

```

from google.colab import drive
drive.mount('/content/drive')

import zipfile, os, shutil

# Extract the dataset from Drive
zip_ref = zipfile.ZipFile('/content/drive/MyDrive/dataset.zip', 'r')
zip_ref.extractall()
zip_ref.close()

print("✅ Dataset extracted successfully!")

```

Mounted at /content/drive
 ✅ Dataset extracted successfully!

```

import os, shutil

def rename_folders(base_dir):
    for crop in os.listdir(base_dir):
        crop_path = os.path.join(base_dir, crop)
        if not os.path.isdir(crop_path):
            continue

        for condition in os.listdir(crop_path):
            old_path = os.path.join(crop_path, condition)
            if not os.path.isdir(old_path):
                continue

            new_folder_name = f"{crop}_{condition}"
            new_path = os.path.join(base_dir, new_folder_name)

            if os.path.exists(new_path):
                for file in os.listdir(old_path):
                    shutil.move(os.path.join(old_path, file), new_path)
                os.rmdir(old_path)
            else:
                shutil.move(old_path, new_path)

        if not os.listdir(crop_path):
            os.rmdir(crop_path)

base_dir = "/content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset"
rename_folders(base_dir)
print("✅ Dataset folders renamed successfully!")

```

✅ Dataset folders renamed successfully!

Start coding or [generate](#) with AI.

```

import os
import shutil
import numpy as np
import torch
import matplotlib.pyplot as plt
from PIL import Image
from PIL import ImageFile # 🐡 add this
from sklearn.model_selection import train_test_split
from torchvision import transforms, datasets
from torch.utils.data import DataLoader

# 🐡 add this line here
ImageFile.LOAD_TRUNCATED_IMAGES = True

```

```

IMAGE_SIZE = 224
PATCH_SIZE = 16

```

```

# Verify Images Function
def verify_images(directory):
    broken_images = []
    for root, _, files in os.walk(directory):
        for file in files:
            file_path = os.path.join(root, file)
            try:
                img = Image.open(file_path)

```

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        img.verify()
    except Exception as e:
        print(f" Corrupted image: {file_path} | Error: {e}")
        broken_images.append(file_path)
    return broken_images

```

```

# Train/Validation Split (fixed to stay inside dataset folder)
def split_dataset(base_dir, val_ratio=0.15):
    val_base_dir = os.path.join(base_dir, "Validation")

    classes = os.listdir(base_dir)
    for cls in classes:
        cls_path = os.path.join(base_dir, cls)
        if not os.path.isdir(cls_path):
            continue
        if cls == "Validation": # skip if Validation already exists
            continue

        images = [f for f in os.listdir(cls_path) if f.lower().endswith(('.jpg', '.jpeg', '.png'))]
        if len(images) == 0:
            print(f"⚠ No images found in {cls_path}")
            continue

        train_imgs, val_imgs = train_test_split(images, test_size=val_ratio, random_state=42)

        # Create validation dir for this class
        val_dir = os.path.join(val_base_dir, cls)
        os.makedirs(val_dir, exist_ok=True)

        # Move validation images
        for img in val_imgs:
            shutil.move(os.path.join(cls_path, img), os.path.join(val_dir, img))

        print(f"✅ Moved {len(val_imgs)} images to {val_dir}")

```

```

mean_vals = [0.485, 0.456, 0.406]
std_vals = [0.229, 0.224, 0.225]

```

```

train_transforms = transforms.Compose([
    transforms.Resize((IMAGE_SIZE, IMAGE_SIZE)),
    transforms.ToTensor(),
    transforms.Normalize(mean=mean_vals, std=std_vals)
])

val_transforms = transforms.Compose([
    transforms.Resize((IMAGE_SIZE, IMAGE_SIZE)),
    transforms.ToTensor(),
    transforms.Normalize(mean=mean_vals, std=std_vals)
])

```

```

# Load Dataset
def load_datasets(train_path, val_path):
    train_dataset = datasets.ImageFolder(train_path, transform=train_transforms)
    val_dataset = datasets.ImageFolder(val_path, transform=val_transforms)
    train_loader = DataLoader(train_dataset, batch_size=8, shuffle=True)
    val_loader = DataLoader(val_dataset, batch_size=8, shuffle=False)
    return train_loader, val_loader, train_dataset.classes

```

```

# Convert Image Batch to ViT Patches
def image_to_patches(img_batch, patch_size):
    B, C, H, W = img_batch.shape # Batch Size, Channels, Height, Width
    patches = img_batch.unfold(2, patch_size, patch_size).unfold(3, patch_size, patch_size)
    patches = patches.permute(0, 2, 3, 1, 4, 5).contiguous().view(B, -1, C * patch_size * patch_size)
    return patches # Shape: (Batch, Num_Patches, Flattened Patch Size)

```

```

# Display Sample Images with Patches
def imshow_batch(loader, classes):
    dataiter = iter(loader)
    images, labels = next(dataiter)

    def unnormalize(img):
        std_tensor = torch.tensor(std_vals).view(3, 1, 1)
        mean_tensor = torch.tensor(mean_vals).view(3, 1, 1)
        img = img * std_tensor + mean_tensor # Reverse normalization
        return img.clamp(0, 1) # Clip values between 0-1

    fig, axes = plt.subplots(1, 8, figsize=(20, 3))
    for i in range(8):

```

```

        img = unnormalize(images[i]).permute(1, 2, 0).numpy()
        axes[i].imshow(img)
        axes[i].set_title(classes[labels[i]])
        axes[i].axis('off')
    plt.show()
# Convert to Patches for ViT
    patches = image_to_patches(images, PATCH_SIZE)
    print(f"Patches Shape: {patches.shape}") # (Batch, Num_Patches, Flattened Patch Size)

# Run Pipeline
dataset_path = "/content/Dataset for Crop Pest and Disease Detection"
train_path = os.path.join(dataset_path, "Train")
val_path = os.path.join(dataset_path, "Test")

```

```

import torch
import torch.nn as nn
import torch.optim as optim
from torchvision import transforms, datasets
from torch.utils.data import DataLoader
import timm # Import timm here
from torch.utils.data import random_split # Import random_split
import os # Import os

# Device
device = torch.device("cuda" if torch.cuda.is_available() else "cpu")

# Normalization values (standard for ImageNet)
mean_vals = [0.485, 0.456, 0.406]
std_vals = [0.229, 0.224, 0.225]

# Image preprocessing (using transforms defined earlier for consistency)
# Assuming train_transforms are suitable for both train and test for initial loading
IMAGE_SIZE = 224 # Define IMAGE_SIZE here
transform = transforms.Compose([
    transforms.Resize((IMAGE_SIZE, IMAGE_SIZE)),
    transforms.ToTensor(),
    transforms.Normalize(mean_vals, std_vals) # Using mean_vals and std_vals defined earlier
])

# Dataset paths
dataset_root = "/content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset"

# Check if the dataset directory exists
if not os.path.exists(dataset_root):
    print(f"Error: Dataset directory not found at {dataset_root}")
else:
    # Load full dataset to split
    full_dataset = datasets.ImageFolder(dataset_root, transform=transform)

    class_names = full_dataset.classes
    print("Class Labels:", class_names)

    num_classes = len(full_dataset.classes)

    # Load pretrained MobileViT from timm
    model = timm.create_model("mobilevit_xxs", pretrained=True, num_classes=num_classes)
    model.to(device)

    # Dataloaders (Splitting the full dataset into train and test)
    train_size = int(0.8 * len(full_dataset))
    val_size = len(full_dataset) - train_size
    train_dataset, test_dataset = random_split(full_dataset, [train_size, val_size]) # Using test_dataset for co

    train_loader = DataLoader(train_dataset, batch_size=16, shuffle=True)
    test_loader = DataLoader(test_dataset, batch_size=16, shuffle=False)

    # Loss & Optimizer
    criterion = nn.CrossEntropyLoss()
    optimizer = optim.Adam(model.parameters(), lr=1e-4)

    print("✅ Model and Dataloaders initialized successfully!")

    # Train and evaluate the model
    # Removed the calls to train_model and evaluate_model from here

```

Class Labels: ['Cashew_anthracnose', 'Cashew_gumosis', 'Cashew_healthy', 'Cashew_leaf miner', 'Cashew_red rust',
/usr/local/lib/python3.12/dist-packages/huggingface_hub/utils/_auth.py:94: UserWarning:
The secret 'HF_TOKEN' does not exist in your Colab secrets.
To authenticate with the Hugging Face Hub, create a token in your settings tab (<https://huggingface.co/settings/t>)
You will be able to reuse this secret in all of your notebooks.
Please note that authentication is recommended but still optional to access public models or datasets.
warnings.warn(
model.safetensors: 100% 5.14M/5.14M [00:01<00:00, 22.0kB/s]
✔ Model and DataLoaders initialized successfully!

```
# Clean dataset from corrupt images
corrupt_files = verify_images(dataset_path)
if corrupt_files:
    print(f"△ Found {len(corrupt_files)} corrupt images. Removing them...")
    for f in corrupt_files:
        try:
            os.remove(f)
            print(f"Removed: {f}")
        except Exception as e:
            print(f"Error removing {f}: {e}")
else:
    print("✔ No corrupt images found!")

# Rebuild datasets and loaders after cleanup
full_dataset = datasets.ImageFolder(dataset_path, transform=train_transforms)

train_size = int(0.8 * len(full_dataset))
val_size = len(full_dataset) - train_size
train_dataset, val_dataset = torch.utils.data.random_split(full_dataset, [train_size, val_size])

train_loader = DataLoader(train_dataset, batch_size=8, shuffle=True, num_workers=2)
val_loader = DataLoader(val_dataset, batch_size=8, shuffle=False, num_workers=2)

print("✔ Dataloaders rebuilt successfully")
```

```
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf blight/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf blight/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf blight/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf blight/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf blight/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf blight/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_healthy/hea
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_healthy/hea
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_healthy/heal
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_healthy/heal
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf blight/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf blight/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf blight/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf blight/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf blight/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf blight/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf beetle/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf beetle/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf beetle/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf beetle/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf beetle/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf beetle/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf beetle/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf beetle/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf beetle/
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_streak virus,
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_streak virus,
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_streak virus,
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_streak virus,
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_streak virus,
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf curl/l
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf curl/l
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf curl/l
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf spot/le:
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf spot/le:
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf spot/le:
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf spot/le:
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf spot/le:
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf spot/le:
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf spot/le:
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf spot/le:
```

```
Corrupted image: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Maize_leaf spot/le
△ Found 50 corrupt images. Removing them...
Removed: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf blight/leaf bli
Removed: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf blight/leaf bli
Removed: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf blight/leaf bli
Removed: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf blight/leaf bli
Removed: /content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset/Tomato_leaf blight/leaf bli
```

```
# Define paths
dataset_path = "/content/Dataset for Crop Pest and Disease Detection/Raw Data/CCMT Dataset"

# Verify images before processing
print("Verifying images...")
broken_images = verify_images(dataset_path)
if broken_images:
    print(f"Found {len(broken_images)} broken images. Consider removing them.")
    # Optionally add code here to remove or quarantine broken_images
else:
    print("All images verified successfully.")

# Train/Validation split handled automatically by torch.utils.data.random_split
full_dataset = datasets.ImageFolder(dataset_path, transform=train_transforms)

# 80/20 split
train_size = int(0.8 * len(full_dataset))
val_size = len(full_dataset) - train_size
train_dataset, val_dataset = torch.utils.data.random_split(full_dataset, [train_size, val_size])

train_loader = DataLoader(train_dataset, batch_size=8, shuffle=True)
val_loader = DataLoader(val_dataset, batch_size=8, shuffle=False)

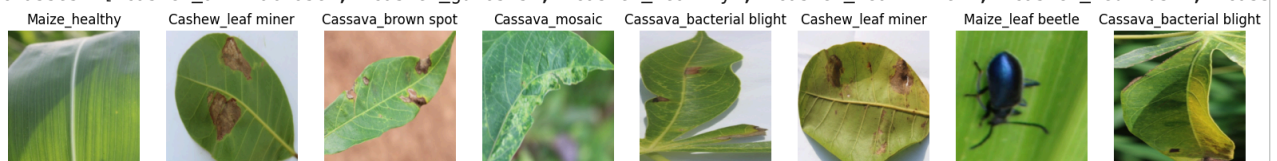
class_names = full_dataset.classes
print("Classes:", class_names)

# Show a sample batch
imshow_batch(train_loader, class_names)
```

Verifying images...

All images verified successfully.

Classes: ['Cashew_anthraco', 'Cashew_gumosis', 'Cashew_healthy', 'Cashew_leaf miner', 'Cashew_red rust', 'Cass



Patches Shape: torch.Size([8, 196, 768])

```
!pip install -q torch torchvision torchaudio tqdm scikit-learn matplotlib
```

```
import os, random, numpy as np
import torch
import torch.nn as nn
import torch.optim as optim
from torch.utils.data import DataLoader
from torchvision import transforms, models
from torchvision.datasets import ImageFolder
from sklearn.metrics import classification_report, confusion_matrix
from tqdm import tqdm
import matplotlib.pyplot as plt
from PIL import Image
```

```
seed = 42
random.seed(seed)
np.random.seed(seed)
torch.manual_seed(seed)
torch.cuda.manual_seed_all(seed)
```

```
device = torch.device("cuda" if torch.cuda.is_available() else "cpu")
print("🚀 Using device:", device)
```

🚀 Using device: cuda

```
IMG_SIZE = 224
BATCH_SIZE = 32
```

```
# Use the datasets created in cell BtKYEQSKi07R
# train_dir = os.path.join(extract_path, 'train')
# val_dir = os.path.join(extract_path, 'val')
# test_dir = os.path.join(extract_path, 'test')

# train_dataset = ImageFolder(train_dir, transform=train_transform)
# val_dataset = ImageFolder(val_dir, transform=val_test_transform)
# test_dataset = ImageFolder(test_dir, transform=val_test_transform)

train_loader = DataLoader(train_dataset, batch_size=BATCH_SIZE, shuffle=True)
val_loader = DataLoader(val_dataset, batch_size=BATCH_SIZE, shuffle=False)
test_loader = DataLoader(test_dataset, batch_size=BATCH_SIZE, shuffle=False)

class_names = full_dataset.classes # Use class names from the full dataset
print("✅ Classes:", class_names)
print(f"📊 Train: {len(train_dataset)} | Val: {len(val_dataset)} | Test: {len(test_dataset)}")
```

✅ Classes: ['Cashew_anthrachnose', 'Cashew_gumosis', 'Cashew_healthy', 'Cashew_leaf miner', 'Cashew_red rust', 'C
📊 Train: 20136 | Val: 5034 | Test: 5044

```
model = models.efficientnet_v2_s(weights='IMAGENET1K_V1')
in_features = model.classifier[1].in_features
model.classifier[1] = nn.Linear(in_features, len(class_names))
model = model.to(device)

criterion = nn.CrossEntropyLoss()
optimizer = optim.AdamW(model.parameters(), lr=1e-4, weight_decay=1e-2)
scheduler = torch.optim.lr_scheduler.ReduceLROnPlateau(optimizer, mode='max', factor=0.5, patience=5)

print("✅ Model loaded and ready for training!")
```

Downloading: "https://download.pytorch.org/models/efficientnet_v2_s-dd5fe13b.pth" to /root/.cache/torch/hub/check
100%|██████████| 82.7M/82.7M [00:00<00:00, 135MB/s]
✅ Model loaded and ready for training!

```
EPOCHS = 1
best_val_acc = 0.0
save_path = '/content/efficientnetv2_ccmt_best.pth'

for epoch in range(1, EPOCHS+1):
    model.train()
    running_loss = 0.0
    pbar = tqdm(train_loader, desc=f"Epoch {epoch}/{EPOCHS}")
    for imgs, labels in pbar:
        imgs, labels = imgs.to(device), labels.to(device)
        optimizer.zero_grad()
        outputs = model(imgs)
        loss = criterion(outputs, labels)
        loss.backward()
        optimizer.step()
        running_loss += loss.item()
        pbar.set_postfix({'loss': running_loss/len(pbar)})
    avg_train_loss = running_loss / len(train_loader)

    # Validation
    model.eval()
    correct, total = 0, 0
    with torch.no_grad():
        for imgs, labels in val_loader:
            imgs, labels = imgs.to(device), labels.to(device)
            outputs = model(imgs)
            _, preds = torch.max(outputs, 1)
            correct += (preds == labels).sum().item()
            total += labels.size(0)
    val_acc = correct / total
    scheduler.step(val_acc)

    print(f"📊 Epoch {epoch}: TrainLoss={avg_train_loss:.4f} | ValAcc={val_acc:.4f}")

    if val_acc > best_val_acc:
        best_val_acc = val_acc
        torch.save(model.state_dict(), save_path)
        print(f"📁 Best model saved (ValAcc={val_acc:.4f})")
```

Epoch 1/1: 100%|██████████| 630/630 [05:15<00:00, 2.00it/s, loss=0.715]
📊 Epoch 1: TrainLoss=0.7147 | ValAcc=0.8788
📁 Best model saved (ValAcc=0.8788)

```
# ✅ Evaluate Total Accuracy
from sklearn.metrics import accuracy_score
from torch.utils.data import DataLoader # Import DataLoader here

# Rebuild the test loader after removing corrupt images
# Assuming full_dataset, train_size, and val_size are defined in previous cells
# and that the corrupt images have been removed from the dataset directory
full_dataset = datasets.ImageFolder(dataset_path, transform=train_transforms)

train_size = int(0.8 * len(full_dataset))
val_size = len(full_dataset) - train_size
# We are only interested in the test set for evaluation
_, test_dataset = torch.utils.data.random_split(full_dataset, [train_size, val_size])

test_loader = DataLoader(test_dataset, batch_size=BATCH_SIZE, shuffle=False, num_workers=2) # Recreate test_loader

# Load the best model weights
model.load_state_dict(torch.load(save_path, map_location=device))

model.eval()
all_preds = []
all_labels = []

with torch.no_grad():
    for images, labels in test_loader:
        images, labels = images.to(device), labels.to(device)
        outputs = model(images)
        _, preds = torch.max(outputs, 1)
        all_preds.extend(preds.cpu().numpy())
        all_labels.extend(labels.cpu().numpy())

accuracy = accuracy_score(all_labels, all_preds)
print(f"\n✅ Total Test Accuracy: {accuracy * 100:.2f}%")
```

✅ Total Test Accuracy: 90.56%

```
model.load_state_dict(torch.load(save_path, map_location=device))
model.eval()

y_true, y_pred = [], []
with torch.no_grad():
    for imgs, labels in tqdm(test_loader, desc="Testing"):
        imgs = imgs.to(device)
        outputs = model(imgs)
        _, preds = torch.max(outputs, 1)
        y_true.extend(labels.numpy())
        y_pred.extend(preds.cpu().numpy())

print("\n✅ Testing complete!")
print(classification_report(y_true, y_pred, target_names=class_names, digits=4))
```

Testing: 100%|██████████| 158/158 [00:24<00:00, 6.56it/s]

✅ Testing complete!

	precision	recall	f1-score	support
Cashew_anthrachnose	0.9813	0.9347	0.9574	337
Cashew_gumosis	0.9759	1.0000	0.9878	81
Cashew_healthy	0.9599	1.0000	0.9795	287
Cashew_leaf miner	0.9737	0.9774	0.9755	265
Cashew_red rust	0.9852	0.9911	0.9881	336
Cassava_bacterial blight	0.9326	0.9752	0.9534	525
Cassava_brown spot	0.9723	0.9322	0.9518	339
Cassava_green mite	0.9409	0.9646	0.9526	198
Cassava_healthy	0.9919	0.9801	0.9860	251
Cassava_mosaic	0.9904	0.9452	0.9673	219
Maize_fall armyworm	0.9778	0.9565	0.9670	46
Maize_grasshoper	0.9921	1.0000	0.9960	125
Maize_healthy	0.8966	0.7879	0.8387	33
Maize_leaf beetle	0.9892	0.9734	0.9812	188
Maize_leaf blight	0.7488	0.8610	0.8010	187
Maize_leaf spot	0.7991	0.7609	0.7795	230
Maize_streak virus	0.9030	0.8563	0.8791	174
Tomato_healthy	0.9109	0.9892	0.9485	93
Tomato_leaf blight	0.6181	0.7599	0.6817	279
Tomato_leaf curl	0.8933	0.6837	0.7746	98
Tomato_septoria leaf spot	0.8619	0.8196	0.8402	571
Tomato_verticulium wilt	0.7483	0.6395	0.6897	172
accuracy			0.9056	5034
macro avg	0.9111	0.8995	0.9035	5034

weighted avg	0.9092	0.9056	0.9061	5034
--------------	--------	--------	--------	------

```
# -----
# ✅ Step 8: Predict on Multiple Images
# -----
from PIL import Image
import matplotlib.pyplot as plt
import numpy as np
import torch
from torchvision import transforms

# Make sure class_names and device are already defined
# Example: class_names = train_data.classes

def predict_images(image_paths):
    transform = transforms.Compose([
        transforms.Resize((IMG_SIZE, IMG_SIZE)),
        transforms.ToTensor(),
        transforms.Normalize(mean=[0.485, 0.456, 0.406], std=[0.229, 0.224, 0.225])
    ])

    model.eval()

    for image_path in image_paths:
        try:
            img = Image.open(image_path).convert('RGB')
            x = transform(img).unsqueeze(0).to(device)

            with torch.no_grad():
                outputs = model(x)
                probs = torch.softmax(outputs, dim=1).cpu().numpy()[0]
                pred_idx = np.argmax(probs)
                pred_class = class_names[pred_idx]

            plt.imshow(img)
            plt.axis('off')
            plt.title(f"Predicted: {pred_class} ({probs[pred_idx]*100:.2f}%)")
            plt.show()

            print(f"\nTop-3 Predictions for {image_path}:")
            for i in np.argsort(probs)[-3:][::-1]:
                print(f"{class_names[i]:20s} : {probs[i]*100:.2f}%")

        except FileNotFoundError:
            print(f"Error: Image not found at {image_path}")
        except Exception as e:
            print(f"Error processing {image_path}: {e}")

# 💡 Input Block
image_paths_input = input("Enter leaf image paths (comma separated): ")
image_paths_to_predict = [path.strip() for path in image_paths_input.split(',')]
predict_images(image_paths_to_predict)
```

Enter leaf image paths (comma separated): /content/drive/MyDrive/OIP (1).webp,/content/drive/MyDrive/disease1_.

Predicted: Maize_healthy (83.00%)



Top-3 Predictions for /content/drive/MyDrive/OIP (1).webp:

Maize_healthy	: 83.00%
Maize_leaf spot	: 11.83%
Maize_streak virus	: 3.41%

Predicted: Cashew_leaf miner (91.38%)

