalAveragePooling2D reduced overfitting.
- L2 and dropout improved generalization.
- Pipeline is scalable and GPU-compatible.
- Still accuracy is almost 48% due to technical support.





## Demo example outcome of training

Epoch 2/50  
317/317 — 8s 26ms/step - accuracy: 0.4423 -  
Epoch 3/50  
317/317 — 7s 22ms/step - accuracy: 0.4571 -  
Epoch 4/50  
317/317 — 8s 26ms/step - accuracy: 0.4642 -  
Epoch 5/50  
317/317 — 8s 26ms/step - accuracy: 0.4677 -  
Epoch 6/50  
317/317 — 7s 22ms/step - accuracy: 0.4590 -  
Epoch 7/50  
317/317 — 7s 22ms/step - accuracy: 0.4614 -  
Epoch 8/50  
317/317 — 8s 26ms/step - accuracy: 0.4593 -  
Epoch 9/50  
317/317 — 8s 26ms/step - accuracy: 0.4594 -  
Epoch 10/50  
317/317 — 8s 26ms/step - accuracy: 0.4626 -  
Epoch 11/50  
317/317 — 7s 22ms/step - accuracy: 0.4625 -  
Epoch 12/50  
317/317 — 7s 22ms/step - accuracy: 0.4636 -  
Epoch 13/50  
317/317 — 8s 26ms/step - accuracy: 0.4611 -  
Epoch 14/50  
317/317 — 8s 26ms/step - accuracy: 0.4618 -  
Epoch 15/50  
317/317 — 8s 26ms/step - accuracy: 0.4641 -  
Epoch 16/50  
317/317 — 7s 22ms/step - accuracy: 0.4637 -  
Epoch 17/50  
317/317 — 7s 22ms/step - accuracy: 0.4657 -  
Epoch 18/50  
317/317 — 8s 26ms/step - accuracy: 0.4651 -  
Epoch 19/50  
317/317 — 7s 22ms/step - accuracy: 0.4662 -  
Epoch 20/50  
317/317 — 8s 26ms/step - accuracy: 0.4653 -  
Epoch 21/50

635/635 — 286s 399ms/step - accuracy: 0.4538  
Epoch 2/10  
635/635 — 145s 226ms/step - accuracy: 0.4591  
Epoch 3/10  
635/635 — 137s 214ms/step - accuracy: 0.4644  
Epoch 4/10  
635/635 — 136s 213ms/step - accuracy: 0.4604  
Epoch 5/10  
634/635 — 0s 170ms/step - accuracy: 0.4580 -  
Epoch 5: ReduceLROnPlateau reducing learning rate to 0.000200000  
635/635 — 137s 213ms/step - accuracy: 0.4581  
Epoch 6/10  
635/635 — 136s 213ms/step - accuracy: 0.4560  
Epoch 7/10  
635/635 — 137s 214ms/step - accuracy: 0.4575  
Epoch 8/10  
635/635 — 140s 218ms/step - accuracy: 0.4603  
Epoch 9/10  
635/635 — 135s 210ms/step - accuracy: 0.4597  
Epoch 10/10  
635/635 — 136s 212ms/step - accuracy: 0.4654



## FUTURE WORK

- Try data balancing techniques like SMOTE or class weighting.
- Experiment with larger pre-trained models (e.g., EfficientNetB7).
- Implement ensemble models.
- Improve handling of "new\_whale" prediction.
- Include data for different animals like red panda, African short neck giraffe,

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# THANK YOU

- GitHub / Notebook link:

<https://www.kaggle.com/code/dipanjoysaha/whale-identification>

- Contact: [dipanjoydipanjoysaha@gmail.com](mailto:dipanjoydipanjoysaha@gmail.com)