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import tensorflow as tf
from tensorflow.keras.preprocessing.image import ImageDataGenerator
from tensorflow.keras.applications import ResNet50
from tensorflow.keras.models import Model
from tensorflow.keras.layers import Dense, GlobalAveragePooling2D
from sklearn.metrics import classification_report, confusion_matrix
import matplotlib.pyplot as plt
import numpy as np
import os

# Define directories
train_dir = "dataset/train"
val_dir = "dataset/val"
test_dir = "dataset/test"

# Image parameters
IMG_SIZE = 224
BATCH_SIZE = 32

# Data preprocessing
datagen = ImageDataGenerator(rescale=1./255)

train_generator = datagen.flow_from_directory(
    train_dir,
    target_size=(IMG_SIZE, IMG_SIZE),
    batch_size=BATCH_SIZE,
    class_mode='categorical'
)

val_generator = datagen.flow_from_directory(
    val_dir,
    target_size=(IMG_SIZE, IMG_SIZE),
    batch_size=BATCH_SIZE,
    class_mode='categorical'
)

test_generator = datagen.flow_from_directory(
    test_dir,
    target_size=(IMG_SIZE, IMG_SIZE),
    batch_size=BATCH_SIZE,
    class_mode='categorical',
    shuffle=False
)

# Load ResNet50 model without the top layer
base_model = ResNet50(weights='imagenet', include_top=False, input_shape=(IMG_SIZE,
IMG_SIZE, 3))

# Freeze base model
base_model.trainable = False

# Add custom layers
x = base_model.output
x = GlobalAveragePooling2D()(x)

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x = Dense(256, activation='relu')(x)
predictions = Dense(train_generator.num_classes, activation='softmax')(x)

model = Model(inputs=base_model.input, outputs=predictions)

# Compile the model
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])

# Train the model
history = model.fit(
    train_generator,
    epochs=10,
    validation_data=val_generator
)

# Evaluate on test data
loss, accuracy = model.evaluate(test_generator)
print(f"Test Accuracy: {accuracy*100:.2f}%")

# Classification report
y_pred = model.predict(test_generator)
y_pred_classes = np.argmax(y_pred, axis=1)
y_true = test_generator.classes

print("Classification Report:")
print(classification_report(y_true, y_pred_classes,
target_names=test_generator.class_indices.keys()))

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