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#zoom random 5e-4 500 epochs then 1100

#Have commented out a lot of print statements to try and save time
#03/07/25 Code updated to remove z score norm and check channel dims
#LR scheduler added
#Stratified split not random
#27/06/25 PVA calcs added and to print at end of all training done

import os
import re
import torch
import numpy as np
import torch.nn as nn
import torch.optim as optim
from collections import Counter
from torch.utils.data import Dataset, DataLoader
from torchvision import transforms
import torchvision.models
from sklearn.model_selection import train_test_split
import timm
import matplotlib.pyplot as plt
from google.colab import files
uploaded = files.upload()
import sys
from math import sqrt
#From [name of imported file] import [name of class within that file]
from MBConvBlock import MBConvBlock
#From [name of imported file] import [name of class within that file]
from ScaledDotProductAttention import ScaledDotProductAttention
sys.path.append('.')
from torch.utils.data import random_split
from sklearn.metrics import confusion_matrix
import seaborn as sns
from sklearn.metrics import classification_report
from torch.utils.data import Subset
from torch.optim import lr_scheduler
from torch.nn.functional import pad
from torch.optim import lr_scheduler
import random

# Set device to GPU if available
device = torch.device("cuda" if torch.cuda.is_available() else "cpu")
def set_seed(seed=42):
    random.seed(seed)
    np.random.seed(seed)
    torch.manual_seed(seed)
    torch.cuda.manual_seed(seed)
    torch.backends.cudnn.deterministic = True
    torch.backends.cudnn.benchmark = False

set_seed(42)
#The pre-processing pipeline already performed z-score normalisation and channel changes, therefore
#the tensors being loaded are already shape [1, 224, 224]

def extract_number(filename):
    """Extracts numbers for sorting files like 'file_23.pt'."""
    match = re.search(r'(\d+)', filename)
    return int(match.group(1)) if match else 0

def generate_labels_from_filenames(mel_spectrogram_files, files_per_class=500):
    """
    Generates integer class labels based on file order.
    Example: 0 for first 25 files, 1 for next 25, etc.
    """
    mel_spectrogram_files.sort(key=extract_number)
    labels = [idx // files_per_class for idx in range(len(mel_spectrogram_files))]

    for idx, file in enumerate(mel_spectrogram_files):
        print(f"File: {file}, Label: {labels[idx]}")
    return labels

def check_labels(mel_spectrogram_files, labels):
    print("Checking file-label mapping:")
    for file, label in zip(mel_spectrogram_files, labels):
        print(f"File: {file} -> Label: {label}")

def collate_pad(batch):
    tensors, labels = zip(*batch)

    # Find max time dimension
    max_len = max(tensor.shape[-1] for tensor in tensors)

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# Pad all tensors to max_len
padded_tensors = []
for tensor in tensors:
    pad_len = max_len - tensor.shape[-1]
    padded_tensor = pad(tensor, (0, pad_len)) # pad last dimension
    padded_tensors.append(padded_tensor)

return torch.stack(padded_tensors), torch.tensor(labels)
class MelSpectrogramDataset(Dataset):
    def __init__(self, mel_spectrogram_dir, mel_spectrogram_files, labels, transform=None):
        self.mel_spectrogram_files = mel_spectrogram_files
        self.labels = labels
        self.transform = transform
        self.mel_spectrogram_dir = mel_spectrogram_dir

        if len(self.mel_spectrogram_files) != len(self.labels):
            raise ValueError("Mismatch between number of files and labels.")

    def __len__(self):
        return len(self.mel_spectrogram_files)

    def __getitem__(self, idx):
        file_name = self.mel_spectrogram_files[idx]
        path = os.path.join(self.mel_spectrogram_dir, file_name)

        mel = torch.load(path)
        label = int(self.labels[idx]) # Ensure label is integer
        #shouldn't need this next line anymore as my tensors should be
        #shape 1, 224, 224
        #if len(mel.shape) == 2:
        #    mel = mel.unsqueeze(0) # [1, H, W] - #✅ # Add channel dimensions i.e. change from [224, 224] to [1, 224, 224]

        # if self.transform:
        #    mel = nn.functional.interpolate(mel.unsqueeze(0), size=(224, 224), mode='bilinear', align_corners=False).squeeze(0)
        #    mel = self.transform(mel) # Resize + Normalize

        if mel.shape[0] == 1:
            mel = mel.repeat(3, 1, 1) #Duplicate channels to match CoAtNet input ([3, H, W]) i.e. [3, 224, 224]
        #print(f"Tensor shape in Dataset __getitem__: {mel.shape}") #Check that tensor is [3, 224, 224]
        return mel, label

class CoAtNet(nn.Module):
    def __init__(self, in_ch, image_size, num_classes=36, out_chs=[64,96,192,384,768]):
        super(CoAtNet, self).__init__()
        self.out_chs = out_chs
        self.maxpool2d = nn.MaxPool2d(kernel_size=2, stride=2)
        self.maxpool1d = nn.MaxPool1d(kernel_size=2, stride=2)

        self.s0 = nn.Sequential(
            nn.Conv2d(in_ch, in_ch, kernel_size=3, padding=1),
            nn.ReLU(),
            nn.Conv2d(in_ch, in_ch, kernel_size=3, padding=1)
        )
        self.mlp0 = nn.Sequential(
            nn.Conv2d(in_ch, out_chs[0], kernel_size=1),
            nn.ReLU(),
            nn.Conv2d(out_chs[0], out_chs[0], kernel_size=1)
        )
        self.s1 = MBConvBlock(ksize=3, input_filters=out_chs[0], output_filters=out_chs[0], image_size=image_size//2)
        self.mlp1 = nn.Sequential(
            nn.Conv2d(out_chs[0], out_chs[1], kernel_size=1),
            nn.ReLU(),
            nn.Conv2d(out_chs[1], out_chs[1], kernel_size=1)
        )
        self.s2 = MBConvBlock(ksize=3, input_filters=out_chs[1], output_filters=out_chs[1], image_size=image_size//4)
        self.mlp2 = nn.Sequential(
            nn.Conv2d(out_chs[1], out_chs[2], kernel_size=1),
            nn.ReLU(),
            nn.Conv2d(out_chs[2], out_chs[2], kernel_size=1)
        )
        self.s3 = ScaledDotProductAttention(out_chs[2], out_chs[2]//8, out_chs[2]//8, 8)
        self.mlp3 = nn.Sequential(
            nn.Linear(out_chs[2], out_chs[3]),
            nn.ReLU(),
            nn.Linear(out_chs[3], out_chs[3])
        )
        self.s4 = ScaledDotProductAttention(out_chs[3], out_chs[3]//8, out_chs[3]//8, 8)
        self.mlp4 = nn.Sequential(
            nn.Linear(out_chs[3], out_chs[4]),
            nn.ReLU(),
            nn.Linear(out_chs[4], out_chs[4])

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)

self.avgpool = nn.AdaptiveAvgPool1d(1) # Avg pool over the sequence length (N)
self.fc = nn.Linear(out_chs[4], num_classes)

# Define softmax for output probabilities
self.softmax = nn.Softmax(dim=1)

def forward(self, x):
    B, C, H, W = x.shape
    #print(f"Input shape: {x.shape}") # Expect [B, 3, 224, 224] #Debugging to check input shape as expected

    # Stage 0: Conv + MLP + MaxPool
    y = self.mlp0(self.s0(x))
    #print(f"After s0 and mlp0: {y.shape}") # Should keep spatial dims same as s0 output
    # show_feature_map(y, "Stage 0")
    y = self.maxpool2d(y)
    #print(f"After maxpool2d 0: {y.shape}") # spatial dims should halve here

    # Stage 1: MBConv + MLP + MaxPool
    y = self.mlp1(self.s1(y))
    #print(f"After s1 and mlp1: {y.shape}")
    #show_feature_map(y, "Stage 1")
    y = self.maxpool2d(y)
    #print(f"After maxpool2d 1: {y.shape}")

    # Stage 2: MBConv + MLP + MaxPool
    y = self.mlp2(self.s2(y))
    #print(f"After s2 and mlp2: {y.shape}")
    #show_feature_map(y, "Stage 2")
    y = self.maxpool2d(y)
    #print(f"After maxpool2d 2: {y.shape}")

    B, C, H, W = y.shape
    # Stage 3: Self Attention + MLP + MaxPool1d
    y = y.reshape(B, self.out_chs[2], -1).permute(0, 2, 1) # (B, N, C)
    #print(f"After reshape and permute for attention (stage 3): {y.shape}")
    y = self.mlp3(self.s3(y, y))
    #print(f"After s3 and mlp3: {y.shape}")
    y = self.maxpool1d(y.permute(0, 2, 1)).permute(0, 2, 1) # MaxPool over N
    #print(f"After maxpool1d 3: {y.shape}")

    # Stage 4: Self Attention + MLP + Global Average Pool + FC + Softmax
    y = self.mlp4(self.s4(y, y)) # y: (B, N, C)
    #print(f"After s4 and mlp4: {y.shape}")

    #print("Shape before permute:", y.shape) # (B, N, C)
    y = y.permute(0, 2, 1) # (B, C, N)
    #print("Shape after permute:", y.shape)

    y = self.avgpool(y) # (B, C, 1)
    #print("Shape after avgpool:", y.shape)

    y = y.squeeze(-1) # (B, C)
    #print("Shape after squeeze:", y.shape)

    y = self.fc(y) # (B, C)
    #print("Shape after fc:", y.shape)

    # Plot class probabilities for the first example in batch
    class_names = [f"Class {i}" for i in range(y.shape[1])]
    probs = y[0] # since batch size = 1

    #plt.figure(figsize=(10, 4))
    #plt.bar(class_names, probs.detach().cpu().numpy())
    #plt.title("Class Probabilities")
    #plt.xlabel("Classes")
    #plt.ylabel("Probability")
    #plt.xticks(rotation=45)
    #plt.show()

    return y

def main():
    tensor_folder = "/content/drive/MyDrive/ColabNotebooks/ZoomRecordings/ZoomTensorsOnly" #These are the Direct Phone recordings - all
    mel_files = [f for f in os.listdir(tensor_folder) if f.endswith(".pt")]

    # Create labels for 5 mel specs per keystroke i.e. 125 tensors per class
    labels = generate_labels_from_filenames(mel_files, files_per_class=500)
    num_classes = len(set(labels))
    print(f"Number of classes: {num_classes}")

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#Check labels
mel_files = [f for f in os.listdir(tensor_folder) if f.endswith(".pt")]
labels = generate_labels_from_filenames(mel_files, files_per_class=500)
check_labels(mel_files, labels)

# Create Dataset & DataLoader
#dataset = MelSpectrogramDataset(tensor_folder, mel_files, labels, transform=transform)
# Full dataset
full_dataset = MelSpectrogramDataset(tensor_folder, mel_files, labels, transform=None)

# Convert labels to numpy for sklearn
labels_np = np.array(labels)
indices = np.arange(len(labels))
#Stratified split of data
# First split: Train (80%) vs Temp (20%)
# train_indices, temp_indices, y_train, y_temp = train_test_split(
#     indices,
#     labels_np,
#     test_size=0.2,
#     stratify=labels_np,
#     random_state=42
# )

# # Second split: Temp → Validation (10%) and Test (10%)
# val_indices, test_indices, y_val, y_test = train_test_split(
#     temp_indices,
#     y_temp,
#     test_size=0.5,
#     stratify=y_temp,
#     random_state=42
# )

train_indices, temp_indices = train_test_split(
    indices,
    test_size=0.2,
    random_state=42,
    shuffle=True
)

# Second split: Temp → Validation (10%) and Test (10%)
val_indices, test_indices = train_test_split(
    temp_indices,
    test_size=0.5,
    random_state=42,
    shuffle=True
)

# Create Subsets
train_dataset = Subset(full_dataset, train_indices)
validation_dataset = Subset(full_dataset, val_indices)
test_dataset = Subset(full_dataset, test_indices)

#Print the length of the dataset
print("Total number of samples in the dataset:", len(full_dataset))
train_ratio=0.6
validation_ratio=0.2
test_ratio=0.2
dataset_size = len(full_dataset)
train_size = int(train_ratio * dataset_size)
test_size=int(test_ratio * dataset_size)
validation_size = int(validation_ratio * dataset_size)

print("Train labels distribution:", np.bincount([label for _, label in train_dataset]))
print("Validation labels distribution:", np.bincount([label for _, label in validation_dataset]))
print("Test labels distribution:", np.bincount([label for _, label in test_dataset]))

train_loader = DataLoader(train_dataset, batch_size=32, shuffle=True, collate_fn=collate_pad)
validation_loader=DataLoader(validation_dataset, batch_size=32, shuffle=False)
test_loader=DataLoader(test_dataset, batch_size=32, shuffle=False)
print(f'Total dataset size: {dataset_size}')
print(f'Training dataset size: {len(train_dataset)}')
print(f'Validation dataset size: {len(validation_dataset)}')
print(f'Test dataset size: {len(test_dataset)}')

def count_labels(subset, name):
    subset_labels = [full_dataset[i][1] for i in subset.indices]
    label_count = Counter(subset_labels)
    #print(f"{name} labels distribution:")

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    #print(sorted(label_count.items()))
    #print()

count_labels(train_dataset, "Train")
count_labels(validation_dataset, "Validation")
count_labels(test_dataset, "Test")

#The CoAtNet model is defined in it's own CoAtNet custom class above
#3 input channels, image dimensions 224x224, no. output classes for classification
input_height= 224#no. mel freq bins
model = CoAtNet(in_ch=3, image_size=input_height, num_classes=num_classes) #Calls to my Custom CoAtNet model/matches format of it

#Moves model to GPU or CPU for training
model.to(device)

#Loss function is set to Cross entropy loss critereon
criterion = nn.CrossEntropyLoss()
#Sets optimiser to Adam and learning rate is specified
optimizer = optim.Adam(model.parameters(), lr=0.0005)
train_losses = []
val_losses = []
train_accuracies = []
val_accuracies = []
#TRAINING LOOP#
scheduler = lr_scheduler.StepLR(optimizer, step_size=20, gamma=0.5) #LR scheduler
num_epochs = 1100
best_val_accuracy=0.0 #Track peak validation accuracy (PVA)

#Saving data to checkpoint as model keeps timing out
checkpoint_path = "/content/drive/MyDrive/CoAtNet454987445465475426_checkpoint.pth"
start_epoch = 0

# Load checkpoint if it exists
if os.path.exists(checkpoint_path):
    print("Loading checkpoint...")
    checkpoint = torch.load(checkpoint_path, map_location=device)
    file_to_label=checkpoint.get('file_to_label', None)
    model.load_state_dict(checkpoint['model_state_dict'])
    optimizer.load_state_dict(checkpoint['optimizer_state_dict'])
    scheduler.load_state_dict(checkpoint['scheduler_state_dict'])
    start_epoch = checkpoint['epoch'] + 1 # resume from next epoch
    best_val_accuracy = checkpoint.get('best_val_accuracy', 0.0)

    train_losses = checkpoint.get('train_losses', [])
    val_losses = checkpoint.get('val_losses', [])
    train_accuracies = checkpoint.get('train_accuracies', [])
    val_accuracies = checkpoint.get('val_accuracies', [])

    # FIX: Truncate longer list to match shortest one
    min_len = min(len(train_losses), len(val_losses))
    train_losses = train_losses[:min_len]
    val_losses = val_losses[:min_len]
    train_accuracies = train_accuracies[:min_len]
    val_accuracies = val_accuracies[:min_len]

    print(f"Resumed from epoch {start_epoch}, best validation accuracy so far: {best_val_accuracy:.2f}%")
total_epochs = 1100
for epoch in range(start_epoch, num_epochs):
    model.train() #Sets the model to training mode enabling related features
    running_loss = 0.0 #Cumulative loss for the epoch
    correct = 0 #Correct prediction count
    total = 0 #Total sample count
    #Iterates over batches of training data from train_loader
    #Each batch contains images (input data) and labels (ground truth)

    for images, labels in train_loader:
        images, labels = images.to(device), labels.to(device)
        #print("Images shape:", images.shape) # e.g., torch.Size([64, 3, 224, 224])
        #print("Labels:", labels[:10]) # should be integers in [0, 35]
    #Passes the input images through the model to get predictions
    outputs = model(images)
    #Computes the loss (how far the model predictions (outputs) are from the actual labels using a loss function called crite
    loss = criterion(outputs, labels)

    #Clears any gradients from the previous step to avoid the accumulation of gradients
    optimizer.zero_grad()
    #Performs back propagation
    loss.backward()
    #Updates weights
    optimizer.step()

    #Track the loss and accuracy
    running_loss += loss.item()#Adds current loss to total running loss
    _, predicted = outputs.max(1)#Checks how many predictions are correct
    total += labels.size(0)#No. samples processed

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        correct += predicted.eq(labels).sum().item()#Number of correct predictions
#Prints the summary of each epoch
    accuracy = 100 * correct / total
    train_losses.append(running_loss / len(train_loader))
    train_accuracies.append(accuracy)
    scheduler.step() #Steps the learning rate scheduler after each epoch (not after each batch)

    torch.save({
        'epoch': epoch,
        'model_state_dict': model.state_dict(),
        'optimizer_state_dict': optimizer.state_dict(),
        'scheduler_state_dict': scheduler.state_dict(),
        'best_val_accuracy': best_val_accuracy,
        'train_losses': train_losses,
        'train_accuracies': train_accuracies,
        'val_losses': val_losses,
        'val_accuracies': val_accuracies,
        'file_to_label': {f: l for f, l in zip(mel_files, labels)}
    }, checkpoint_path)
    print(f"Checkpoint saved at epoch {epoch + 1}")

#EVALUATION LOOP#This is called immediately after the training loop within the same epoch "for" loop
model.eval() #set the model to evaluation mode (same as Validation)
val_loss = 0.0
val_correct = 0
val_total = 0
with torch.no_grad():
    for images, labels in validation_loader:
        images, labels = images.to(device), labels.to(device)
        outputs = model(images)
        loss = criterion(outputs, labels)
        val_loss += loss.item()

        _, predicted = outputs.max(1)
        val_total += labels.size(0)
        val_correct += predicted.eq(labels).sum().item()

    avg_val_loss = val_loss / len(validation_loader)
    val_accuracy = 100 * val_correct / val_total
    val_losses.append(avg_val_loss)
    val_accuracies.append(val_accuracy)

    # Update best validation accuracy if current is better
    if val_accuracy > best_val_accuracy:
        best_val_accuracy = val_accuracy

    print(f"Epoch [{epoch+1}/{num_epochs}] - Loss: {running_loss:.4f}, Accuracy: {accuracy:.2f}%")
    print(f"Validation - Loss: {avg_val_loss:.4f}, Accuracy: {val_accuracy:.2f}%")

#Print PVA
print(f"\nPeak Validation Accuracy: {best_val_accuracy:.2f}%")

#Plot line plots of training & validation loss & accuracy per epoch
plt.plot(train_losses, label='Train Loss')
plt.plot(val_losses, label='Validation Loss')
plt.legend()
plt.title('Loss over Epochs')
plt.show()

plt.plot(train_accuracies, label='Train Acc')
plt.plot(val_accuracies, label='Val Acc')
plt.legend()
plt.title('Accuracy over Epochs')
plt.show()

# Evaluation on test set
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)
        _, predicted = outputs.max(1)
        all_preds.extend(predicted.cpu().numpy())
        all_labels.extend(labels.cpu().numpy())

# Confusion matrix
cm = confusion_matrix(all_labels, all_preds)
sns.heatmap(cm, annot=True, fmt='d', cmap='Blues')
plt.title("Confusion Matrix")

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plt.xlabel("Predicted")
plt.ylabel("True")
plt.show()

# Classification report
print(classification_report(all_labels, all_preds))
#Produce a confusion matrix to analyse the results after the test loop
#Produce a classification report to analyse the results after the test loop

if __name__ == "__main__":
    main()
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File: s_mel_spec_706_v10.pt -> Label: 28
File: s_mel_spec_706_v11.pt -> Label: 28
File: s_mel_spec_706_v12.pt -> Label: 28
File: s_mel_spec_706_v13.pt -> Label: 28
File: s_mel_spec_706_v14.pt -> Label: 28
File: s_mel_spec_706_v15.pt -> Label: 28
File: s_mel_spec_706_v16.pt -> Label: 28
File: s_mel_spec_706_v17.pt -> Label: 28
File: s_mel_spec_706_v18.pt -> Label: 28
File: s_mel_spec_706_v19.pt -> Label: 28
File: s_mel_spec_707_v0.pt -> Label: 28
File: s_mel_spec_707_v1.pt -> Label: 28
File: s_mel_spec_707_v2.pt -> Label: 28
File: s_mel_spec_707_v3.pt -> Label: 28
File: s_mel_spec_707_v4.pt -> Label: 28
File: s_mel_spec_707_v5.pt -> Label: 28
File: s_mel_spec_707_v6.pt -> Label: 28
File: s_mel_spec_707_v7.pt -> Label: 28
File: s_mel_spec_707_v8.pt -> Label: 28
File: s_mel_spec_707_v9.pt -> Label: 28
File: s_mel_spec_707_v10.pt -> Label: 28
File: s_mel_spec_707_v11.pt -> Label: 28
File: s_mel_spec_707_v12.pt -> Label: 28
File: s_mel_spec_707_v13.pt -> Label: 28
File: s_mel_spec_707_v14.pt -> Label: 28
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File: s_mel_spec_708_v13.pt -> Label: 28
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File: s_mel_spec_709_v6.pt -> Label: 28
File: s_mel_spec_709_v7.pt -> Label: 28
File: s_mel_spec_709_v8.pt -> Label: 28
File: s_mel_spec_709_v9.pt -> Label: 28
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File: s_mel_spec_709_v19.pt -> Label: 28
File: s_mel_spec_710_v0.pt -> Label: 28
File: s_mel_spec_710_v1.pt -> Label: 28
File: s_mel_spec_710_v2.pt -> Label: 28
File: s_mel_spec_710_v3.pt -> Label: 28
File: s_mel_spec_710_v4.pt -> Label: 28
File: s_mel_spec_710_v5.pt -> Label: 28
File: s_mel_spec_710_v6.pt -> Label: 28
File: s_mel_spec_710_v7.pt -> Label: 28
File: s_mel_spec_710_v8.pt -> Label: 28
File: s_mel_spec_710_v9.pt -> Label: 28
File: s_mel_spec_710_v10.pt -> Label: 28
File: s_mel_spec_710_v11.pt -> Label: 28
File: s_mel_spec_710_v12.pt -> Label: 28
File: s_mel_spec_710_v13.pt -> Label: 28
File: s_mel_spec_710_v14.pt -> Label: 28
File: s_mel_spec_710_v15.pt -> Label: 28
File: s_mel_spec_710_v16.pt -> Label: 28
File: s_mel_spec_710_v17.pt -> Label: 28
```


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4.1.4. DIAMETER

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2000 1999 1998 1997 1996 1995 1994 1993 1992 1991 1990 1989 1988 1987 1986 1985 1984 1983 1982 1981 1980 1979 1978 1977 1976 1975 1974 1973 1972 1971 1970 1969 1968 1967 1966 1965 1964 1963 1962 1961 1960 1959 1958 1957 1956 1955 1954 1953 1952 1951 1950 1949 1948 1947 1946 1945 1944 1943 1942 1941 1940 1939 1938 1937 1936 1935 1934 1933 1932 1931 1930 1929 1928 1927 1926 1925 1924 1923 1922 1921 1920 1919 1918 1917 1916 1915 1914 1913 1912 1911 1910 1909 1908 1907 1906 1905 1904 1903 1902 1901 1900

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1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100 101 102 103 104 105 106 107 108 109 110 111 112 113 114 115 116 117 118 119 120 121 122 123 124 125 126 127 128 129 130 131 132 133 134 135 136 137 138 139 140 141 142 143 144 145 146 147 148 149 150 151 152 153 154 155 156 157 158 159 160 161 162 163 164 165 166 167 168 169 170 171 172 173 174 175 176 177 178 179 180 181 182 183 184 185 186 187 188 189 190 191 192 193 194 195 196 197 198 199 200 201 202 203 204 205 206 207 208 209 210 211 212 213 214 215 216 217 218 219 220 221 222 223 224 225 226 227 228 229 230 231 232 233 234 235 236 237 238 239 240 241 242 243 244 245 246 247 248 249 250 251 252 253 254 255 256 257 258 259 260 261 262 263 264 265 266 267 268 269 270 271 272 273 274 275 276 277 278 279 280 281 282 283 284 285 286 287 288 289 290 291 292 293 294 295 296 297 298 299 300 301 302 303 304 305 306 307 308 309 310 311 312 313 314 315 316 317 318 319 320 321 322 323 324 325 326 327 328 329 330 331 332 333 334 335 336 337 338 339 340 341 342 343 344 345 346 347 348 349 350 351 352 353 354 355 356 357 358 359 360 361 362 363 364 365 366 367 368 369 370 371 372 373 374 375 376 377 378 379 380 381 382 383 384 385 386 387 388 389 390 391 392 393 394 395 396 397 398 399 400 401 402 403 404 405 406 407 408 409 410 411 412 413 414 415 416 417 418 419 420 421 422 423 424 425 426 427 428 429 430 431 432 433 434 435 436 437 438 439 440 441 442 443 444 445 446 447 448 449 450 451 452 453 454 455 456 457 458 459 460 461 462 463 464 465 466 467 468 469 470 471 472 473 474 475 476 477 478 479 480 481 482 483 484 485 486 487 488 489 490 491 492 493 494 495 496 497 498 499 500 501 502 503 504 505 506 507 508 509 510 511 512 513 514 515 516 517 518 519 520 521 522 523 524 525 526 527 528 529 530 531 532 533 534 535 536 537 538 539 540 541 542 543 544 545 546 547 548 549 550 551 552 553 554 555 556 557 558 559 560 561 562 563 564 565 566 567 568 569 570 571 572 573 574 575 576 577 578 579 580 581 582 583 584 585 586 587 588 589 590 591 592 593 594 595 596 597 598 599 600 601 602 603 604 605 606 607 608 609 610 611 612 613 614 615 616 617 618 619 620 621 622 623 624 625 626 627 628 629 630 631 632 633 634 635 636 637 638 639 640 641 642 643 644 645 646 647 648 649 650 651 652 653 654 655 656 657 658 659 660 661 662 663 664 665 666 667 668 669 670 671 672 673 674 675 676 677 678 679 680 681 682 683 684 685 686 687 688 689 690 691 692 693 694 695 696 697 698 699 700 701 702 703 704 705 706 707 708 709 710 711 712 713 714 715 716 717 718 719 720 721 722 723 724 725 726 727 728 729 730 731 732 733 734 735 736 737 738 739 740 741 742 743 744 745 746 747 748 749 750 751 752 753 754 755 756 757 758 759 760 761 762 763 764 765 766 767 768 769 770 771 772 773 774 775 776 777 778 779 780 781 782 783 784 785 786 787 788 789 790 791 792 793 794 795 796 797 798 799 800 801 802 803 804 805 806 807 808 809 810 811 812 813 814 815 816 817 818 819 820 821 822 823 824 825 826 827 828 829 830 831 832 833 834 835 836 837 838 839 840 841 842 843 844 845 846 847 848 849 850 851 852 853 854 855 856 857 858 859 860 861 862 863 864 865 866 867 868 869 870 871 872 873 874 875 876 877 878 879 880 881 882 883 884 885 886 887 888 889 890 891 892 893 894 895 896 897 898 899 900 901 902 903 904 905 906 907 908 909 910 911 912 913 914 915 916 917 918 919 920 921 922 923 924 925 926 927 928 929 930 931 932 933 934 935 936 937 938 939 940 941 942 943 944 945 946 947 948 949 950 951 952 953 954 955 956 957 958 959 960 961 962 963 964 965 966 967 968 969 970 971 972 973 974 975 976 977 978 979 980 981 982 983 984 985 986 987 988 989 990 991 992 993 994 995 996 997 998 999 1000 1001 1002 1003 1004 1005 1006 1007 1008 1009 1010 1011 1012 1013 1014 1015 1016 1017 1018 1019 1020 1021 1022 1023 1024 1025 1026 1027 1028 1029 1030 1031 1032 1033 1034 1035 1036 1037 1038 1039 1040 1

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```
File: z_mel_spec_900_v19.pt -> Label: 35
Total number of samples in the dataset: 18000
Train labels distribution: [394 419 390 412 393 399 397 398 395 395 403 401 391 403 400 387 402 402
 399 390 402 408 385 411 397 409 398 392 407 401 401 403 403 409 407 397]
Validation labels distribution: [49 43 48 48 54 47 53 51 48 51 52 59 52 47 57 51 57 46 46 48 56 47 49 55
 57 36 50 52 52 55 44 46 52 42 44 56]
Test labels distribution: [57 38 62 40 53 54 50 51 57 54 45 40 57 50 43 62 41 52 55 62 42 45 66 34
 46 55 52 56 41 44 55 51 45 49 49 47]
Total dataset size: 18000
Training dataset size: 14400
Validation dataset size: 1800
Test dataset size: 1800
Loading checkpoint...
Resumed from epoch 735, best validation accuracy so far: 92.06%
Checkpoint saved at epoch 736
Epoch [736/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6816, Accuracy: 91.67%
Checkpoint saved at epoch 737
Epoch [737/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6797, Accuracy: 91.67%
Checkpoint saved at epoch 738
Epoch [738/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6882, Accuracy: 91.67%
Checkpoint saved at epoch 739
Epoch [739/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6775, Accuracy: 91.61%
Checkpoint saved at epoch 740
Epoch [740/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6824, Accuracy: 91.67%
Checkpoint saved at epoch 741
Epoch [741/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6826, Accuracy: 91.72%
Checkpoint saved at epoch 742
Epoch [742/1100] - Loss: 0.0008, Accuracy: 100.00%
Validation - Loss: 0.6801, Accuracy: 91.67%
Checkpoint saved at epoch 743
Epoch [743/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6773, Accuracy: 91.72%
Checkpoint saved at epoch 744
Epoch [744/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6781, Accuracy: 91.56%
Checkpoint saved at epoch 745
Epoch [745/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6761, Accuracy: 91.78%
Checkpoint saved at epoch 746
Epoch [746/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6782, Accuracy: 91.72%
Checkpoint saved at epoch 747
Epoch [747/1100] - Loss: 0.0002, Accuracy: 100.00%
Validation - Loss: 0.6824, Accuracy: 91.78%
Checkpoint saved at epoch 748
Epoch [748/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6812, Accuracy: 91.78%
Checkpoint saved at epoch 749
Epoch [749/1100] - Loss: 0.0010, Accuracy: 100.00%
Validation - Loss: 0.6763, Accuracy: 91.72%
Checkpoint saved at epoch 750
Epoch [750/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6829, Accuracy: 91.83%
Checkpoint saved at epoch 751
Epoch [751/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6867, Accuracy: 91.72%
Checkpoint saved at epoch 752
Epoch [752/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6779, Accuracy: 91.56%
Checkpoint saved at epoch 753
Epoch [753/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6790, Accuracy: 91.56%
Checkpoint saved at epoch 754
Epoch [754/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6848, Accuracy: 91.78%
Checkpoint saved at epoch 755
Epoch [755/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6771, Accuracy: 91.78%
Checkpoint saved at epoch 756
Epoch [756/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6839, Accuracy: 91.78%
Checkpoint saved at epoch 757
Epoch [757/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6864, Accuracy: 91.67%
Checkpoint saved at epoch 758
Epoch [758/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6778, Accuracy: 91.67%
Checkpoint saved at epoch 759
Epoch [759/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6794, Accuracy: 91.83%
Checkpoint saved at epoch 760
Epoch [760/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6777, Accuracy: 91.61%
Checkpoint saved at epoch 761
```

Epoch [761/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6786, Accuracy: 91.72%
Checkpoint saved at epoch 762
Epoch [762/1100] - Loss: 0.0007, Accuracy: 100.00%
Validation - Loss: 0.6755, Accuracy: 91.56%
Checkpoint saved at epoch 763
Epoch [763/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6763, Accuracy: 91.72%
Checkpoint saved at epoch 764
Epoch [764/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6796, Accuracy: 91.72%
Checkpoint saved at epoch 765
Epoch [765/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6810, Accuracy: 91.78%
Checkpoint saved at epoch 766
Epoch [766/1100] - Loss: 0.0327, Accuracy: 99.99%
Validation - Loss: 0.6815, Accuracy: 91.61%
Checkpoint saved at epoch 767
Epoch [767/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6831, Accuracy: 91.72%
Checkpoint saved at epoch 768
Epoch [768/1100] - Loss: 0.0002, Accuracy: 100.00%
Validation - Loss: 0.6845, Accuracy: 91.78%
Checkpoint saved at epoch 769
Epoch [769/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6780, Accuracy: 91.67%
Checkpoint saved at epoch 770
Epoch [770/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6780, Accuracy: 91.56%
Checkpoint saved at epoch 771
Epoch [771/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6841, Accuracy: 91.89%
Checkpoint saved at epoch 772
Epoch [772/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6772, Accuracy: 91.83%
Checkpoint saved at epoch 773
Epoch [773/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6824, Accuracy: 91.78%
Checkpoint saved at epoch 774
Epoch [774/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6809, Accuracy: 91.67%
Checkpoint saved at epoch 775
Epoch [775/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6818, Accuracy: 91.89%
Checkpoint saved at epoch 776
Epoch [776/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6770, Accuracy: 91.83%
Checkpoint saved at epoch 777
Epoch [777/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6791, Accuracy: 91.72%
Checkpoint saved at epoch 778
Epoch [778/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6813, Accuracy: 91.78%
Checkpoint saved at epoch 779
Epoch [779/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6816, Accuracy: 91.67%
Checkpoint saved at epoch 780
Epoch [780/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6834, Accuracy: 91.67%
Checkpoint saved at epoch 781
Epoch [781/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6761, Accuracy: 91.67%
Checkpoint saved at epoch 782
Epoch [782/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6773, Accuracy: 91.67%
Checkpoint saved at epoch 783
Epoch [783/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6814, Accuracy: 91.72%
Checkpoint saved at epoch 784
Epoch [784/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6800, Accuracy: 91.72%
Checkpoint saved at epoch 785
Epoch [785/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6829, Accuracy: 91.56%
Checkpoint saved at epoch 786
Epoch [786/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6788, Accuracy: 91.50%
Checkpoint saved at epoch 787
Epoch [787/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6790, Accuracy: 91.56%
Checkpoint saved at epoch 788
Epoch [788/1100] - Loss: 0.0089, Accuracy: 100.00%
Validation - Loss: 0.6789, Accuracy: 91.56%
Checkpoint saved at epoch 789
Epoch [789/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6844, Accuracy: 91.78%
Checkpoint saved at epoch 790
Epoch [790/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6763, Accuracy: 91.44%
Checkpoint saved at epoch 791
Epoch [791/1100] - Loss: 0.0005, Accuracy: 100.00%

Validation - Loss: 0.6808, Accuracy: 91.72%
Checkpoint saved at epoch 792
Epoch [792/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6801, Accuracy: 91.61%
Checkpoint saved at epoch 793
Epoch [793/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6793, Accuracy: 91.61%
Checkpoint saved at epoch 794
Epoch [794/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6817, Accuracy: 91.94%
Checkpoint saved at epoch 795
Epoch [795/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6786, Accuracy: 91.67%
Checkpoint saved at epoch 796
Epoch [796/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6819, Accuracy: 91.83%
Checkpoint saved at epoch 797
Epoch [797/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6793, Accuracy: 91.61%
Checkpoint saved at epoch 798
Epoch [798/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6857, Accuracy: 91.72%
Checkpoint saved at epoch 799
Epoch [799/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6789, Accuracy: 91.78%
Checkpoint saved at epoch 800
Epoch [800/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6805, Accuracy: 91.78%
Checkpoint saved at epoch 801
Epoch [801/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6797, Accuracy: 91.72%
Checkpoint saved at epoch 802
Epoch [802/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6824, Accuracy: 91.67%
Checkpoint saved at epoch 803
Epoch [803/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6772, Accuracy: 91.56%
Checkpoint saved at epoch 804
Epoch [804/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6761, Accuracy: 91.61%
Checkpoint saved at epoch 805
Epoch [805/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6842, Accuracy: 91.78%
Checkpoint saved at epoch 806
Epoch [806/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6753, Accuracy: 91.72%
Checkpoint saved at epoch 807
Epoch [807/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6797, Accuracy: 91.83%
Checkpoint saved at epoch 808
Epoch [808/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6868, Accuracy: 91.78%
Checkpoint saved at epoch 809
Epoch [809/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6810, Accuracy: 91.50%
Checkpoint saved at epoch 810
Epoch [810/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6813, Accuracy: 91.78%
Checkpoint saved at epoch 811
Epoch [811/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6769, Accuracy: 91.67%
Checkpoint saved at epoch 812
Epoch [812/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6760, Accuracy: 91.78%
Checkpoint saved at epoch 813
Epoch [813/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6757, Accuracy: 91.78%
Checkpoint saved at epoch 814
Epoch [814/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6801, Accuracy: 91.83%
Checkpoint saved at epoch 815
Epoch [815/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6788, Accuracy: 91.67%
Checkpoint saved at epoch 816
Epoch [816/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6777, Accuracy: 91.56%
Checkpoint saved at epoch 817
Epoch [817/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6825, Accuracy: 91.78%
Checkpoint saved at epoch 818
Epoch [818/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6819, Accuracy: 91.67%
Checkpoint saved at epoch 819
Epoch [819/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6779, Accuracy: 91.61%
Checkpoint saved at epoch 820
Epoch [820/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6785, Accuracy: 91.67%
Checkpoint saved at epoch 821
Epoch [821/1100] - Loss: 0.0005, Accuracy: 100.00%

```
validation - Loss: 0.6824, Accuracy: 91.78%
Checkpoint saved at epoch 822
Epoch [822/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6774, Accuracy: 91.72%
Checkpoint saved at epoch 823
Epoch [823/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6783, Accuracy: 91.83%
Checkpoint saved at epoch 824
Epoch [824/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6806, Accuracy: 91.61%
Checkpoint saved at epoch 825
Epoch [825/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6802, Accuracy: 91.67%
Checkpoint saved at epoch 826
Epoch [826/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6773, Accuracy: 91.67%
Checkpoint saved at epoch 827
Epoch [827/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6749, Accuracy: 91.78%
Checkpoint saved at epoch 828
Epoch [828/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6807, Accuracy: 91.67%
Checkpoint saved at epoch 829
Epoch [829/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6793, Accuracy: 91.61%
Checkpoint saved at epoch 830
Epoch [830/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6783, Accuracy: 91.61%
Checkpoint saved at epoch 831
Epoch [831/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6758, Accuracy: 91.83%
Checkpoint saved at epoch 832
Epoch [832/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6834, Accuracy: 91.72%
Checkpoint saved at epoch 833
Epoch [833/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6797, Accuracy: 91.72%
Checkpoint saved at epoch 834
Epoch [834/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6747, Accuracy: 91.83%
Checkpoint saved at epoch 835
Epoch [835/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6756, Accuracy: 91.61%
Checkpoint saved at epoch 836
Epoch [836/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6824, Accuracy: 91.67%
Checkpoint saved at epoch 837
Epoch [837/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6770, Accuracy: 91.56%
Checkpoint saved at epoch 838
Epoch [838/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6776, Accuracy: 91.67%
Checkpoint saved at epoch 839
Epoch [839/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6800, Accuracy: 91.89%
Checkpoint saved at epoch 840
Epoch [840/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6805, Accuracy: 91.61%
Checkpoint saved at epoch 841
Epoch [841/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6807, Accuracy: 91.94%
Checkpoint saved at epoch 842
Epoch [842/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6752, Accuracy: 91.56%
Checkpoint saved at epoch 843
Epoch [843/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6806, Accuracy: 91.61%
Checkpoint saved at epoch 844
Epoch [844/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6796, Accuracy: 91.78%
Checkpoint saved at epoch 845
Epoch [845/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6750, Accuracy: 91.61%
Checkpoint saved at epoch 846
Epoch [846/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6787, Accuracy: 91.61%
Checkpoint saved at epoch 847
Epoch [847/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6780, Accuracy: 91.33%
Checkpoint saved at epoch 848
Epoch [848/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6836, Accuracy: 91.78%
Checkpoint saved at epoch 849
Epoch [849/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6827, Accuracy: 91.61%
Checkpoint saved at epoch 850
Epoch [850/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6793, Accuracy: 91.72%
Checkpoint saved at epoch 851
Epoch [851/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6810, Accuracy: 91.78%
```

Checkpoint saved at epoch 852
Epoch [852/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6807, Accuracy: 91.67%
Checkpoint saved at epoch 853
Epoch [853/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6812, Accuracy: 91.72%
Checkpoint saved at epoch 854
Epoch [854/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6768, Accuracy: 91.72%
Checkpoint saved at epoch 855
Epoch [855/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6777, Accuracy: 91.89%
Checkpoint saved at epoch 856
Epoch [856/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6787, Accuracy: 91.56%
Checkpoint saved at epoch 857
Epoch [857/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6729, Accuracy: 91.61%
Checkpoint saved at epoch 858
Epoch [858/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6793, Accuracy: 91.72%
Checkpoint saved at epoch 859
Epoch [859/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6738, Accuracy: 91.50%
Checkpoint saved at epoch 860
Epoch [860/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6822, Accuracy: 91.78%
Checkpoint saved at epoch 861
Epoch [861/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6788, Accuracy: 91.56%
Checkpoint saved at epoch 862
Epoch [862/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6810, Accuracy: 91.72%
Checkpoint saved at epoch 863
Epoch [863/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6775, Accuracy: 91.72%
Checkpoint saved at epoch 864
Epoch [864/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6847, Accuracy: 91.67%
Checkpoint saved at epoch 865
Epoch [865/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6796, Accuracy: 91.72%
Checkpoint saved at epoch 866
Epoch [866/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6782, Accuracy: 91.67%
Checkpoint saved at epoch 867
Epoch [867/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6830, Accuracy: 91.89%
Checkpoint saved at epoch 868
Epoch [868/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6792, Accuracy: 91.61%
Checkpoint saved at epoch 869
Epoch [869/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6789, Accuracy: 91.72%
Checkpoint saved at epoch 870
Epoch [870/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6797, Accuracy: 91.72%
Checkpoint saved at epoch 871
Epoch [871/1100] - Loss: 0.0002, Accuracy: 100.00%
Validation - Loss: 0.6760, Accuracy: 91.56%
Checkpoint saved at epoch 872
Epoch [872/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6855, Accuracy: 91.67%
Checkpoint saved at epoch 873
Epoch [873/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6801, Accuracy: 91.67%
Checkpoint saved at epoch 874
Epoch [874/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6828, Accuracy: 91.50%
Checkpoint saved at epoch 875
Epoch [875/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6916, Accuracy: 91.67%
Checkpoint saved at epoch 876
Epoch [876/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6812, Accuracy: 91.89%
Checkpoint saved at epoch 877
Epoch [877/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6805, Accuracy: 91.83%
Checkpoint saved at epoch 878
Epoch [878/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6801, Accuracy: 91.61%
Checkpoint saved at epoch 879
Epoch [879/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6835, Accuracy: 91.72%
Checkpoint saved at epoch 880
Epoch [880/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6832, Accuracy: 91.72%
Checkpoint saved at epoch 881
Epoch [881/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6785, Accuracy: 91.72%

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Checkpoint saved at epoch 882
Epoch [882/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6812, Accuracy: 91.61%
Checkpoint saved at epoch 883
Epoch [883/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6755, Accuracy: 91.61%
Checkpoint saved at epoch 884
Epoch [884/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6774, Accuracy: 91.67%
Checkpoint saved at epoch 885
Epoch [885/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6806, Accuracy: 91.61%
Checkpoint saved at epoch 886
Epoch [886/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6874, Accuracy: 91.78%
Checkpoint saved at epoch 887
Epoch [887/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6808, Accuracy: 91.61%
Checkpoint saved at epoch 888
Epoch [888/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6819, Accuracy: 92.00%
Checkpoint saved at epoch 889
Epoch [889/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6770, Accuracy: 91.61%
Checkpoint saved at epoch 890
Epoch [890/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6821, Accuracy: 91.78%
Checkpoint saved at epoch 891
Epoch [891/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6787, Accuracy: 91.61%
Checkpoint saved at epoch 892
Epoch [892/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6820, Accuracy: 91.72%
Checkpoint saved at epoch 893
Epoch [893/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6832, Accuracy: 91.56%
Checkpoint saved at epoch 894
Epoch [894/1100] - Loss: 0.0002, Accuracy: 100.00%
Validation - Loss: 0.6782, Accuracy: 91.61%
Checkpoint saved at epoch 895
Epoch [895/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6787, Accuracy: 91.56%
Checkpoint saved at epoch 896
Epoch [896/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6815, Accuracy: 91.72%
Checkpoint saved at epoch 897
Epoch [897/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6842, Accuracy: 91.67%
Checkpoint saved at epoch 898
Epoch [898/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6776, Accuracy: 91.61%
Checkpoint saved at epoch 899
Epoch [899/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6800, Accuracy: 91.72%
Checkpoint saved at epoch 900
Epoch [900/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6781, Accuracy: 91.61%
Checkpoint saved at epoch 901
Epoch [901/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6822, Accuracy: 91.72%
Checkpoint saved at epoch 902
Epoch [902/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6774, Accuracy: 91.56%
Checkpoint saved at epoch 903
Epoch [903/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6859, Accuracy: 91.78%
Checkpoint saved at epoch 904
Epoch [904/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6817, Accuracy: 91.83%
Checkpoint saved at epoch 905
Epoch [905/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6809, Accuracy: 91.72%
Checkpoint saved at epoch 906
Epoch [906/1100] - Loss: 0.0002, Accuracy: 100.00%
Validation - Loss: 0.6808, Accuracy: 91.67%
Checkpoint saved at epoch 907
Epoch [907/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6766, Accuracy: 91.72%
Checkpoint saved at epoch 908
Epoch [908/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6821, Accuracy: 91.72%
Checkpoint saved at epoch 909
Epoch [909/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6848, Accuracy: 91.83%
Checkpoint saved at epoch 910
Epoch [910/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6792, Accuracy: 91.67%
Checkpoint saved at epoch 911
Epoch [911/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6807, Accuracy: 91.72%
Checkpoint saved at epoch 912
```


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Epoch [942/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6804, Accuracy: 91.72%
Checkpoint saved at epoch 943
Epoch [943/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6779, Accuracy: 91.61%
Checkpoint saved at epoch 944
Epoch [944/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6774, Accuracy: 91.72%
Checkpoint saved at epoch 945
Epoch [945/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6743, Accuracy: 91.56%
Checkpoint saved at epoch 946
Epoch [946/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6758, Accuracy: 91.61%
Checkpoint saved at epoch 947
Epoch [947/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6799, Accuracy: 91.61%
Checkpoint saved at epoch 948
Epoch [948/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6804, Accuracy: 91.83%
Checkpoint saved at epoch 949
Epoch [949/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6835, Accuracy: 91.78%
Checkpoint saved at epoch 950
Epoch [950/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6750, Accuracy: 91.61%
Checkpoint saved at epoch 951
Epoch [951/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6786, Accuracy: 91.83%
Checkpoint saved at epoch 952
Epoch [952/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6839, Accuracy: 91.78%
Checkpoint saved at epoch 953
Epoch [953/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6783, Accuracy: 91.72%
Checkpoint saved at epoch 954
Epoch [954/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6780, Accuracy: 91.56%
Checkpoint saved at epoch 955
Epoch [955/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6807, Accuracy: 91.72%
Checkpoint saved at epoch 956
Epoch [956/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6795, Accuracy: 91.83%
Checkpoint saved at epoch 957
Epoch [957/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6798, Accuracy: 91.72%
Checkpoint saved at epoch 958
Epoch [958/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6791, Accuracy: 91.67%
Checkpoint saved at epoch 959
Epoch [959/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6809, Accuracy: 91.72%
Checkpoint saved at epoch 960
Epoch [960/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6770, Accuracy: 91.83%
Checkpoint saved at epoch 961
Epoch [961/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6775, Accuracy: 91.72%
Checkpoint saved at epoch 962
Epoch [962/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6848, Accuracy: 91.72%
Checkpoint saved at epoch 963
Epoch [963/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6788, Accuracy: 91.56%
Checkpoint saved at epoch 964
Epoch [964/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6792, Accuracy: 91.67%
Checkpoint saved at epoch 965
Epoch [965/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6799, Accuracy: 91.83%
Checkpoint saved at epoch 966
Epoch [966/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6786, Accuracy: 91.22%
Checkpoint saved at epoch 967
Epoch [967/1100] - Loss: 0.0007, Accuracy: 100.00%
Validation - Loss: 0.6779, Accuracy: 91.67%
Checkpoint saved at epoch 968
Epoch [968/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6785, Accuracy: 91.78%
Checkpoint saved at epoch 969
Epoch [969/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6800, Accuracy: 91.78%
Checkpoint saved at epoch 970
Epoch [970/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6798, Accuracy: 91.83%
Checkpoint saved at epoch 971
Epoch [971/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6813, Accuracy: 91.78%
Checkpoint saved at epoch 972
Epoch [972/1100] - Loss: 0.0003, Accuracy: 100.00%

Validation - Loss: 0.6835, Accuracy: 91.67%
Checkpoint saved at epoch 973
Epoch [973/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6822, Accuracy: 91.67%
Checkpoint saved at epoch 974
Epoch [974/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6843, Accuracy: 91.72%
Checkpoint saved at epoch 975
Epoch [975/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6782, Accuracy: 91.61%
Checkpoint saved at epoch 976
Epoch [976/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6857, Accuracy: 91.67%
Checkpoint saved at epoch 977
Epoch [977/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6774, Accuracy: 91.61%
Checkpoint saved at epoch 978
Epoch [978/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6775, Accuracy: 91.56%
Checkpoint saved at epoch 979
Epoch [979/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6863, Accuracy: 91.78%
Checkpoint saved at epoch 980
Epoch [980/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6771, Accuracy: 91.56%
Checkpoint saved at epoch 981
Epoch [981/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6806, Accuracy: 91.61%
Checkpoint saved at epoch 982
Epoch [982/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6844, Accuracy: 91.83%
Checkpoint saved at epoch 983
Epoch [983/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6764, Accuracy: 92.00%
Checkpoint saved at epoch 984
Epoch [984/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6801, Accuracy: 91.83%
Checkpoint saved at epoch 985
Epoch [985/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6797, Accuracy: 91.56%
Checkpoint saved at epoch 986
Epoch [986/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6804, Accuracy: 91.67%
Checkpoint saved at epoch 987
Epoch [987/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6844, Accuracy: 91.67%
Checkpoint saved at epoch 988
Epoch [988/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6762, Accuracy: 91.61%
Checkpoint saved at epoch 989
Epoch [989/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6806, Accuracy: 91.67%
Checkpoint saved at epoch 990
Epoch [990/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6808, Accuracy: 91.78%
Checkpoint saved at epoch 991
Epoch [991/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6768, Accuracy: 91.50%
Checkpoint saved at epoch 992
Epoch [992/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6820, Accuracy: 91.83%
Checkpoint saved at epoch 993
Epoch [993/1100] - Loss: 0.0007, Accuracy: 100.00%
Validation - Loss: 0.6778, Accuracy: 91.61%
Checkpoint saved at epoch 994
Epoch [994/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6854, Accuracy: 91.72%
Checkpoint saved at epoch 995
Epoch [995/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6832, Accuracy: 91.72%
Checkpoint saved at epoch 996
Epoch [996/1100] - Loss: 0.0011, Accuracy: 100.00%
Validation - Loss: 0.6746, Accuracy: 91.83%
Checkpoint saved at epoch 997
Epoch [997/1100] - Loss: 0.0012, Accuracy: 100.00%
Validation - Loss: 0.6824, Accuracy: 91.61%
Checkpoint saved at epoch 998
Epoch [998/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6806, Accuracy: 91.61%
Checkpoint saved at epoch 999
Epoch [999/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6766, Accuracy: 91.72%
Checkpoint saved at epoch 1000
Epoch [1000/1100] - Loss: 0.0012, Accuracy: 100.00%
Validation - Loss: 0.6780, Accuracy: 91.67%
Checkpoint saved at epoch 1001
Epoch [1001/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6853, Accuracy: 91.67%
Checkpoint saved at epoch 1002
Epoch [1002/1100] - Loss: 0.0003, Accuracy: 100.00%

Validation - Loss: 0.6801, Accuracy: 91.72%
Checkpoint saved at epoch 1003
Epoch [1003/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6735, Accuracy: 91.61%
Checkpoint saved at epoch 1004
Epoch [1004/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6788, Accuracy: 91.72%
Checkpoint saved at epoch 1005
Epoch [1005/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6772, Accuracy: 91.72%
Checkpoint saved at epoch 1006
Epoch [1006/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6786, Accuracy: 91.72%
Checkpoint saved at epoch 1007
Epoch [1007/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6787, Accuracy: 91.72%
Checkpoint saved at epoch 1008
Epoch [1008/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6757, Accuracy: 91.44%
Checkpoint saved at epoch 1009
Epoch [1009/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6852, Accuracy: 91.67%
Checkpoint saved at epoch 1010
Epoch [1010/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6795, Accuracy: 91.78%
Checkpoint saved at epoch 1011
Epoch [1011/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6801, Accuracy: 91.56%
Checkpoint saved at epoch 1012
Epoch [1012/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6785, Accuracy: 91.67%
Checkpoint saved at epoch 1013
Epoch [1013/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6787, Accuracy: 91.50%
Checkpoint saved at epoch 1014
Epoch [1014/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6817, Accuracy: 91.61%
Checkpoint saved at epoch 1015
Epoch [1015/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6805, Accuracy: 91.78%
Checkpoint saved at epoch 1016
Epoch [1016/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6841, Accuracy: 91.72%
Checkpoint saved at epoch 1017
Epoch [1017/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6784, Accuracy: 91.78%
Checkpoint saved at epoch 1018
Epoch [1018/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6785, Accuracy: 91.67%
Checkpoint saved at epoch 1019
Epoch [1019/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6796, Accuracy: 91.50%
Checkpoint saved at epoch 1020
Epoch [1020/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6834, Accuracy: 91.72%
Checkpoint saved at epoch 1021
Epoch [1021/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6838, Accuracy: 91.72%
Checkpoint saved at epoch 1022
Epoch [1022/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6800, Accuracy: 91.89%
Checkpoint saved at epoch 1023
Epoch [1023/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6782, Accuracy: 91.67%
Checkpoint saved at epoch 1024
Epoch [1024/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6778, Accuracy: 91.56%
Checkpoint saved at epoch 1025
Epoch [1025/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6753, Accuracy: 91.83%
Checkpoint saved at epoch 1026
Epoch [1026/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6786, Accuracy: 91.78%
Checkpoint saved at epoch 1027
Epoch [1027/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6787, Accuracy: 91.72%
Checkpoint saved at epoch 1028
Epoch [1028/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6756, Accuracy: 91.56%
Checkpoint saved at epoch 1029
Epoch [1029/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6828, Accuracy: 91.67%
Checkpoint saved at epoch 1030
Epoch [1030/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6896, Accuracy: 91.83%
Checkpoint saved at epoch 1031
Epoch [1031/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6824, Accuracy: 91.50%
Checkpoint saved at epoch 1032
Epoch [1032/1100] - Loss: 0.0007, Accuracy: 100.00%
Validation - Loss: 0.6747, Accuracy: 91.56%

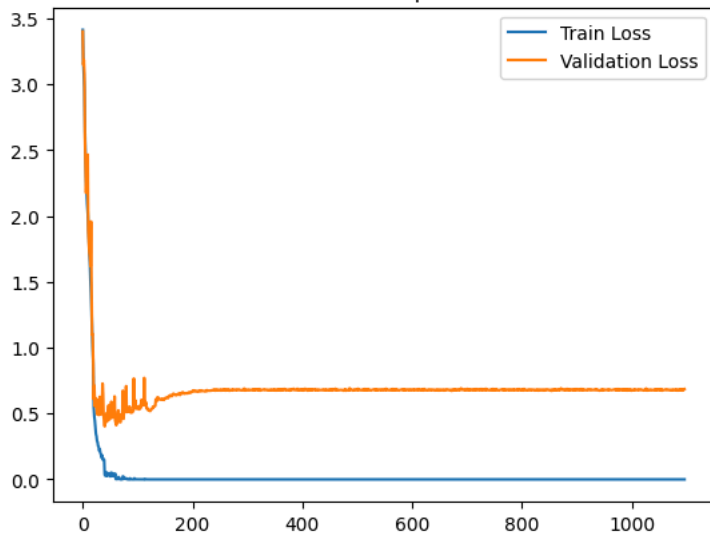
Checkpoint saved at epoch 1033
Epoch [1033/1100] - Loss: 0.0010, Accuracy: 100.00%
Validation - Loss: 0.6800, Accuracy: 91.67%
Checkpoint saved at epoch 1034
Epoch [1034/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6770, Accuracy: 91.67%
Checkpoint saved at epoch 1035
Epoch [1035/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6785, Accuracy: 91.83%
Checkpoint saved at epoch 1036
Epoch [1036/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6807, Accuracy: 91.67%
Checkpoint saved at epoch 1037
Epoch [1037/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6781, Accuracy: 91.61%
Checkpoint saved at epoch 1038
Epoch [1038/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6770, Accuracy: 91.67%
Checkpoint saved at epoch 1039
Epoch [1039/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6817, Accuracy: 91.61%
Checkpoint saved at epoch 1040
Epoch [1040/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6795, Accuracy: 91.72%
Checkpoint saved at epoch 1041
Epoch [1041/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6784, Accuracy: 91.67%
Checkpoint saved at epoch 1042
Epoch [1042/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6778, Accuracy: 91.44%
Checkpoint saved at epoch 1043
Epoch [1043/1100] - Loss: 0.0010, Accuracy: 100.00%
Validation - Loss: 0.6791, Accuracy: 91.67%
Checkpoint saved at epoch 1044
Epoch [1044/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6801, Accuracy: 91.56%
Checkpoint saved at epoch 1045
Epoch [1045/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6768, Accuracy: 91.61%
Checkpoint saved at epoch 1046
Epoch [1046/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6821, Accuracy: 91.78%
Checkpoint saved at epoch 1047
Epoch [1047/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6825, Accuracy: 91.78%
Checkpoint saved at epoch 1048
Epoch [1048/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6759, Accuracy: 91.67%
Checkpoint saved at epoch 1049
Epoch [1049/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6823, Accuracy: 91.72%
Checkpoint saved at epoch 1050
Epoch [1050/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6771, Accuracy: 91.67%
Checkpoint saved at epoch 1051
Epoch [1051/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6817, Accuracy: 91.78%
Checkpoint saved at epoch 1052
Epoch [1052/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6808, Accuracy: 91.61%
Checkpoint saved at epoch 1053
Epoch [1053/1100] - Loss: 0.0011, Accuracy: 100.00%
Validation - Loss: 0.6846, Accuracy: 91.61%
Checkpoint saved at epoch 1054
Epoch [1054/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6811, Accuracy: 91.78%
Checkpoint saved at epoch 1055
Epoch [1055/1100] - Loss: 0.0021, Accuracy: 100.00%
Validation - Loss: 0.6836, Accuracy: 91.72%
Checkpoint saved at epoch 1056
Epoch [1056/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6758, Accuracy: 91.61%
Checkpoint saved at epoch 1057
Epoch [1057/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6805, Accuracy: 91.89%
Checkpoint saved at epoch 1058
Epoch [1058/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6857, Accuracy: 91.83%
Checkpoint saved at epoch 1059
Epoch [1059/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6741, Accuracy: 91.78%
Checkpoint saved at epoch 1060
Epoch [1060/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6782, Accuracy: 91.61%
Checkpoint saved at epoch 1061
Epoch [1061/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6777, Accuracy: 91.72%
Checkpoint saved at epoch 1062
Epoch [1062/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6783, Accuracy: 91.78%

Checkpoint saved at epoch 1063
Epoch [1063/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6806, Accuracy: 91.78%
Checkpoint saved at epoch 1064
Epoch [1064/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6795, Accuracy: 91.61%
Checkpoint saved at epoch 1065
Epoch [1065/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6815, Accuracy: 91.61%
Checkpoint saved at epoch 1066
Epoch [1066/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6842, Accuracy: 91.89%
Checkpoint saved at epoch 1067
Epoch [1067/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6824, Accuracy: 91.67%
Checkpoint saved at epoch 1068
Epoch [1068/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6779, Accuracy: 91.50%
Checkpoint saved at epoch 1069
Epoch [1069/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6802, Accuracy: 91.72%
Checkpoint saved at epoch 1070
Epoch [1070/1100] - Loss: 0.0009, Accuracy: 100.00%
Validation - Loss: 0.6803, Accuracy: 91.72%
Checkpoint saved at epoch 1071
Epoch [1071/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6793, Accuracy: 91.50%
Checkpoint saved at epoch 1072
Epoch [1072/1100] - Loss: 0.0007, Accuracy: 100.00%
Validation - Loss: 0.6779, Accuracy: 91.39%
Checkpoint saved at epoch 1073
Epoch [1073/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6806, Accuracy: 91.72%
Checkpoint saved at epoch 1074
Epoch [1074/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6776, Accuracy: 91.72%
Checkpoint saved at epoch 1075
Epoch [1075/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6760, Accuracy: 91.61%
Checkpoint saved at epoch 1076
Epoch [1076/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6790, Accuracy: 91.72%
Checkpoint saved at epoch 1077
Epoch [1077/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6775, Accuracy: 91.67%
Checkpoint saved at epoch 1078
Epoch [1078/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6808, Accuracy: 91.72%
Checkpoint saved at epoch 1079
Epoch [1079/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6770, Accuracy: 91.72%
Checkpoint saved at epoch 1080
Epoch [1080/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6804, Accuracy: 91.78%
Checkpoint saved at epoch 1081
Epoch [1081/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6800, Accuracy: 91.67%
Checkpoint saved at epoch 1082
Epoch [1082/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6819, Accuracy: 91.67%
Checkpoint saved at epoch 1083
Epoch [1083/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6831, Accuracy: 91.72%
Checkpoint saved at epoch 1084
Epoch [1084/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6758, Accuracy: 91.56%
Checkpoint saved at epoch 1085
Epoch [1085/1100] - Loss: 0.0004, Accuracy: 100.00%
Validation - Loss: 0.6769, Accuracy: 91.72%
Checkpoint saved at epoch 1086
Epoch [1086/1100] - Loss: 0.0005, Accuracy: 100.00%
Validation - Loss: 0.6832, Accuracy: 91.72%
Checkpoint saved at epoch 1087
Epoch [1087/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6812, Accuracy: 91.72%
Checkpoint saved at epoch 1088
Epoch [1088/1100] - Loss: 0.0006, Accuracy: 100.00%
Validation - Loss: 0.6749, Accuracy: 91.33%
Checkpoint saved at epoch 1089
Epoch [1089/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6787, Accuracy: 91.72%
Checkpoint saved at epoch 1090
Epoch [1090/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6802, Accuracy: 91.72%
Checkpoint saved at epoch 1091
Epoch [1091/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6836, Accuracy: 91.61%
Checkpoint saved at epoch 1092
Epoch [1092/1100] - Loss: 0.0003, Accuracy: 100.00%
Validation - Loss: 0.6760, Accuracy: 91.67%
Checkpoint saved at epoch 1093

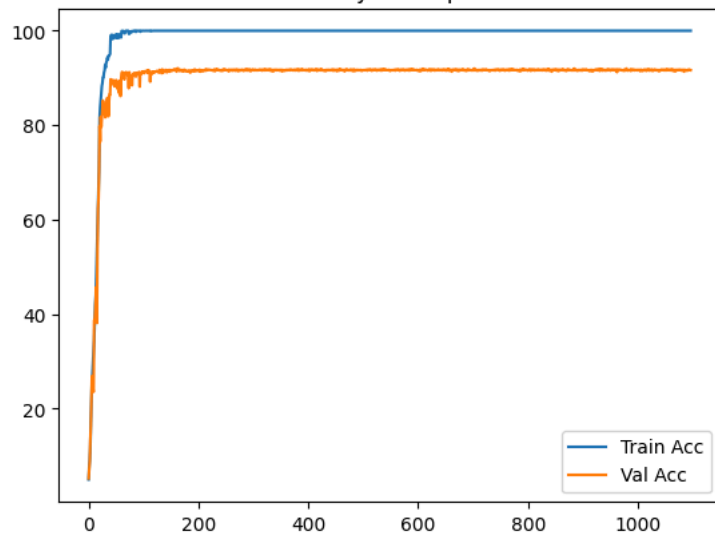
```
Epoch [1093/1100] - Loss: 0.0004, Accuracy: 100.00%  
Validation - Loss: 0.6834, Accuracy: 91.56%  
Checkpoint saved at epoch 1094  
Epoch [1094/1100] - Loss: 0.0003, Accuracy: 100.00%  
Validation - Loss: 0.6762, Accuracy: 91.56%  
Checkpoint saved at epoch 1095  
Epoch [1095/1100] - Loss: 0.0004, Accuracy: 100.00%  
Validation - Loss: 0.6780, Accuracy: 91.72%  
Checkpoint saved at epoch 1096  
Epoch [1096/1100] - Loss: 0.0003, Accuracy: 100.00%  
Validation - Loss: 0.6752, Accuracy: 91.67%  
Checkpoint saved at epoch 1097  
Epoch [1097/1100] - Loss: 0.0003, Accuracy: 100.00%  
Validation - Loss: 0.6843, Accuracy: 91.78%  
Checkpoint saved at epoch 1098  
Epoch [1098/1100] - Loss: 0.0008, Accuracy: 100.00%  
Validation - Loss: 0.6792, Accuracy: 91.67%  
Checkpoint saved at epoch 1099  
Epoch [1099/1100] - Loss: 0.0005, Accuracy: 100.00%  
Validation - Loss: 0.6819, Accuracy: 91.72%  
Checkpoint saved at epoch 1100  
Epoch [1100/1100] - Loss: 0.0005, Accuracy: 100.00%  
Validation - Loss: 0.6853, Accuracy: 91.67%
```

Peak Validation Accuracy: 92.06%

Loss over Epochs



Accuracy over Epochs



Confusion Matrix

