CAR VS MOTORCYCLE CLASSIFICATION

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Our Team

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OUR PROBLEM

- PREDICT WHETHER THE IMAGE IS A CAR OR A MOTORCYCLE

DATA DESCRIPTION

Random images from the 'motorcycle' category:

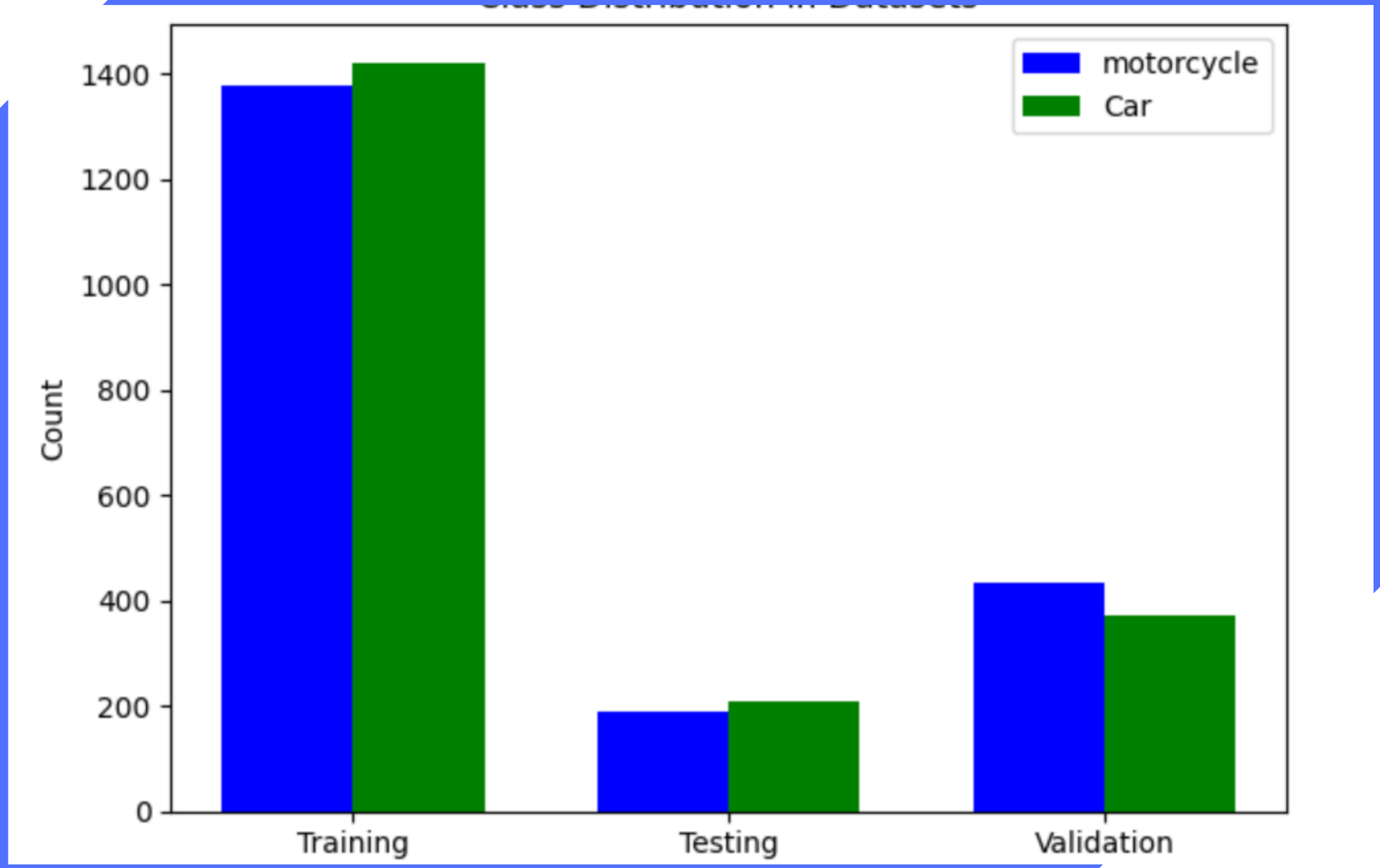



Random images from the 'Car' category:





DATA DISTRIBUTION



MODELING

- Logistic Regression
- Logistic Regression + neural network, alpha=0.001
- Logistic Regression + neural network, alpha=0.0001
- Cnn
- Cnn + dropout

LOGISTIC REGRESSION

THE LOGISTIC FUNCTION IS: $g(z) = \frac{1}{1+e^{-z}}$

OUR MODEL FUNCTION WILL BE: $h(x) = \frac{1}{1+e^{-(xW+b)}}$

A PREDICTION OF 1 WILL MEAN THAT WE ARE CERTAIN THAT THE VALUE IS 1.
IN GENERAL, WE WANT THAT:

THEREFORE:

$$p(y\_i \mid x\_i; w, b) = h(x\_i)^{(y\_i)} (1-h(x\_i))^{(1-y\_i)}$$

SIGMOID

SIGMOID IS A TYPE OF ACTIVATION FUNCTION THAT SQUASHES INPUT VALUES TO THE RANGE [0, 1].
IT IS OFTEN USED IN THE OUTPUT LAYER OF BINARY CLASSIFICATION MODELS, WHERE IT PREDICTS THE PROBABILITY OF A SAMPLE BELONGING TO A CERTAIN CLASS.
THE SIGMOID FUNCTION IS DEFINED AS $\sigma(x) = \frac{1}{1+e^{-x}}$.

IT IS PARTICULARLY USEFUL WHEN YOU NEED PROBABILITIES AS OUTPUT, AS IT NATURALLY CONSTRAINS THE OUTPUT TO THE RANGE [0, 1].

RELU

RELU STANDS FOR RECTIFIED LINEAR UNIT.
IT IS AN ACTIVATION FUNCTION COMMONLY USED IN HIDDEN LAYERS OF NEURAL NETWORKS.
RELU RETURNS 0 FOR NEGATIVE INPUTS AND RETURNS THE INPUT VALUE FOR POSITIVE INPUTS.
MATHEMATICALLY, RELU IS DEFINED AS
F(X)=MAX(0,X).
RELU IS COMPUTATIONALLY EFFICIENT AND HELPS ALLEVIATE THE VANISHING GRADIENT PROBLEM.

ADAM

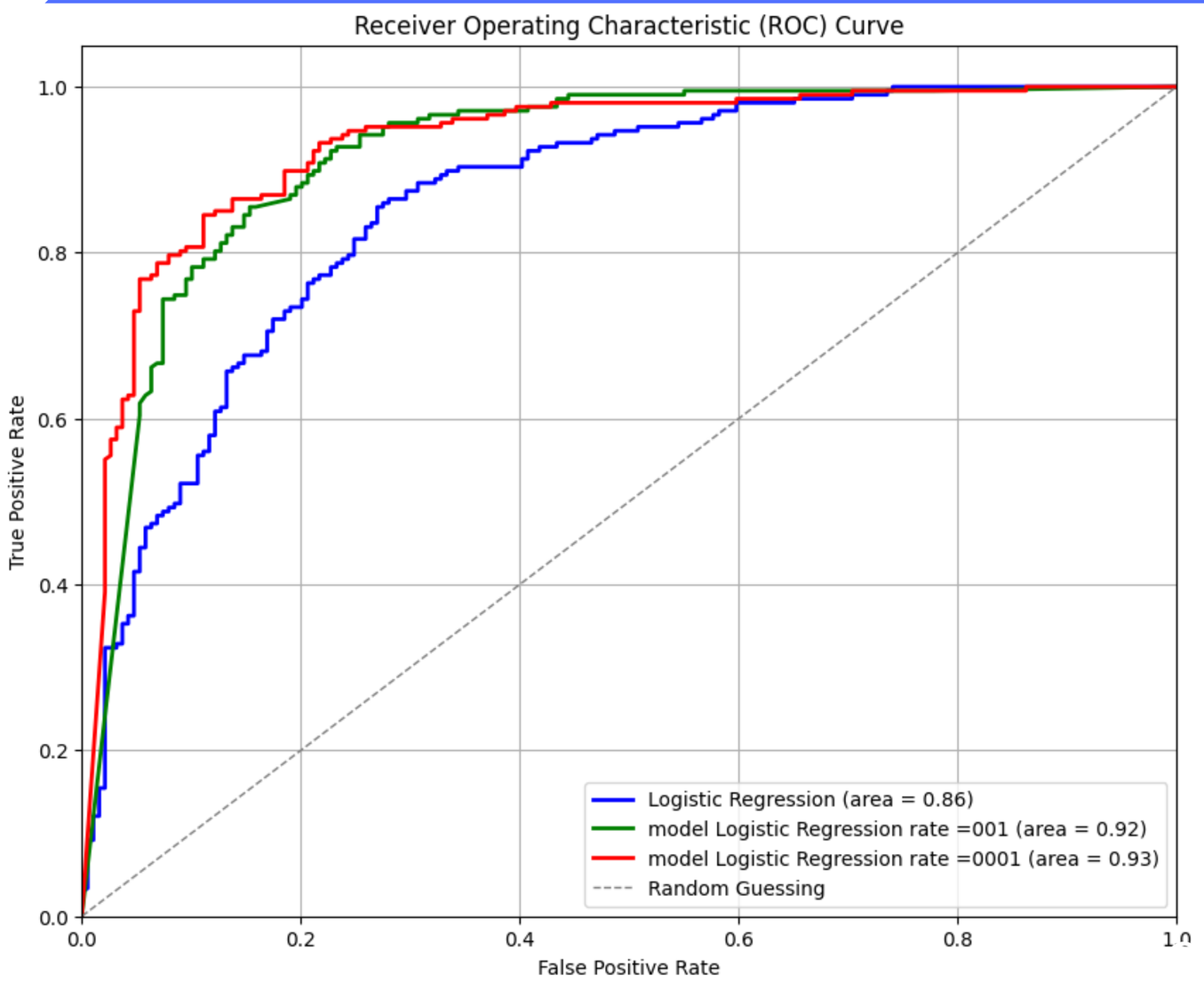
ADAM STANDS FOR ADAPTIVE MOMENT ESTIMATION. IT IS AN OPTIMIZATION ALGORITHM USED FOR TRAINING DEEP LEARNING MODELS.

ADAM COMBINES THE ADVANTAGES OF TWO OTHER EXTENSIONS OF STOCHASTIC GRADIENT DESCENT, ADAGRAD AND RMSPROP.

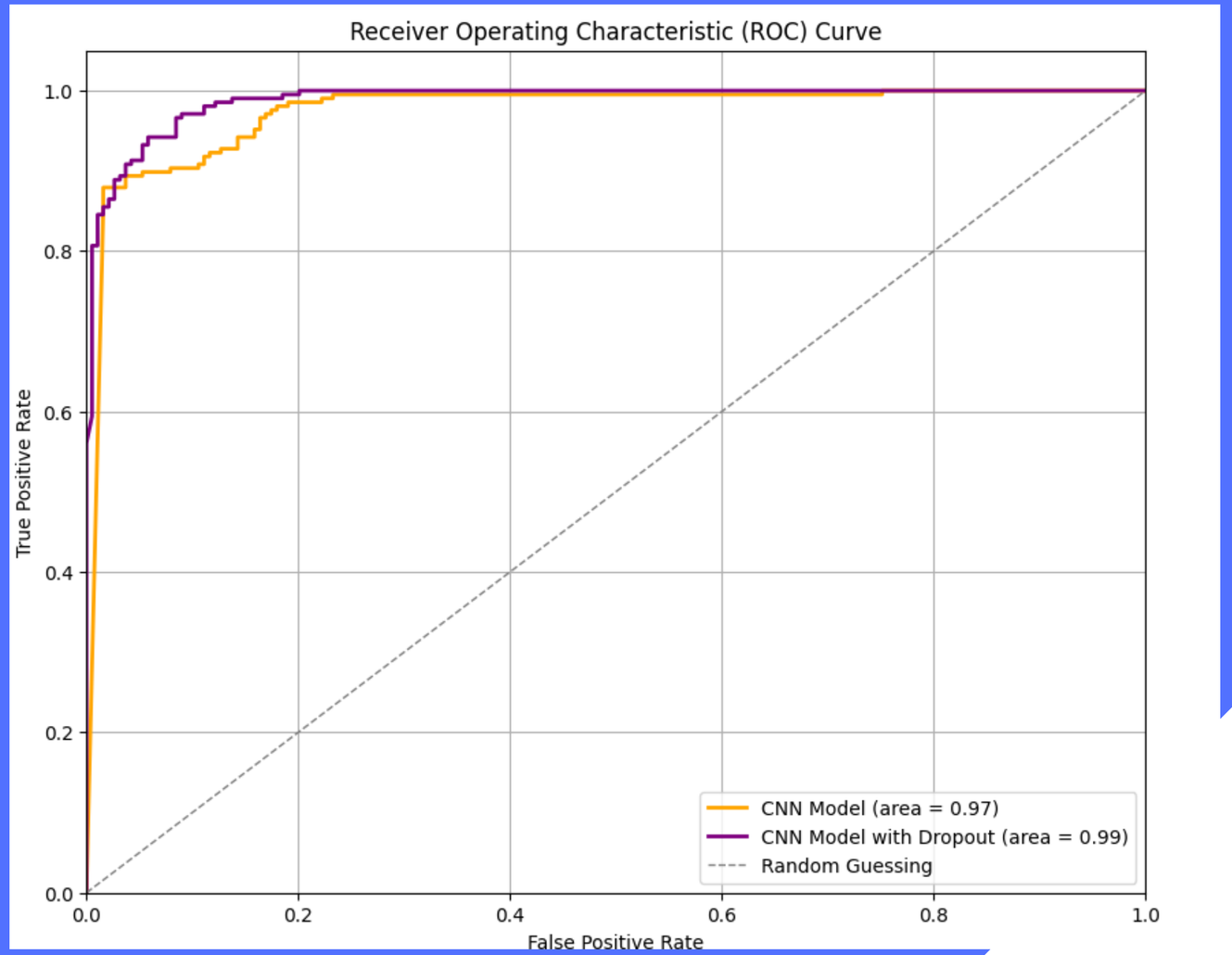
IT COMPUTES ADAPTIVE LEARNING RATES FOR EACH PARAMETER. THIS MEANS THAT IT ADJUSTS THE LEARNING RATES OF EACH PARAMETER BASED ON THE PAST GRADIENTS AND UPDATES.

ADAM IS POPULAR DUE TO ITS EFFICIENCY IN TERMS OF MEMORY USAGE AND COMPUTATIONAL RESOURCES.

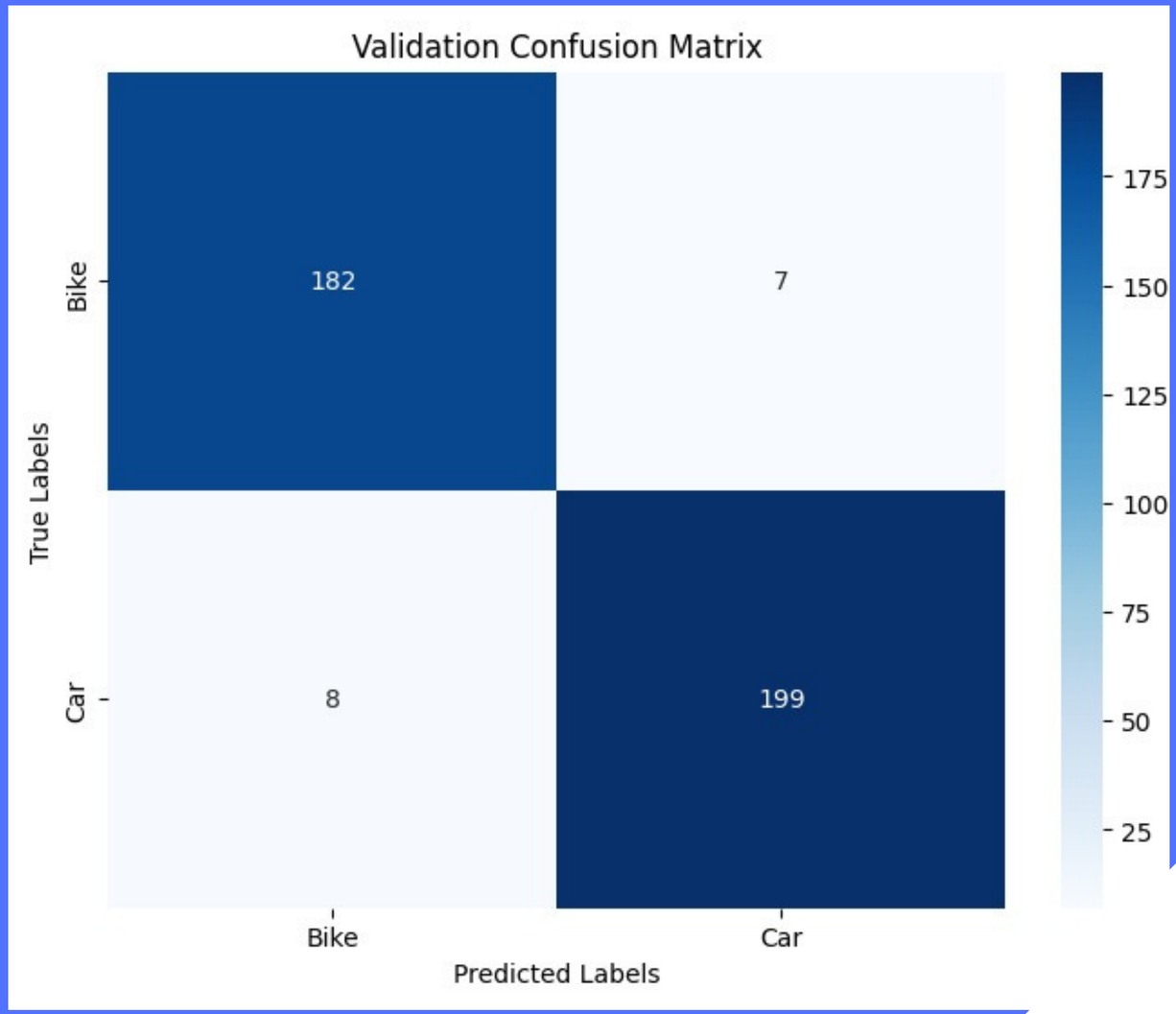
ROC CURVE


Receiver Operating Characteristic (ROC) Curve
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
Logistic Regression (area = 0.86)
model Logistic Regression rate =001 (area = 0.92)
model Logistic Regression rate =0001 (area = 0.93)
Random Guessing

ROC CURVE


Receiver Operating Characteristic (ROC) Curve
True Positive Rate
False Positive Rate
0.0
0.2
0.4
0.6
0.8
1.0
CNN Model (area = 0.97)
CNN Model with Dropout (area = 0.99)
Random Guessing

Confsion Matrix



RESULT

Actual: Motorcycle
Predicted: Motorcycle
Confidence: 100.00%

Actual: Car
Predicted: Car
Confidence: 79.15%

Actual: Motorcycle
Predicted: Motorcycle
Confidence: 100.00%

Actual: Car
Predicted: Motorcycle
Confidence: 100.00%

Actual: Car
Predicted: Motorcycle
Confidence: 100.00%

Actual: Motorcycle
Predicted: Motorcycle
Confidence: 100.00%

Actual: Motorcycle
Predicted: Motorcycle
Confidence: 100.00%

Actual: Motorcycle
Predicted: Motorcycle
Confidence: 100.00%

Actual: Motorcycle
Predicted: Motorcycle
Confidence: 54.93%

Actual: Motorcycle
Predicted: Car
Confidence: 100.00%

RESULT

Actual: Motorcycle
Predicted: Motorcycle
Confidence: 100.00%

Actual: Motorcycle
Predicted: Motorcycle
Confidence: 100.00%

Actual: Motorcycle
Predicted: Motorcycle
Confidence: 100.00%

Actual: Motorcycle
Predicted: Motorcycle
Confidence: 100.00%

Actual: Car
Predicted: Car
Confidence: 100.00%

Actual: Car
Predicted: Car
Confidence: 100.00%

Actual: Car
Predicted: Car
Confidence: 100.00%

Actual: Car
Predicted: Car
Confidence: 100.00%

Actual: Car
Predicted: Car
Confidence: 100.00%

Actual: Car
Predicted: Car
Confidence: 100.00%