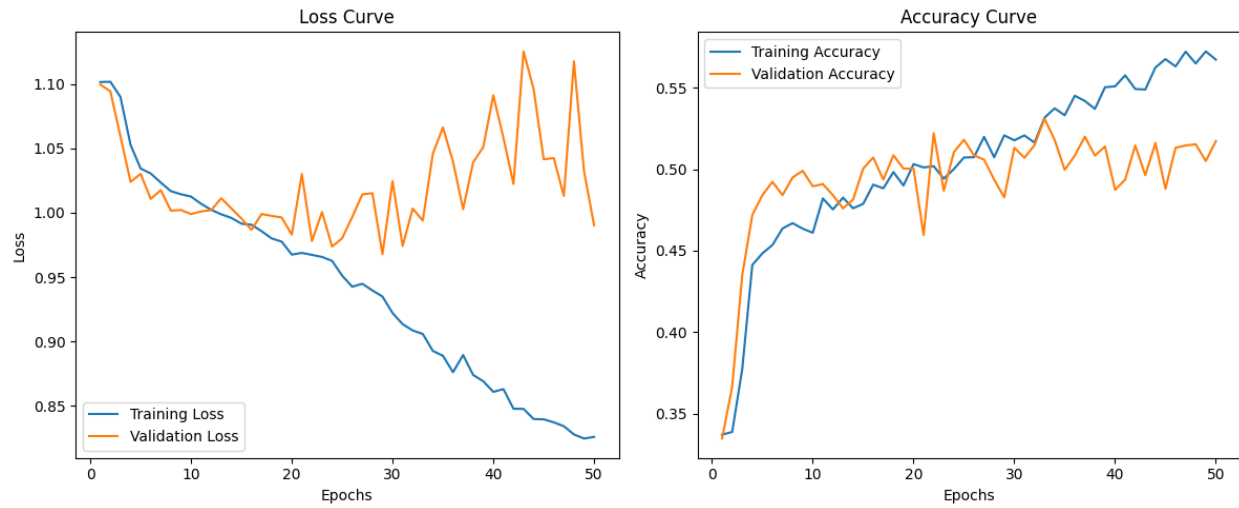
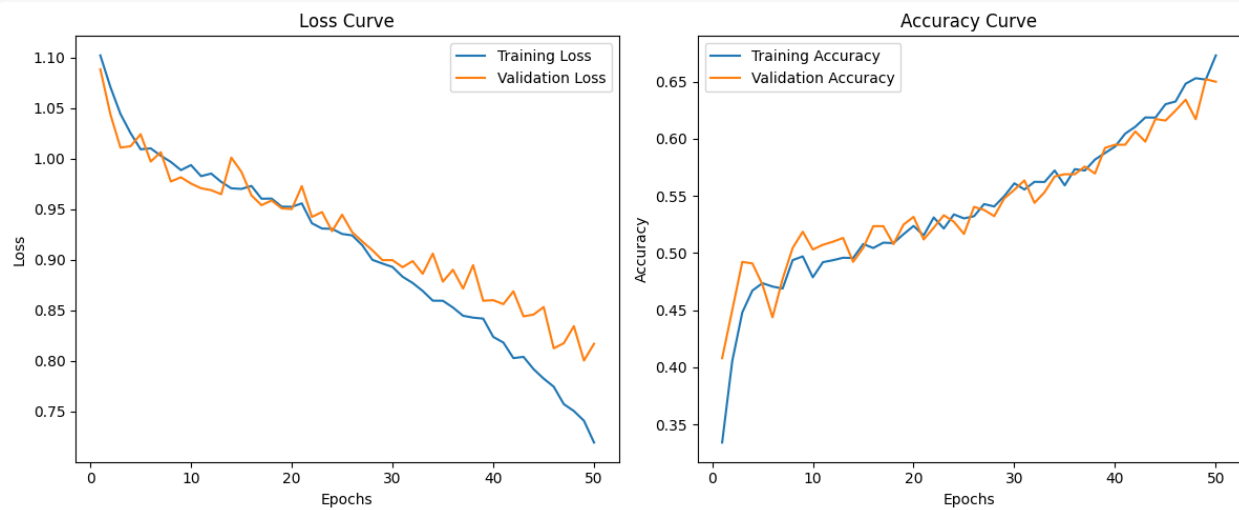


Og optimizer, epochs = 100, dropout=0.5 (was overfitting)



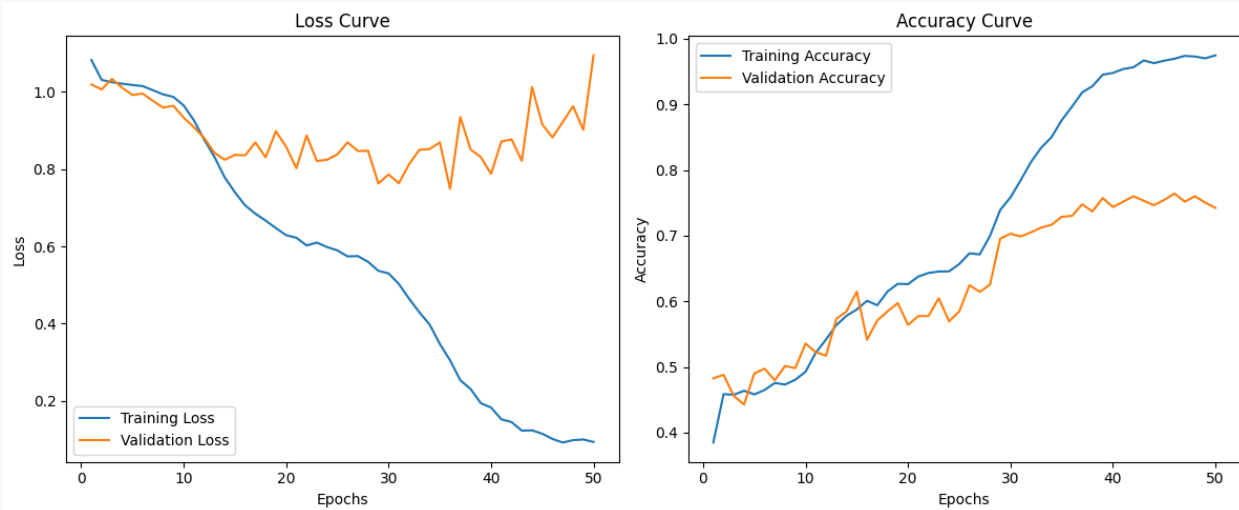
`lr=1e-4, weight_decay=1e-4, epochs=50, DROPOUT=0.5`



`lr=2e-4, weight_decay=5e-4, epochs=50, dropout=0.5,`



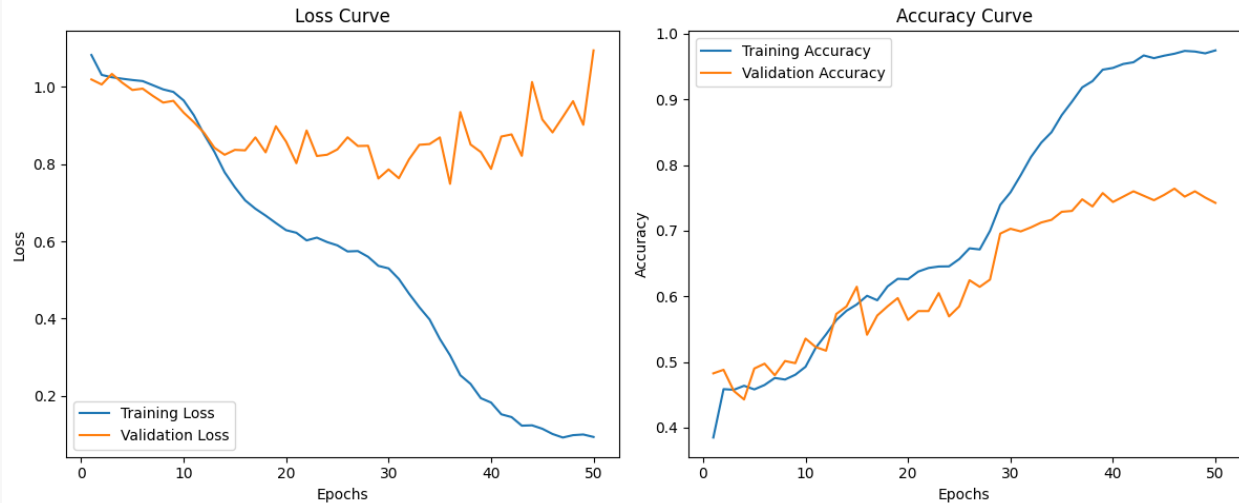
$lr=0.0005$, $weight_decay=5e-4$, $epochs=50$, $dropout=0.6$
 BEST!76 acc



$lr=0.001$, $weight_decay=5e-4$, $epochs=50$, $dropout=0.6$

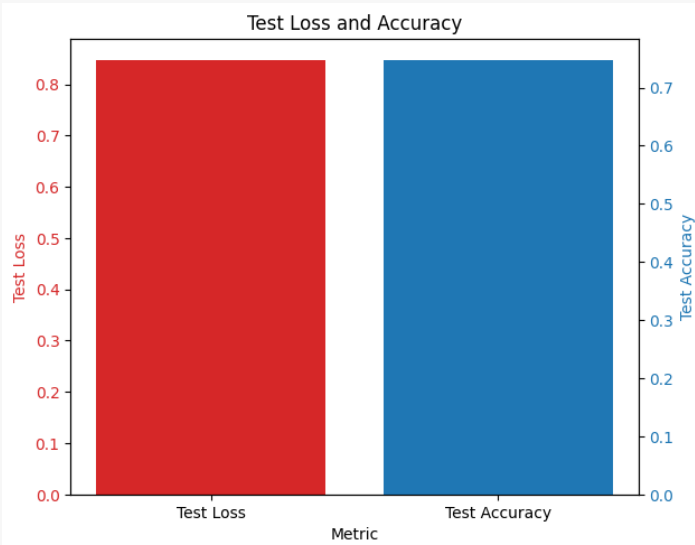


Early stopping + scheduled learning rate



Early stopping and scheduled learning rate

:Test Loss: 0.8463, Test Accuracy: 0.7467



Epoch 1/100 - Training Loss: 1.1013, Training Accuracy: 0.3583, Validation Loss: 1.0802, Validation Accuracy: 0.4037

Epoch 2/100 - Training Loss: 1.0504, Training Accuracy: 0.4324, Validation Loss: 1.0071, Validation Accuracy: 0.4880

Epoch 3/100 - Training Loss: 1.0270, Training Accuracy: 0.4571, Validation Loss: 1.0031, Validation Accuracy: 0.4854

Epoch 4/100 - Training Loss: 1.0185, Training Accuracy: 0.4592, Validation Loss: 1.0002, Validation Accuracy: 0.4717

Epoch 5/100 - Training Loss: 1.0129, Training Accuracy: 0.4712, Validation Loss: 1.0168, Validation Accuracy: 0.4689

Epoch 6/100 - Training Loss: 1.0098, Training Accuracy: 0.4620, Validation Loss: 0.9870, Validation Accuracy: 0.4880

Epoch 7/100 - Training Loss: 1.0006, Training Accuracy: 0.4771, Validation Loss: 0.9763, Validation Accuracy: 0.4866

Epoch 8/100 - Training Loss: 0.9969, Training Accuracy: 0.4821, Validation Loss: 0.9771, Validation Accuracy: 0.4769

Epoch 9/100 - Training Loss: 0.9983, Training Accuracy: 0.4808, Validation Loss: 0.9718, Validation Accuracy: 0.4852

Epoch 10/100 - Training Loss: 0.9865, Training Accuracy: 0.4944, Validation Loss: 0.9861, Validation Accuracy: 0.4934

Epoch 11/100 - Training Loss: 0.9918, Training Accuracy: 0.4931, Validation Loss: 0.9616, Validation Accuracy: 0.5016

Epoch 12/100 - Training Loss: 0.9782, Training Accuracy: 0.4911, Validation Loss: 0.9616, Validation Accuracy: 0.4983

Epoch 13/100 - Training Loss: 0.9739, Training Accuracy: 0.4933, Validation Loss: 0.9531, Validation Accuracy: 0.5202

Epoch 14/100 - Training Loss: 0.9666, Training Accuracy: 0.4943, Validation Loss: 0.9454, Validation Accuracy: 0.5264

Epoch 15/100 - Training Loss: 0.9513, Training Accuracy: 0.4960, Validation Loss: 0.9367, Validation Accuracy: 0.5398

Epoch 16/100 - Training Loss: 0.9495, Training Accuracy: 0.5096, Validation Loss: 0.9316, Validation Accuracy: 0.4975

Epoch 17/100 - Training Loss: 0.9351, Training Accuracy: 0.5061, Validation Loss: 0.9081, Validation Accuracy: 0.5398

Epoch 18/100 - Training Loss: 0.9193, Training Accuracy: 0.5249, Validation Loss: 0.9138, Validation Accuracy: 0.5295

Epoch 19/100 - Training Loss: 0.9009, Training Accuracy: 0.5304, Validation Loss: 0.8881, Validation Accuracy: 0.5274

Epoch 20/100 - Training Loss: 0.8834, Training Accuracy: 0.5413, Validation Loss: 0.8968, Validation Accuracy: 0.5590

Epoch 21/100 - Training Loss: 0.8619, Training Accuracy: 0.5471, Validation Loss: 0.8914, Validation Accuracy: 0.5151

Epoch 22/100 - Training Loss: 0.8387, Training Accuracy: 0.5494, Validation Loss: 0.8419, Validation Accuracy: 0.5842

Epoch 23/100 - Training Loss: 0.8237, Training Accuracy: 0.5649, Validation Loss: 0.8318, Validation Accuracy: 0.5788

Epoch 24/100 - Training Loss: 0.8003, Training Accuracy: 0.5778, Validation Loss: 0.8265, Validation Accuracy: 0.5705

Epoch 25/100 - Training Loss: 0.7811, Training Accuracy: 0.5809, Validation Loss: 0.8248, Validation Accuracy: 0.5829

Epoch 26/100 - Training Loss: 0.7536, Training Accuracy: 0.5838, Validation Loss: 0.7968, Validation Accuracy: 0.6044

Epoch 27/100 - Training Loss: 0.7310, Training Accuracy: 0.6149, Validation Loss: 0.8021, Validation Accuracy: 0.5784

Epoch 28/100 - Training Loss: 0.7304, Training Accuracy: 0.6171, Validation Loss: 0.8126, Validation Accuracy: 0.5879

Epoch 29/100 - Training Loss: 0.7009, Training Accuracy: 0.6291, Validation Loss: 0.8121, Validation Accuracy: 0.5635

Epoch 30/100 - Training Loss: 0.7005, Training Accuracy: 0.6268, Validation Loss: 0.8076, Validation Accuracy: 0.6056

Epoch 31/100 - Training Loss: 0.6795, Training Accuracy: 0.6557, Validation Loss: 0.7759, Validation Accuracy: 0.6731

Epoch 32/100 - Training Loss: 0.6544, Training Accuracy: 0.6759, Validation Loss: 0.7642, Validation Accuracy: 0.6764

Epoch 33/100 - Training Loss: 0.6253, Training Accuracy: 0.7113, Validation Loss: 0.7685, Validation Accuracy: 0.6764

Epoch 34/100 - Training Loss: 0.6097, Training Accuracy: 0.7266, Validation Loss: 0.7537, Validation Accuracy: 0.6900

Epoch 35/100 - Training Loss: 0.5840, Training Accuracy: 0.7519, Validation Loss: 0.7827, Validation Accuracy: 0.6900

Epoch 36/100 - Training Loss: 0.5748, Training Accuracy: 0.7629, Validation Loss: 0.7015, Validation Accuracy: 0.7220

Epoch 37/100 - Training Loss: 0.5451, Training Accuracy: 0.7723, Validation Loss: 0.7123, Validation Accuracy: 0.7316

Epoch 38/100 - Training Loss: 0.5317, Training Accuracy: 0.7867, Validation Loss: 0.7099, Validation Accuracy: 0.7343

Epoch 39/100 - Training Loss: 0.5198, Training Accuracy: 0.7930, Validation Loss: 0.7326, Validation Accuracy: 0.7125

Epoch 40/100 - Training Loss: 0.4945, Training Accuracy: 0.8089, Validation Loss: 0.7426, Validation Accuracy: 0.7479

Epoch 41/100 - Training Loss: 0.4847, Training Accuracy: 0.8157, Validation Loss: 0.7453, Validation Accuracy: 0.7479

Epoch 42/100 - Training Loss: 0.4707, Training Accuracy: 0.8157, Validation Loss: 0.6699, Validation Accuracy: 0.7533

Epoch 43/100 - Training Loss: 0.4383, Training Accuracy: 0.8362, Validation Loss: 0.7747, Validation Accuracy: 0.7479

Epoch 44/100 - Training Loss: 0.4190, Training Accuracy: 0.8475, Validation Loss: 0.7691, Validation Accuracy: 0.7302

Epoch 45/100 - Training Loss: 0.4092, Training Accuracy: 0.8568, Validation Loss: 0.7406, Validation Accuracy: 0.7465

Epoch 46/100 - Training Loss: 0.3892, Training Accuracy: 0.8613, Validation Loss: 0.7240, Validation Accuracy: 0.7547

Epoch 47/100 - Training Loss: 0.3755, Training Accuracy: 0.8682, Validation Loss: 0.6754, Validation Accuracy: 0.7601

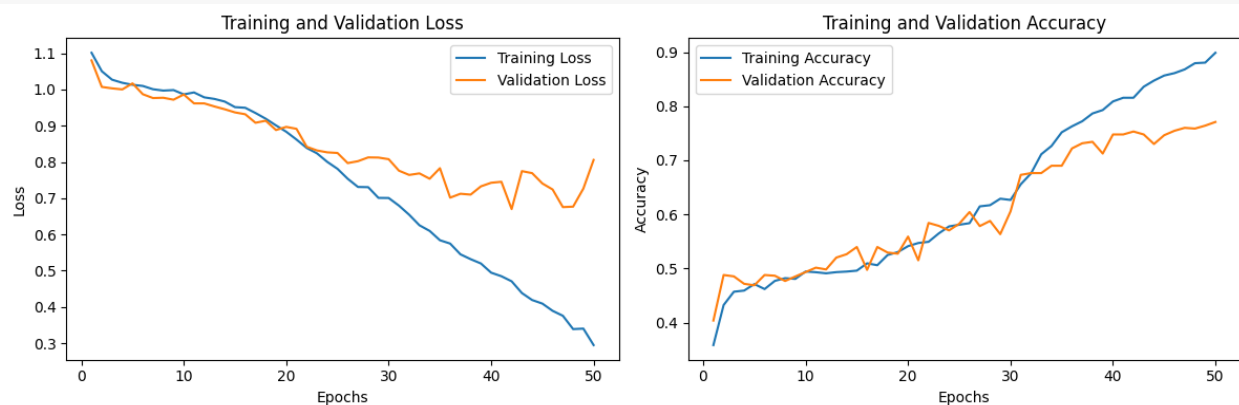
Epoch 48/100 - Training Loss: 0.3388, Training Accuracy: 0.8796, Validation Loss: 0.6767, Validation Accuracy: 0.7587

Epoch 49/100 - Training Loss: 0.3401, Training Accuracy: 0.8807, Validation Loss: 0.7265, Validation Accuracy: 0.7642

Epoch 50/100 - Training Loss: 0.2946, Training Accuracy: 0.8989, Validation Loss: 0.8056, Validation Accuracy: 0.7710

Early stopping triggered.

Make a confusion matrix



FINAL MODEL:

```
vocab_size = len(vocab)
```

```
vocabulary size
```

```
embedding_dim = 100
```

```
hidden_dim = 256
```

```
output_dim = 3 # Output classes: -1, 0, 1 for negative, neutral, positive  
sentiments
```

```
dropout = 0.6
```

```
model = SentimentLSTM(vocab_size=vocab_size, embedding_dim=embedding_dim,  
hidden_dim=hidden_dim, output_dim=3, dropout=dropout)  
loss_fn = nn.CrossEntropyLoss()  
optimizer = optim.Adam(model.parameters(), lr=0.0005, weight_decay=0.0002)  
num_epochs = 100  
patience = 8
```

Epoch 1/100 - Training Loss: 1.0981, Training Accuracy: 0.3708, Training F1: 0.3432, Validation Loss: 1.0513, Validation Accuracy: 0.4550, Validation F1: 0.3598

Epoch 2/100 - Training Loss: 1.0498, Training Accuracy: 0.4404, Training F1: 0.4294, Validation Loss: 1.0120, Validation Accuracy: 0.4798, Validation F1: 0.4583

Epoch 3/100 - Training Loss: 1.0275, Training Accuracy: 0.4553, Training F1: 0.4698, Validation Loss: 1.0058, Validation Accuracy: 0.4785, Validation F1: 0.4820

Epoch 4/100 - Training Loss: 1.0155, Training Accuracy: 0.4682, Training F1: 0.3835, Validation Loss: 1.0103, Validation Accuracy: 0.4798, Validation F1: 0.3936

Epoch 5/100 - Training Loss: 1.0113, Training Accuracy: 0.4643, Training F1: 0.3914, Validation Loss: 1.0070, Validation Accuracy: 0.4732, Validation F1: 0.3872

Epoch 6/100 - Training Loss: 1.0106, Training Accuracy: 0.4699, Training F1: 0.3660, Validation Loss: 1.0303, Validation Accuracy: 0.4691, Validation F1: 0.3770

Epoch 7/100 - Training Loss: 1.0019, Training Accuracy: 0.4816, Training F1: 0.4790, Validation Loss: 0.9979, Validation Accuracy: 0.4674, Validation F1: 0.4809

Epoch 8/100 - Training Loss: 1.0024, Training Accuracy: 0.4755, Training F1: 0.4702, Validation Loss: 0.9902, Validation Accuracy: 0.4839, Validation F1: 0.4742

Epoch 9/100 - Training Loss: 0.9969, Training Accuracy: 0.4751, Training F1: 0.4654, Validation Loss: 0.9827, Validation Accuracy: 0.5029, Validation F1: 0.4796

Epoch 10/100 - Training Loss: 0.9802, Training Accuracy: 0.4853, Training F1: 0.5106, Validation Loss: 0.9854, Validation Accuracy: 0.4961, Validation F1: 0.4964

Epoch 11/100 - Training Loss: 0.9799, Training Accuracy: 0.4848, Training F1: 0.5029, Validation Loss: 0.9673, Validation Accuracy: 0.5118, Validation F1: 0.4957

Epoch 12/100 - Training Loss: 0.9751, Training Accuracy: 0.4956, Training F1: 0.5144, Validation Loss: 0.9502, Validation Accuracy: 0.5105, Validation F1: 0.4960

Epoch 13/100 - Training Loss: 0.9583, Training Accuracy: 0.4952, Training F1: 0.4756, Validation Loss: 0.9579, Validation Accuracy: 0.5085, Validation F1: 0.4390

Epoch 14/100 - Training Loss: 0.9410, Training Accuracy: 0.5014, Training F1: 0.4503, Validation Loss: 0.9517, Validation Accuracy: 0.5229, Validation F1: 0.4273

Epoch 15/100 - Training Loss: 0.9257, Training Accuracy: 0.5110, Training F1: 0.5087, Validation Loss: 0.9385, Validation Accuracy: 0.5254, Validation F1: 0.4943

Epoch 16/100 - Training Loss: 0.9053, Training Accuracy: 0.5276, Training F1: 0.5425, Validation Loss: 0.9408, Validation Accuracy: 0.5316, Validation F1: 0.5029

Epoch 17/100 - Training Loss: 0.8890, Training Accuracy: 0.5272, Training F1: 0.5519, Validation Loss: 0.8800, Validation Accuracy: 0.5526, Validation F1: 0.5362

Epoch 18/100 - Training Loss: 0.8493, Training Accuracy: 0.5580, Training F1: 0.5451, Validation Loss: 0.9154, Validation Accuracy: 0.5458, Validation F1: 0.5117

Epoch 19/100 - Training Loss: 0.8355, Training Accuracy: 0.5638, Training F1: 0.5410, Validation Loss: 0.8660, Validation Accuracy: 0.5342, Validation F1: 0.5142

Epoch 20/100 - Training Loss: 0.8076, Training Accuracy: 0.5704, Training F1: 0.5868, Validation Loss: 0.8696, Validation Accuracy: 0.5881, Validation F1: 0.5658

Epoch 21/100 - Training Loss: 0.7880, Training Accuracy: 0.5622, Training F1: 0.5606, Validation Loss: 0.8880, Validation Accuracy: 0.5512, Validation F1: 0.5305

Epoch 22/100 - Training Loss: 0.7641, Training Accuracy: 0.5886, Training F1: 0.5843, Validation Loss: 0.8517, Validation Accuracy: 0.6064, Validation F1: 0.5821

Epoch 23/100 - Training Loss: 0.7460, Training Accuracy: 0.5924, Training F1: 0.6070, Validation Loss: 0.8616, Validation Accuracy: 0.6159, Validation F1: 0.6005

Epoch 24/100 - Training Loss: 0.7333, Training Accuracy: 0.6078, Training F1: 0.5589, Validation Loss: 0.8602, Validation Accuracy: 0.5654, Validation F1: 0.5076

Epoch 25/100 - Training Loss: 0.7210, Training Accuracy: 0.6183, Training F1: 0.6444, Validation Loss: 0.8390, Validation Accuracy: 0.5941, Validation F1: 0.5816

Epoch 26/100 - Training Loss: 0.6954, Training Accuracy: 0.6250, Training F1: 0.6457, Validation Loss: 0.8590, Validation Accuracy: 0.6229, Validation F1: 0.6010

Epoch 27/100 - Training Loss: 0.6805, Training Accuracy: 0.6365, Training F1: 0.6529, Validation Loss: 0.8792, Validation Accuracy: 0.6167, Validation F1: 0.5972

Epoch 28/100 - Training Loss: 0.6744, Training Accuracy: 0.6500, Training F1: 0.6936, Validation Loss: 0.8361, Validation Accuracy: 0.6526, Validation F1: 0.6472

Epoch 29/100 - Training Loss: 0.6481, Training Accuracy: 0.6757, Training F1: 0.7320, Validation Loss: 0.8414, Validation Accuracy: 0.6832, Validation F1: 0.6766

Epoch 30/100 - Training Loss: 0.6264, Training Accuracy: 0.7022, Training F1: 0.7712, Validation Loss: 0.7953, Validation Accuracy: 0.7009, Validation F1: 0.6973

Epoch 31/100 - Training Loss: 0.6129, Training Accuracy: 0.7269, Training F1: 0.7820, Validation Loss: 0.8393, Validation Accuracy: 0.6632, Validation F1: 0.6748

Epoch 32/100 - Training Loss: 0.5882, Training Accuracy: 0.7509, Training F1: 0.8131, Validation Loss: 0.7172, Validation Accuracy: 0.7343, Validation F1: 0.7289

Epoch 33/100 - Training Loss: 0.5546, Training Accuracy: 0.7626, Training F1: 0.8271, Validation Loss: 0.8238, Validation Accuracy: 0.7411, Validation F1: 0.7341

Epoch 34/100 - Training Loss: 0.5244, Training Accuracy: 0.7877, Training F1: 0.8322, Validation Loss: 0.7503, Validation Accuracy: 0.7519, Validation F1: 0.7471

Epoch 35/100 - Training Loss: 0.5026, Training Accuracy: 0.8017, Training F1: 0.8461, Validation Loss: 0.7350, Validation Accuracy: 0.7411, Validation F1: 0.7357

Epoch 36/100 - Training Loss: 0.4756, Training Accuracy: 0.8166, Training F1: 0.8708, Validation Loss: 0.7381, Validation Accuracy: 0.7438, Validation F1: 0.7394

Epoch 37/100 - Training Loss: 0.4424, Training Accuracy: 0.8261, Training F1: 0.8846, Validation Loss: 0.7486, Validation Accuracy: 0.7574, Validation F1: 0.7521

Epoch 38/100 - Training Loss: 0.4151, Training Accuracy: 0.8480, Training F1: 0.8865, Validation Loss: 0.7724, Validation Accuracy: 0.7560, Validation F1: 0.7474

Epoch 39/100 - Training Loss: 0.3825, Training Accuracy: 0.8583, Training F1: 0.8952, Validation Loss: 0.6764, Validation Accuracy: 0.7832, Validation F1: 0.7790

Epoch 40/100 - Training Loss: 0.3618, Training Accuracy: 0.8719, Training F1: 0.9192, Validation Loss: 0.7005, Validation Accuracy: 0.7655, Validation F1: 0.7603

Epoch 41/100 - Training Loss: 0.3454, Training Accuracy: 0.8780, Training F1: 0.9202, Validation Loss: 0.6596, Validation Accuracy: 0.7750, Validation F1: 0.7711

Epoch 42/100 - Training Loss: 0.3076, Training Accuracy: 0.8902, Training F1: 0.9382, Validation Loss: 0.6787, Validation Accuracy: 0.7859, Validation F1: 0.7823

Epoch 43/100 - Training Loss: 0.2821, Training Accuracy: 0.9045, Training F1: 0.9482, Validation Loss: 0.7401, Validation Accuracy: 0.7778, Validation F1: 0.7746

Epoch 44/100 - Training Loss: 0.2701, Training Accuracy: 0.9106, Training F1: 0.9526, Validation Loss: 0.7934, Validation Accuracy: 0.7723, Validation F1: 0.7682

Epoch 45/100 - Training Loss: 0.2531, Training Accuracy: 0.9153, Training F1: 0.9438, Validation Loss: 0.8413, Validation Accuracy: 0.7723, Validation F1: 0.7679

Epoch 46/100 - Training Loss: 0.2304, Training Accuracy: 0.9251, Training F1: 0.9619, Validation Loss: 0.7506, Validation Accuracy: 0.7764, Validation F1: 0.7739

Epoch 47/100 - Training Loss: 0.2233, Training Accuracy: 0.9271, Training F1: 0.9683, Validation Loss: 0.7258, Validation Accuracy: 0.7859, Validation F1: 0.7830

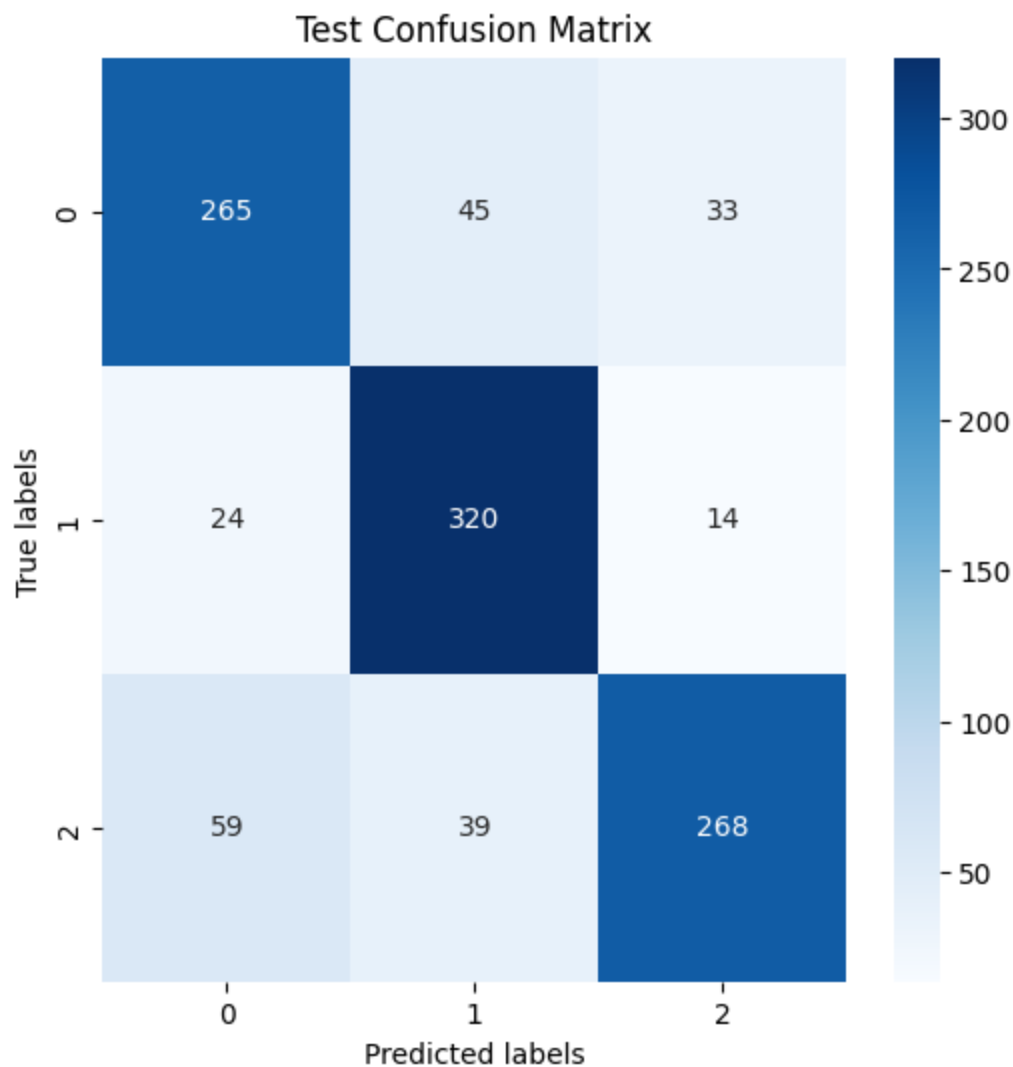
Epoch 48/100 - Training Loss: 0.2025, Training Accuracy: 0.9347, Training F1: 0.9734, Validation Loss: 0.7008, Validation Accuracy: 0.7913, Validation F1: 0.7894

Epoch 49/100 - Training Loss: 0.1957, Training Accuracy: 0.9366, Training F1: 0.9760, Validation Loss: 0.7676, Validation Accuracy: 0.7913, Validation F1: 0.7890

Early stopping triggered.



Test Loss: 0.7849, Test Accuracy: 0.7994, Test F1 Score: 0.7983



Epoch 1/100 - Training Loss: 1.0120, Training Accuracy: 0.4619, Training F1: 0.4401, Validation Loss: 0.9752, Validation Accuracy: 0.4894, Validation F1: 0.4468

Epoch 2/100 - Training Loss: 0.9943, Training Accuracy: 0.4729, Training F1: 0.4132, Validation Loss: 0.9387, Validation Accuracy: 0.5089, Validation F1: 0.4246

Epoch 3/100 - Training Loss: 0.9336, Training Accuracy: 0.5115, Training F1: 0.5786, Validation Loss: 0.8272, Validation Accuracy: 0.5890, Validation F1: 0.5696

Epoch 4/100 - Training Loss: 0.8274, Training Accuracy: 0.6079, Training F1: 0.6945, Validation Loss: 0.7199, Validation Accuracy: 0.6927, Validation F1: 0.6825

Epoch 5/100 - Training Loss: 0.7419, Training Accuracy: 0.6823, Training F1: 0.7508, Validation Loss: 0.6288, Validation Accuracy: 0.7518, Validation F1: 0.7452

Epoch 6/100 - Training Loss: 0.6418, Training Accuracy: 0.7453, Training F1: 0.7935, Validation Loss: 0.5504, Validation Accuracy: 0.7879, Validation F1: 0.7823

Epoch 7/100 - Training Loss: 0.5592, Training Accuracy: 0.7895, Training F1: 0.8294, Validation Loss: 0.5113, Validation Accuracy: 0.8237, Validation F1: 0.8207

Epoch 8/100 - Training Loss: 0.4879, Training Accuracy: 0.8231, Training F1: 0.8647, Validation Loss: 0.4389, Validation Accuracy: 0.8501, Validation F1: 0.8487

Epoch 9/100 - Training Loss: 0.4376, Training Accuracy: 0.8460, Training F1: 0.8829, Validation Loss: 0.4024, Validation Accuracy: 0.8612, Validation F1: 0.8602

Epoch 10/100 - Training Loss: 0.3951, Training Accuracy: 0.8611, Training F1: 0.9031, Validation Loss: 0.3766, Validation Accuracy: 0.8717, Validation F1: 0.8718

Epoch 11/100 - Training Loss: 0.3626, Training Accuracy: 0.8748, Training F1: 0.9062, Validation Loss: 0.3832, Validation Accuracy: 0.8777, Validation F1: 0.8770

Epoch 12/100 - Training Loss: 0.3326, Training Accuracy: 0.8868, Training F1: 0.9164, Validation Loss: 0.3764, Validation Accuracy: 0.8834, Validation F1: 0.8830

Epoch 13/100 - Training Loss: 0.3110, Training Accuracy: 0.8956, Training F1: 0.9294, Validation Loss: 0.3629, Validation Accuracy: 0.8810, Validation F1: 0.8808

Epoch 14/100 - Training Loss: 0.2890, Training Accuracy: 0.9025, Training F1: 0.9397, Validation Loss: 0.3509, Validation Accuracy: 0.8828, Validation F1: 0.8827

Epoch 15/100 - Training Loss: 0.2684, Training Accuracy: 0.9097, Training F1: 0.9377, Validation Loss: 0.3730, Validation Accuracy: 0.8844, Validation F1: 0.8841

Epoch 16/100 - Training Loss: 0.2515, Training Accuracy: 0.9163, Training F1: 0.9476, Validation Loss: 0.3633, Validation Accuracy: 0.8844, Validation F1: 0.8843

Epoch 17/100 - Training Loss: 0.2358, Training Accuracy: 0.9219, Training F1: 0.9537, Validation Loss: 0.3529, Validation Accuracy: 0.8847, Validation F1: 0.8845

Epoch 18/100 - Training Loss: 0.2243, Training Accuracy: 0.9280, Training F1: 0.9580, Validation Loss: 0.3699, Validation Accuracy: 0.8750, Validation F1: 0.8751

Epoch 19/100 - Training Loss: 0.2141, Training Accuracy: 0.9296, Training F1: 0.9614, Validation Loss: 0.3693, Validation Accuracy: 0.8874, Validation F1: 0.8872

Epoch 20/100 - Training Loss: 0.2023, Training Accuracy: 0.9338, Training F1: 0.9616, Validation Loss: 0.3912, Validation Accuracy: 0.8690, Validation F1: 0.8691

Epoch 21/100 - Training Loss: 0.1919, Training Accuracy: 0.9373, Training F1: 0.9658, Validation Loss: 0.3698, Validation Accuracy: 0.8822, Validation F1: 0.8821

Epoch 22/100 - Training Loss: 0.1834, Training Accuracy: 0.9404, Training F1: 0.9683, Validation Loss: 0.3760, Validation Accuracy: 0.8828, Validation F1: 0.8830

Early stopping triggered.

