Machine Learning Project

Car Images Classification By Training Model

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Deep Learning Steps

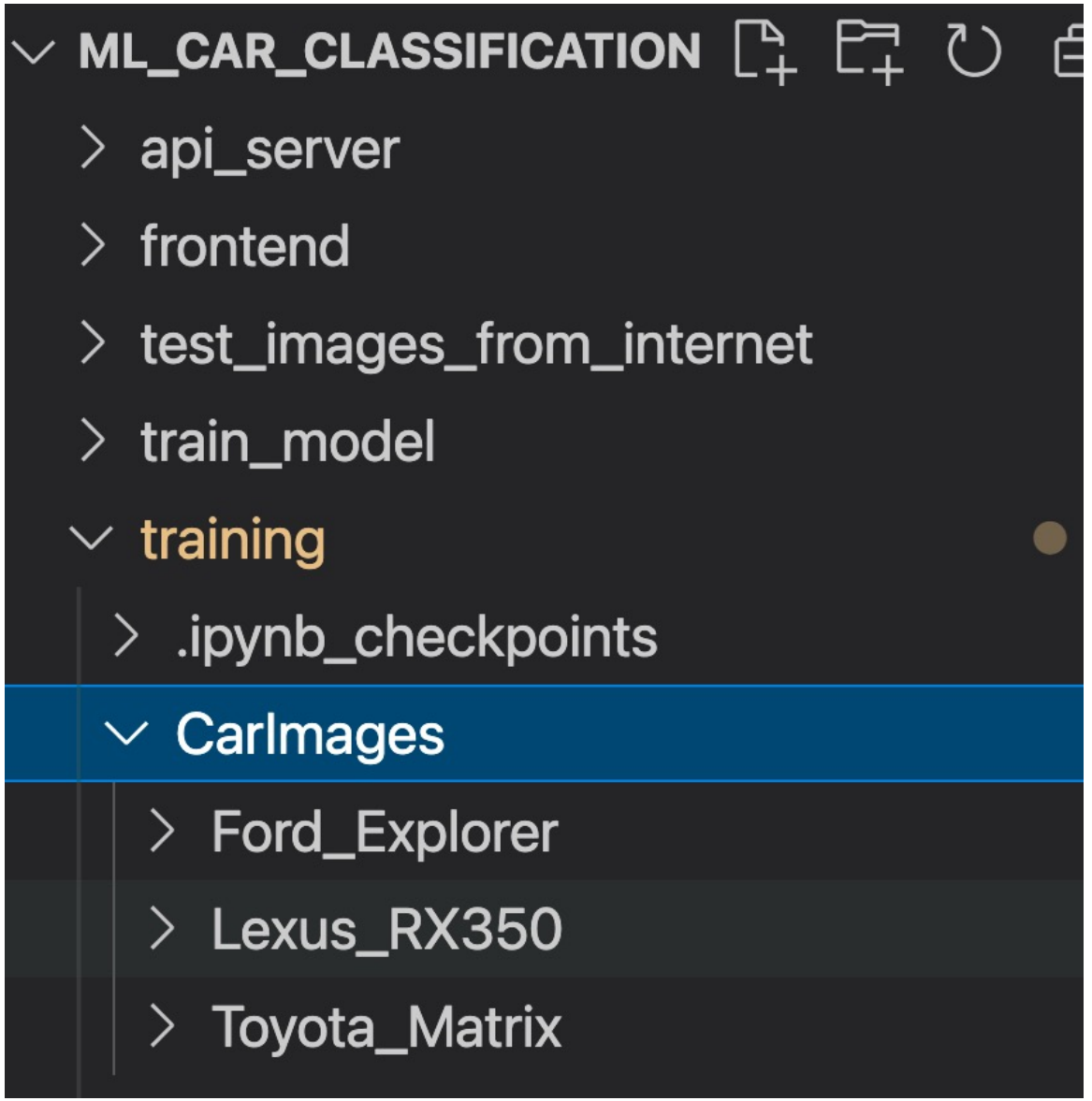
1. Data collection
2. Data Preparation
3. Training the Model
4. Serving Trained Model with API Server
5. Consuming the Model for Prediction

1. Data Collection

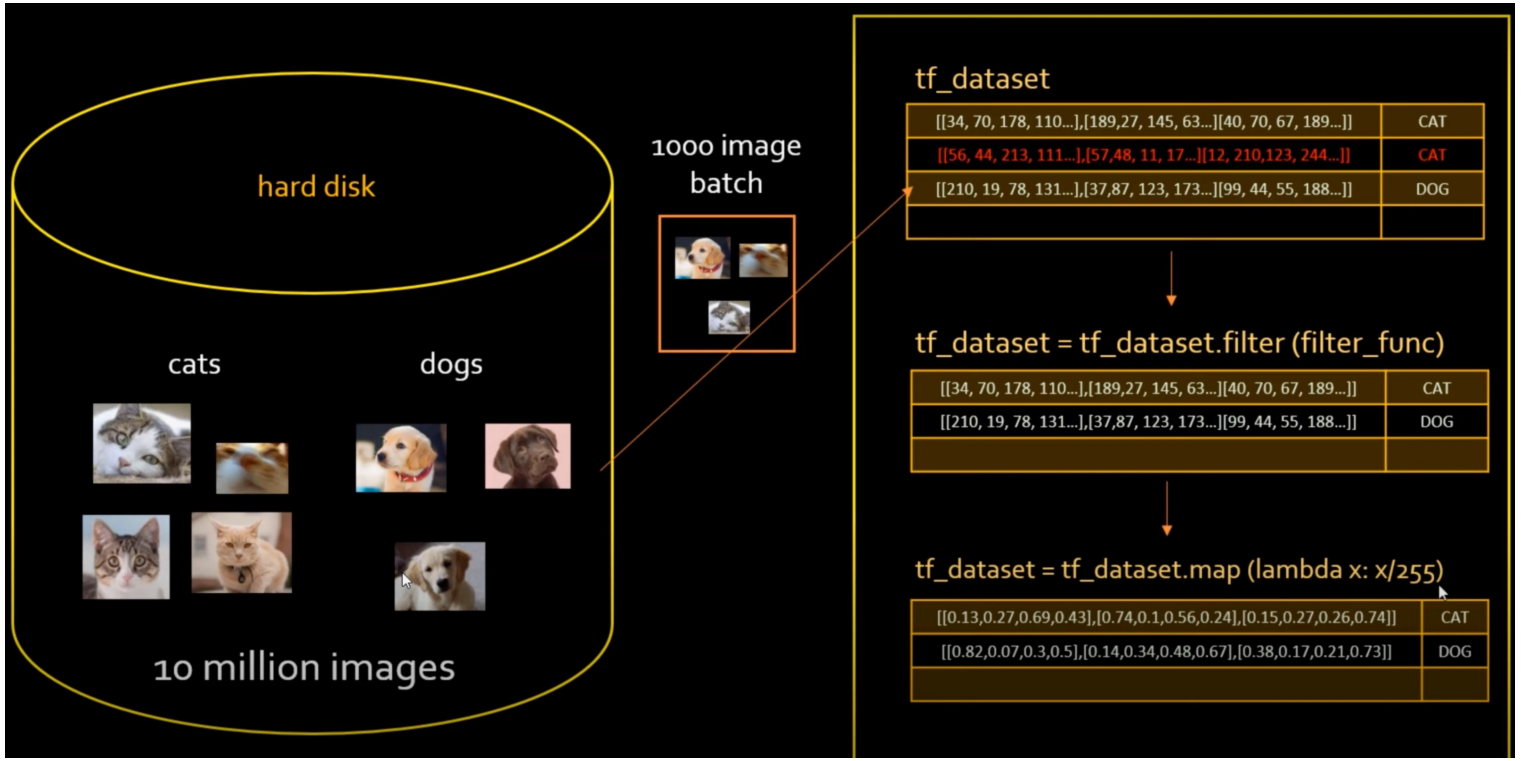
We use different methods to collect data

Data Collection from Internet

- We download the Data from the Internet
- Total Files = 193
- Classified into 3 classes
    1. Ford_Explorer
    2. Lexus_RX350
    3. Toyota_Matrix



Loading data with **tf_dataset** batch_size= 10



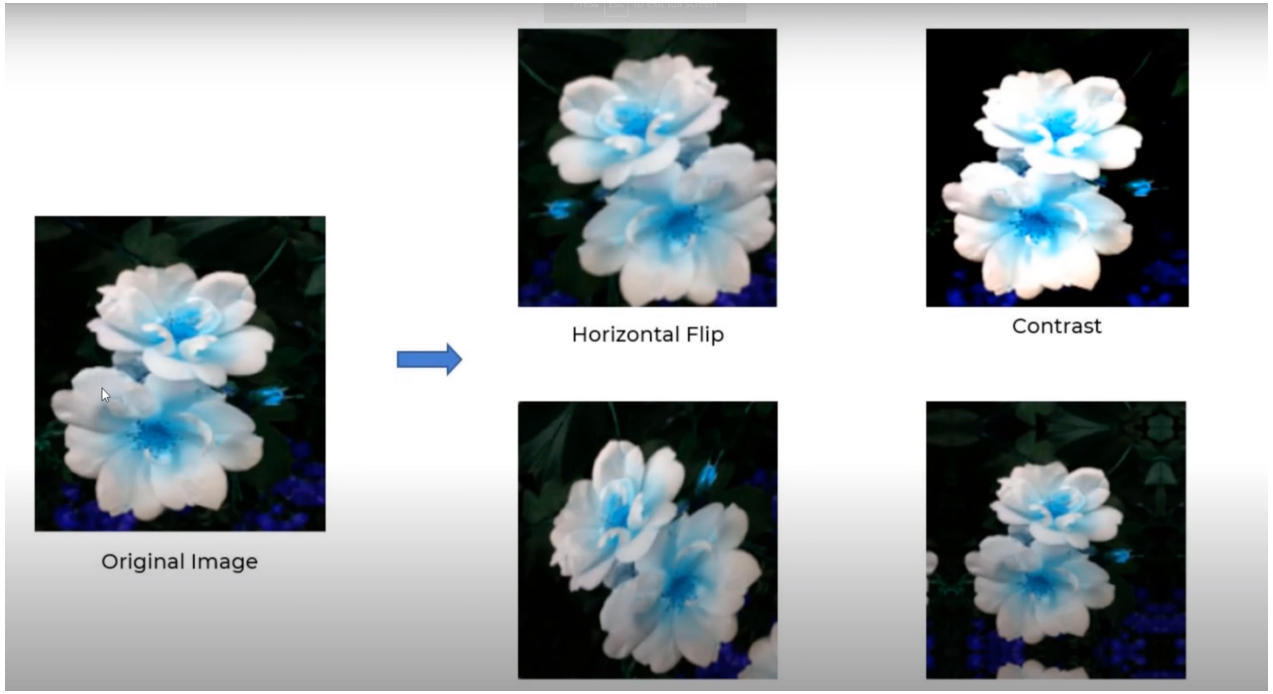
2. Data Preprocessing

We multiply one images into 4-5 images but with different shape and look

Data augmentation Layer is used to multiply an image

- Flip
- Random Zoom
- Random Rotate
- Resize
- Rescale

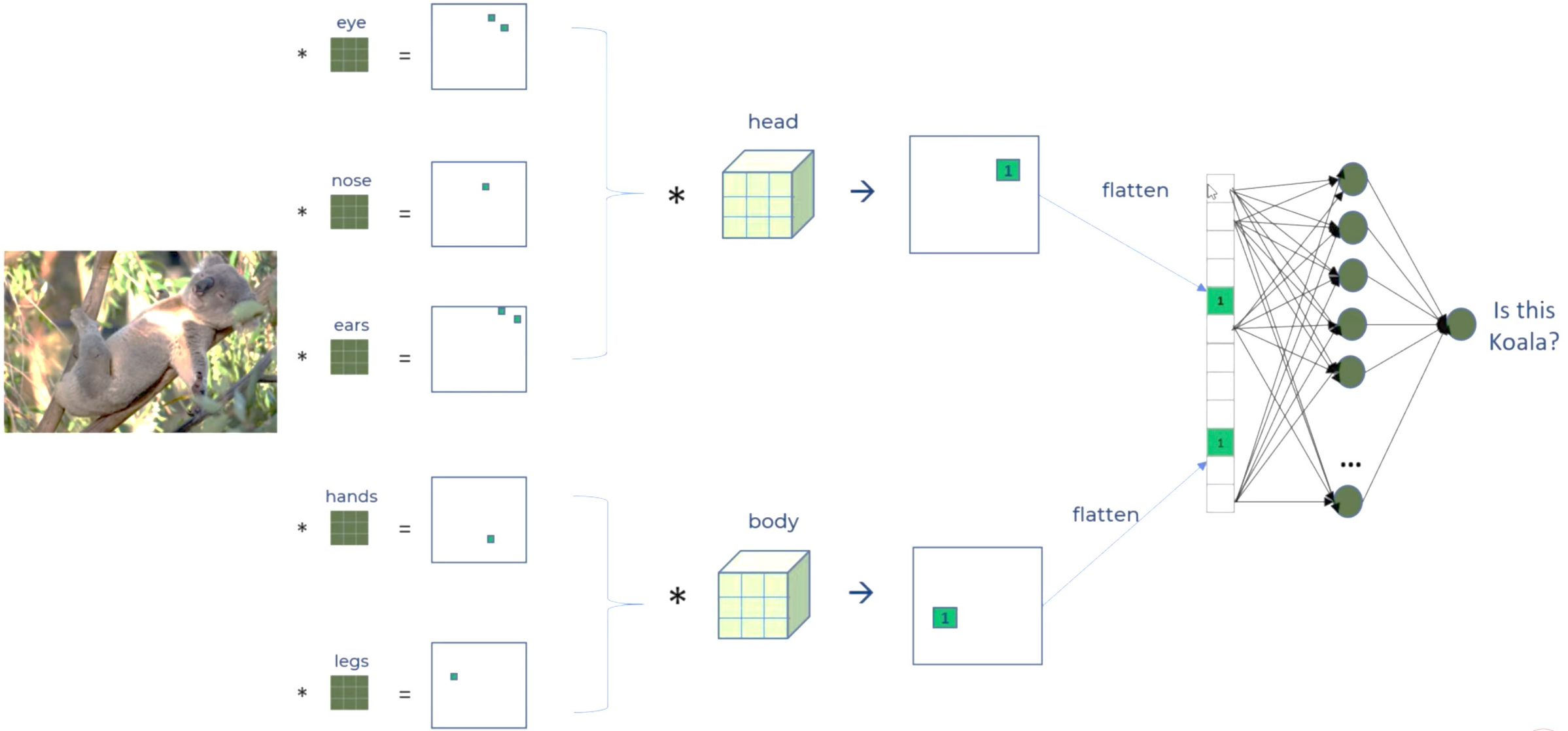
- 80% of data using for training
- 10% for validation
- 10% for testing



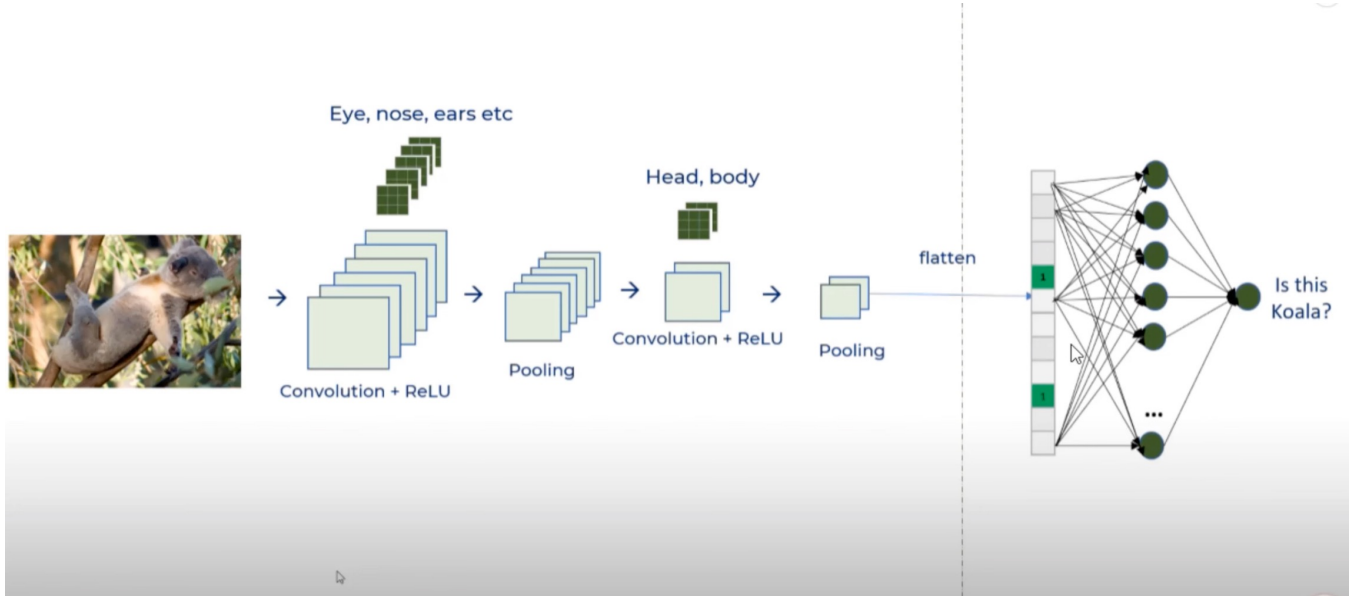
3. Training the Model

We are using Convolutional Neural Network (CNN)
Algorithm to train a model using training sample

Convolutional Neural Network Algorithm



Convolutional Neural Network Layers



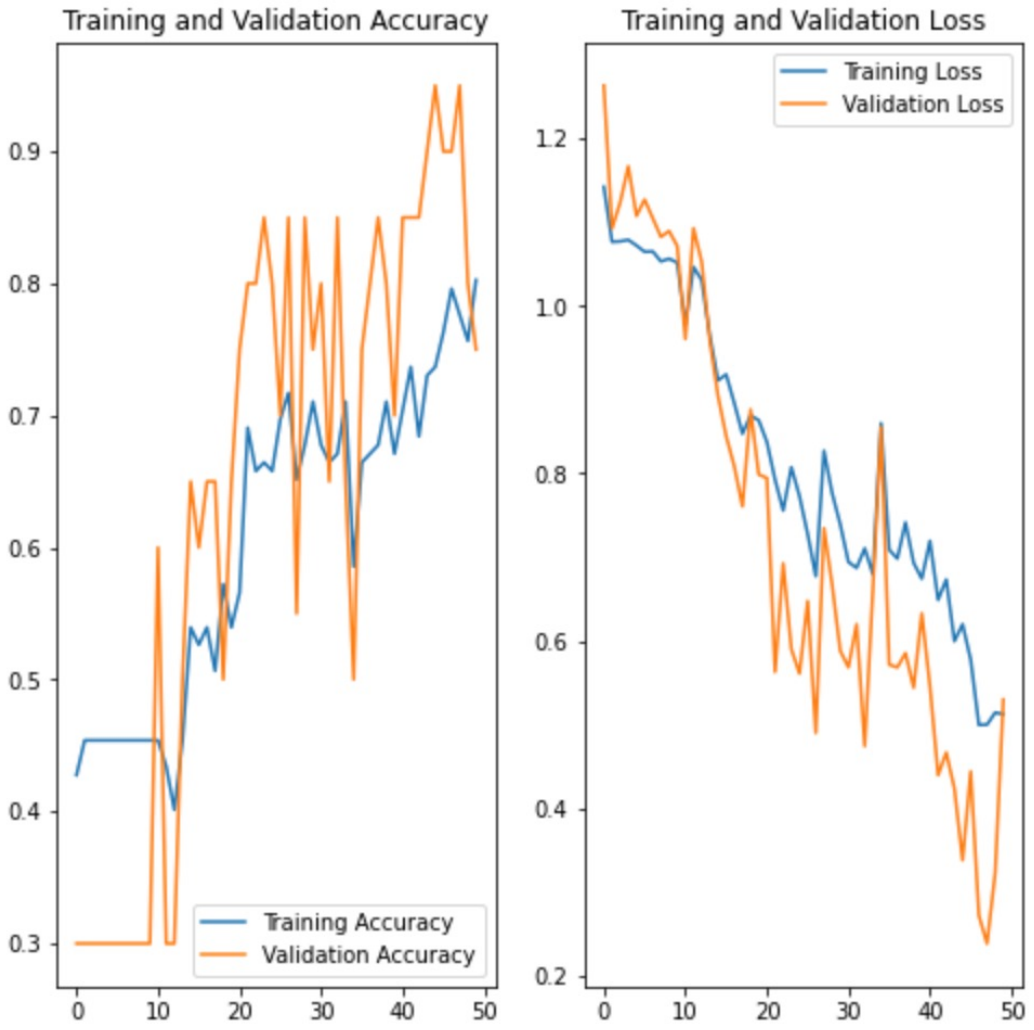

```
model = models.Sequential([
    resize_and_rescale,
    data_augmentation,
    layers.Conv2D(32, (3,3), activation='relu', input_shape
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64,  kernel_size = (3,3), activation='relu
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64,  kernel_size = (3,3), activation='relu
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Conv2D(64, (3, 3), activation='relu'),
    layers.MaxPooling2D((2, 2)),
    layers.Flatten(),
    layers.Dense(64, activation='relu'),
    layers.Dense(n_classes, activation='softmax'),
])

model.build(input_shape=input_shape)
```

Training The Model 50 rounds and validation

```
Epoch 43/50
16/16 [==============================] - 87s 5s/step - loss: 0.6734 - accuracy: 0.6842 - val_loss: 0.4667 - val_accur
acy: 0.8500
Epoch 44/50
16/16 [==============================] - 84s 5s/step - loss: 0.5997 - accuracy: 0.7303 - val_loss: 0.4238 - val_accur
acy: 0.9000
Epoch 45/50
16/16 [==============================] - 87s 5s/step - loss: 0.6199 - accuracy: 0.7368 - val_loss: 0.3381 - val_accur
acy: 0.9500
Epoch 46/50
16/16 [==============================] - 85s 5s/step - loss: 0.5776 - accuracy: 0.7632 - val_loss: 0.4440 - val_accur
acy: 0.9000
Epoch 47/50
16/16 [==============================] - 83s 5s/step - loss: 0.4997 - accuracy: 0.7961 - val_loss: 0.2722 - val_accur
acy: 0.9000
Epoch 48/50
16/16 [==============================] - 85s 5s/step - loss: 0.5000 - accuracy: 0.7763 - val_loss: 0.2386 - val_accur
acy: 0.9500
Epoch 49/50
16/16 [==============================] - 86s 5s/step - loss: 0.5144 - accuracy: 0.7566 - val_loss: 0.3226 - val_accur
acy: 0.8000
Epoch 50/50
16/16 [==============================] - 85s 5s/step - loss: 0.5126 - accuracy: 0.8026 - val_loss: 0.5300 - val_accur
acy: 0.7500
```

```python
history = model.fit(
    train_ds,
    batch_size=BATCH_SIZE,
    validation_data=val_ds,
    verbose=1,
    epochs=50,
)
```

Accuracy Increase steadily toward 90%



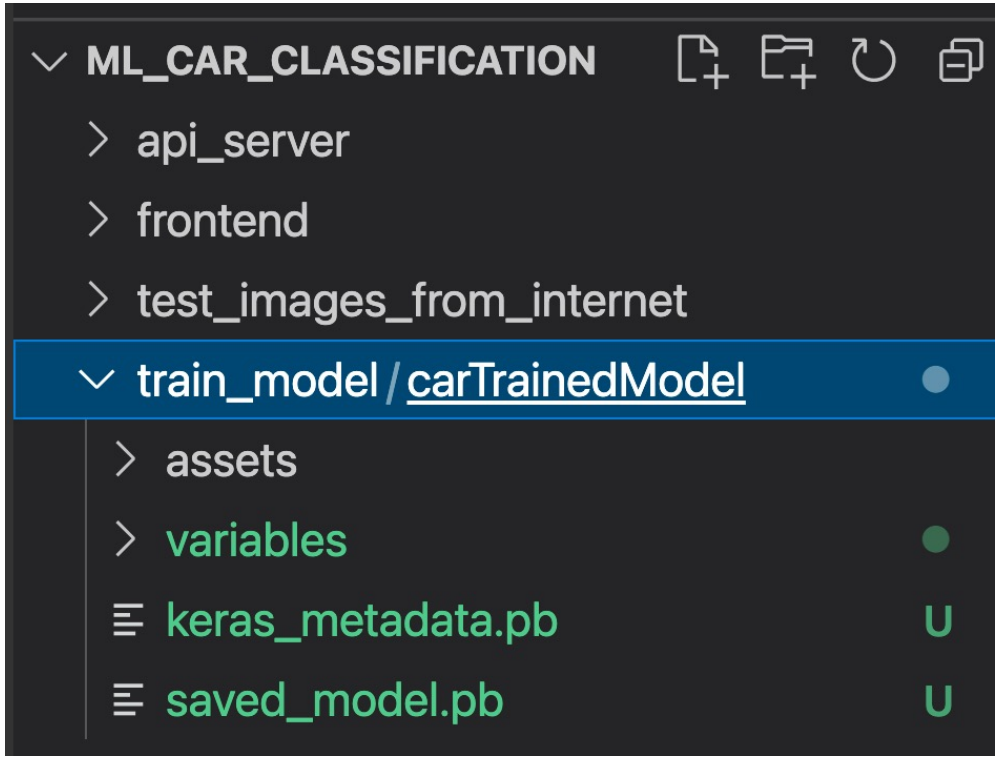
Predicate with Test Sample

In [34]:
```
plt.figure(figsize=(15, 15))
for images, labels in test_ds.take(1):
    for i in range(9):
        ax = plt.subplot(3, 3, i + 1)
        plt.imshow(images[i].numpy().astype("uint8"))

        predicted_class, confidence = predict(model, images[i].numpy())
        actual_class = class_names[labels[i]]

        plt.title(f"Actual: {actual_class},\n Predicted: {predicted_class}.\n Confidence: {confidence}%")

        plt.axis("off")
```

Saving Trained Model

Saving the Model

```
In [36]: model.save(f"../train_model/carTrainedModel")

         INFO:tensorflow:Assets written to: ../train_model/carT
```



API Server

We are using Python FastAPI Server to Serve the post-api with tenserflow (tf)

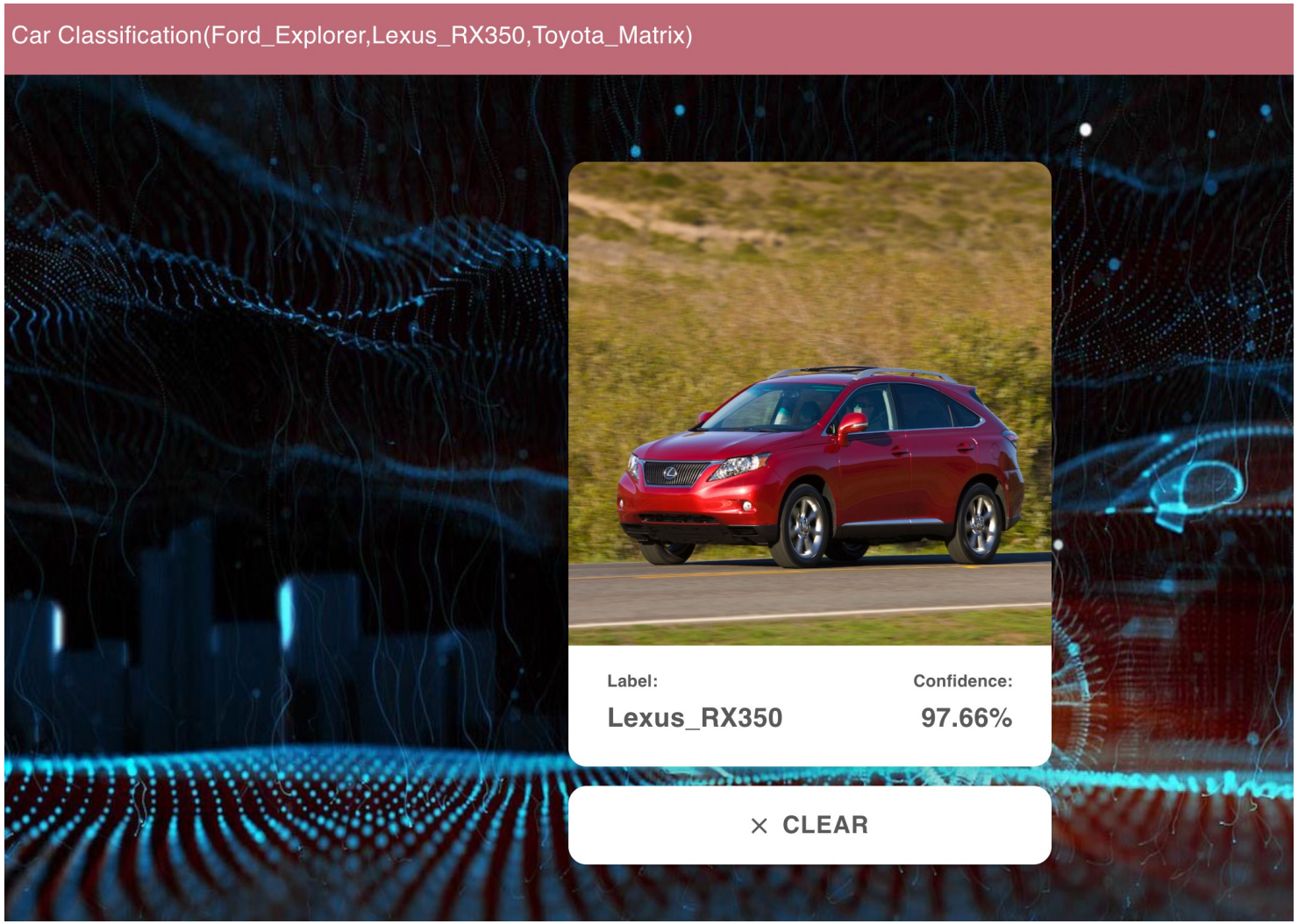
Serving Trained Model with API Server

```python
MODEL = tf.keras.models.load_model("../train_model/carTrainedModel")

CLASS_NAMES = ["Ford_Explorer", "Lexus_RX350", "Toyota_Matrix"]

@app.get("/")
async def ping():
    return "Welcome to Car Classification API "

def read_file_as_image(data) -> np.ndarray:
    image = np.array(Image.open(BytesIO(data)))
    return image

@app.post("/predict")
async def predict(
    file: UploadFile = File(...)
):
    image = read_file_as_image(await file.read())
    img_batch = np.expand_dims(image, 0)

    predictions = MODEL.predict(img_batch)

    predicted_class = CLASS_NAMES[np.argmax(predictions[0])]
    confidence = np.max(predictions[0])
    return {
        'class': predicted_class,
        'confidence': float(confidence)
    }

if __name__ == "__main__":
    uvicorn.run(app, host='localhost', port=8080)
```

4. Consuming API

We use React Javascript Simple App, as simple application to verify the result.

Serving Application with React JS



Thank You