run_simpleaddembed

November 21, 2024

1 Method Info

Model = SimpleAddEmbed : Takes the word embeddings from glove-50 and for each cell just sums up the embedding for all tokens then passes through FF to get a binary prediction

DS Hierarchy : big > medium > small > tiny > micro > teeny

2 Setup

2.1 Import necessary libraries

[8]:
```
# Import importlib to reload modules and sys and os to add the path for other␣
↪imports
import importlib
import sys
import os
import torch

# Append the parent directory to the path to import the necessary modules
sys.path.append(os.path.abspath(os.path.join(os.getcwd(), '..')))

# Import the utilities and the dataloader
from utils import selfutil, inferutil, trainutil
from classes import SpreadsheetDataLoader, SimpleAddEmbed

# Now reload the modules to ensure they are up-to-date
importlib.reload(selfutil)
importlib.reload(inferutil)
importlib.reload(trainutil)
importlib.reload(SpreadsheetDataLoader)
importlib.reload(SimpleAddEmbed)

# Import the funcs needed from utils
from utils.selfutil import get_vocab2, create_embeddings
from utils.trainutil import train_model
from utils.inferutil import infer_one, infer_full

# Import the SpreadsheetDataLoader class
```

```
from classes.SpreadsheetDataLoader import SpreadsheetDataLoader
from classes.SimpleAddEmbed import SimpleAddEmbed

# Setup device as a global constant
devstr = "cuda:0" # "cpu"
gpu = False if (devstr == 'cpu') else True
DEVICE = 'cpu' if (devstr == 'cpu') else (torch.device(devstr if torch.cuda.
 ↪is_available() else 'cpu') if devstr else torch.cuda.current_device())
print(DEVICE)

devstr2 = "cuda:1" # "cpu"
gpu2 = False if (devstr2 == 'cpu') else True
DEVICE2 = 'cpu' if (devstr2 == 'cpu') else (torch.device(devstr2 if torch.cuda.
 ↪is_available() else 'cpu') if devstr2 else torch.cuda.current_device())
print(DEVICE2)

devstr3 = "cuda:2" # "cpu"
gpu3 = False if (devstr3 == 'cpu') else True
DEVICE3 = 'cpu' if (devstr3 == 'cpu') else (torch.device(devstr3 if torch.cuda.
 ↪is_available() else 'cpu') if devstr3 else torch.cuda.current_device())
print(DEVICE3)

devstr4 = "cuda:3" # "cpu"
gpu4 = False if (devstr4 == 'cpu') else True
DEVICE4 = 'cpu' if (devstr4 == 'cpu') else (torch.device(devstr4 if torch.cuda.
 ↪is_available() else 'cpu') if devstr4 else torch.cuda.current_device())
print(DEVICE4)
```

```
cuda:0
cuda:1
cuda:2
cuda:3
```

2.2 Files

[2]:
```
# Define the directory for training/validation/testing
train_dir = '../../data/farzan/train_big/'
val_dir = '../../data/farzan/val_big/'
test_dir = '../../data/farzan/test_big/'

# Get the valid file paths
train_files = [os.path.join(train_dir, filename) for filename in os.
 ↪listdir(train_dir)
       if filename.lower().endswith(('.xls', '.xlsx', '.csv')) and os.path.
 ↪isfile(os.path.join(train_dir, filename))
   ]
val_files = [os.path.join(val_dir, filename) for filename in os.listdir(val_dir)
```

```
        if filename.lower().endswith(('.xls', '.xlsx', '.csv')) and os.path.
 ↪isfile(os.path.join(val_dir, filename))
    ]
test_files = [os.path.join(test_dir, filename) for filename in os.
 ↪listdir(test_dir)
        if filename.lower().endswith(('.xls', '.xlsx', '.csv')) and os.path.
 ↪isfile(os.path.join(test_dir, filename))
    ]

# Observe length
print(f'Train/Val/Test : {len(train_files)}/{len(val_files)}/{len(test_files)}')
```

```
Train/Val/Test : 800/100/100
```

2.3 Vocab and Embeddings

Get the vocabulary object from the helper function as well as the processed file paths.

[3]:
```
### Train vocab using training files from largest dataset with fixed size of␣
 ↪50000
vocab_dir = '../../data/farzan/train_big/'
spreadsheet_vocab = get_vocab2(vocab_dir, 50000)

# Create the embeddings for each word in the vocabulary and view info
spreadsheet_wvs = create_embeddings(spreadsheet_vocab)
print(f'Word Embeddings Shape: {spreadsheet_wvs.shape}')
```

```
Processing Files: 100%|                          | 800/800
[01:42<00:00,  7.80it/s]

800(P) = 800(G) + 0(E)
Unique Tokens: 140385
Vocab Size: 50000

100%|                                  | 50000/50000
[00:00<00:00, 98522.64it/s]

Word Embeddings Shape: torch.Size([50000, 50])
```

2.4 Data Loader

[4]:
```
train_loader = SpreadsheetDataLoader(train_files, spreadsheet_vocab)
val_loader = SpreadsheetDataLoader(val_files, spreadsheet_vocab)
test_loader = SpreadsheetDataLoader(test_files, spreadsheet_vocab)

print(f'Training Files Processed: {len(train_loader)}')
print(f'Validation Files Processed: {len(val_loader)}')
print(f'Testing Files Processed: {len(test_loader)}')
```

```
Processing files: 100%|                                | 800/800
[00:38<00:00, 20.66it/s]
Processing files: 100%|                                | 100/100
[00:03<00:00, 32.10it/s]
Processing files: 100%|                                | 100/100
[00:01<00:00, 69.25it/s]

Training Files Processed: 800
Validation Files Processed: 100
Testing Files Processed: 100
```

3 Training

3.1 Training Loop

[5]:
```python
import time
# Define the model
untrained_model = SimpleAddEmbed(spreadsheet_wvs).to(DEVICE)

# Call the function to train the model
start = time.time()
trained_model = train_model(
    untrained_model, train_loader, val_loader, DEVICE,
    batch_size=800, lr=1e-3, mu=0.25, max_epochs=20, patience=3,
    save_int=0, save_dir='../models/', save_name = 'simpleaddembed_big'
)
print(f'Train Time: {time.time() - start}')
```

```
Epoch 0

Batch Processing: 100%|                                  | 1/1
[00:08<00:00,  8.89s/it]
Validation Processing: 100%|                               | 1/1
[00:01<00:00,  1.46s/it]

Train Loss: 2.0192244052886963, Perplexity: 1.0000002524030824
Val Loss: 0.92741459608078, Perplexity: 1.0000001159268312


Epoch 1

Batch Processing: 100%|                                  | 1/1
[00:08<00:00,  8.49s/it]
Validation Processing: 100%|                               | 1/1
[00:01<00:00,  1.40s/it]

Train Loss: 1.7112913131713867, Perplexity: 1.000000213911437
Val Loss: 0.8598417043685913, Perplexity: 1.0000001074802187
```

```
Epoch 2

Batch Processing: 100%|                                | 1/1
[00:08<00:00,  8.56s/it]
Validation Processing: 100%|                             | 1/1
[00:01<00:00,  1.54s/it]

Train Loss: 1.556275725364685, Perplexity: 1.0000001945344845
Val Loss: 0.8082690834999084, Perplexity: 1.0000001010336406


Epoch 3

Batch Processing: 100%|                                | 1/1
[00:08<00:00,  8.84s/it]
Validation Processing: 100%|                             | 1/1
[00:01<00:00,  1.57s/it]

Train Loss: 1.4391082525253296, Perplexity: 1.0000001798885478
Val Loss: 0.761481761932373, Perplexity: 1.0000000951852248


Epoch 4

Batch Processing: 100%|                                | 1/1
[00:09<00:00,  9.66s/it]
Validation Processing: 100%|                             | 1/1
[00:01<00:00,  1.57s/it]

Train Loss: 1.352797508239746, Perplexity: 1.000000169099703
Val Loss: 0.719844400882721, Perplexity: 1.0000000899805541


Epoch 5

Batch Processing: 100%|                                | 1/1
[00:09<00:00,  9.34s/it]
Validation Processing: 100%|                             | 1/1
[00:01<00:00,  1.49s/it]

Train Loss: 1.2796885967254639, Perplexity: 1.0000001599610875
Val Loss: 0.6806326508522034, Perplexity: 1.0000000850790849


Epoch 6

Batch Processing: 100%|                                | 1/1
[00:08<00:00,  8.24s/it]
Validation Processing: 100%|                             | 1/1
[00:01<00:00,  1.54s/it]
```

```
Train Loss: 1.2399780750274658, Perplexity: 1.0000001549972715
Val Loss: 0.6502676606178284, Perplexity: 1.0000000812834609


Epoch 7

Batch Processing: 100%|                                | 1/1
[00:08<00:00,  8.59s/it]
Validation Processing: 100%|                             | 1/1
[00:01<00:00,  1.45s/it]

Train Loss: 1.1934484243392944, Perplexity: 1.0000001491810642
Val Loss: 0.621749758720398, Perplexity: 1.0000000777187228


Epoch 8

Batch Processing: 100%|                                | 1/1
[00:08<00:00,  8.45s/it]
Validation Processing: 100%|                             | 1/1
[00:01<00:00,  1.56s/it]

Train Loss: 1.172524094581604, Perplexity: 1.0000001465655226
Val Loss: 0.6004493832588196, Perplexity: 1.0000000750561757


Epoch 9

Batch Processing: 100%|                                | 1/1
[00:08<00:00,  8.91s/it]
Validation Processing: 100%|                             | 1/1
[00:01<00:00,  1.44s/it]

Train Loss: 1.1402819156646729, Perplexity: 1.0000001425352496
Val Loss: 0.5806065201759338, Perplexity: 1.0000000725758176


Epoch 10

Batch Processing: 100%|                                | 1/1
[00:09<00:00,  9.20s/it]
Validation Processing: 100%|                             | 1/1
[00:01<00:00,  1.43s/it]

Train Loss: 1.0983015298843384, Perplexity: 1.0000001372877008
Val Loss: 0.560370147228241, Perplexity: 1.0000000700462708


Epoch 11

Batch Processing: 100%|                                | 1/1
[00:08<00:00,  8.35s/it]
```

```
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.43s/it]

Train Loss: 1.1020963191986084, Perplexity: 1.0000001377620493
Val Loss: 0.5593439936637878, Perplexity: 1.0000000699180016


Epoch 12

Batch Processing: 100%|                             | 1/1
[00:08<00:00,  8.48s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.50s/it]

Train Loss: 1.0761486291885376, Perplexity: 1.0000001345185876
Val Loss: 0.5473160147666931, Perplexity: 1.0000000684145043


Epoch 13

Batch Processing: 100%|                             | 1/1
[00:08<00:00,  8.21s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.42s/it]

Train Loss: 1.0661669969558716, Perplexity: 1.0000001332708834
Val Loss: 0.5433531403541565, Perplexity: 1.0000000679191448


Epoch 14

Batch Processing: 100%|                             | 1/1
[00:08<00:00,  8.64s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.47s/it]

Train Loss: 1.0480455160140991, Perplexity: 1.000000131005698
Val Loss: 0.53364098072052, Perplexity: 1.0000000667051248


Epoch 15

Batch Processing: 100%|                             | 1/1
[00:08<00:00,  8.36s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.49s/it]

Train Loss: 1.065098762512207, Perplexity: 1.0000001331373543
Val Loss: 0.5417384505271912, Perplexity: 1.0000000677173086


Epoch 16
```

```
Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.59s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.50s/it]

Train Loss: 1.0264631509780884, Perplexity: 1.000000128307902
Val Loss: 0.5252918004989624, Perplexity: 1.0000000656614771


Epoch 17

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.83s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.40s/it]

Train Loss: 1.0304778814315796, Perplexity: 1.0000001288097435
Val Loss: 0.5223202705383301, Perplexity: 1.000000065290036


Epoch 18

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.20s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.43s/it]

Train Loss: 1.042776107788086, Perplexity: 1.000000130347022
Val Loss: 0.5306870341300964, Perplexity: 1.0000000663358815


Epoch 19

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.61s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.34s/it]

Train Loss: 1.014580488204956, Perplexity: 1.0000001268225691
Val Loss: 0.5139964818954468, Perplexity: 1.0000000642495623



TRAINING DONE at epoch 19, best epoch 19
Train Loss = 1.014580488204956, Perplexity = 1.0000001268225691
Val Loss = 0.5139964818954468, Perplexity = 1.0000000642495623
Train Time: 204.01724696159363
```

[6]:
```
import time
# Define the model
untrained_model2 = SimpleAddEmbed(spreadsheet_wvs).to(DEVICE2)

# Call the function to train the model
start = time.time()
trained_model2 = train_model(
    untrained_model2, train_loader, val_loader, DEVICE2,
    batch_size=800, lr=9e-4, mu=0.25, max_epochs=20, patience=3,
    save_int=0, save_dir='../models/', save_name = 'simpleaddembed_big'
)
print(f'Train Time: {time.time() - start}')
```

```
Epoch 0

Batch Processing: 100%|                                | 1/1
[00:08<00:00,  8.36s/it]
Validation Processing: 100%|                             | 1/1
[00:01<00:00,  1.39s/it]

Train Loss: 29.23206329345703, Perplexity: 1.0000036540145876
Val Loss: 28.947063446044922, Perplexity: 1.0000036183894772


Epoch 1

Batch Processing: 100%|                                | 1/1
[00:08<00:00,  8.37s/it]
Validation Processing: 100%|                             | 1/1
[00:01<00:00,  1.33s/it]

Train Loss: 28.175071716308594, Perplexity: 1.0000035218901664
Val Loss: 28.183794021606445, Perplexity: 1.0000035229804585


Epoch 2

Batch Processing: 100%|                                | 1/1
[00:08<00:00,  8.03s/it]
Validation Processing: 100%|                             | 1/1
[00:01<00:00,  1.44s/it]

Train Loss: 27.4273681640625, Perplexity: 1.0000034284268975
Val Loss: 27.56108856201172, Perplexity: 1.0000034451420048


Epoch 3

Batch Processing: 100%|                                | 1/1
[00:08<00:00,  8.11s/it]
Validation Processing: 100%|                             | 1/1
```

```
[00:01<00:00,  1.47s/it]

Train Loss: 26.832691192626953, Perplexity: 1.0000033540920241
Val Loss: 27.02235984802246, Perplexity: 1.0000033778006858


Epoch 4

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.35s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.38s/it]

Train Loss: 26.29958724975586, Perplexity: 1.0000032874538098
Val Loss: 26.540691375732422, Perplexity: 1.0000033175919252


Epoch 5

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.18s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.53s/it]

Train Loss: 25.76168441772461, Perplexity: 1.0000032202157372
Val Loss: 26.101408004760742, Perplexity: 1.0000032626813231


Epoch 6

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.13s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.52s/it]

Train Loss: 25.30310821533203, Perplexity: 1.0000031628935289
Val Loss: 25.69497299194336, Perplexity: 1.000003211876782


Epoch 7

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.15s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.49s/it]

Train Loss: 24.977863311767578, Perplexity: 1.000003122237788
Val Loss: 25.314844131469727, Perplexity: 1.000003164360523


Epoch 8
```

```
Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.22s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.42s/it]

Train Loss: 24.609527587890625, Perplexity: 1.00000307619568
Val Loss: 24.956539154052734, Perplexity: 1.00000311957226


Epoch 9

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.53s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.59s/it]

Train Loss: 24.289403915405273, Perplexity: 1.0000030361800987
Val Loss: 24.61676788330078, Perplexity: 1.0000030771007198


Epoch 10

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.56s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.37s/it]

Train Loss: 23.904176712036133, Perplexity: 1.000002988026553
Val Loss: 24.29296875, Perplexity: 1.0000030366257042


Epoch 11

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.23s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.44s/it]

Train Loss: 23.55169105529785, Perplexity: 1.0000029439657154
Val Loss: 23.98301124572754, Perplexity: 1.0000029978808993


Epoch 12

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.16s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.31s/it]

Train Loss: 23.30938148498535, Perplexity: 1.0000029136769304
Val Loss: 23.685348510742188, Perplexity: 1.0000029606729466
```

```
Epoch 13

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.02s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.42s/it]

Train Loss: 22.99418830871582, Perplexity: 1.0000028742776692
Val Loss: 23.398632049560547, Perplexity: 1.0000029248332836


Epoch 14

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.25s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.43s/it]

Train Loss: 22.764955520629883, Perplexity: 1.0000028456234888
Val Loss: 23.121572494506836, Perplexity: 1.0000028902007385


Epoch 15

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.02s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.34s/it]

Train Loss: 22.434616088867188, Perplexity: 1.0000028043309432
Val Loss: 22.853517532348633, Perplexity: 1.000002856693772


Epoch 16

Batch Processing: 100%|                              | 1/1
[00:07<00:00,  7.95s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.30s/it]

Train Loss: 22.179012298583984, Perplexity: 1.0000027723803804
Val Loss: 22.5935001373291, Perplexity: 1.000002824191505


Epoch 17

Batch Processing: 100%|                              | 1/1
[00:07<00:00,  7.91s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.56s/it]
```

```
Train Loss: 21.925491333007812, Perplexity: 1.0000027406901724
Val Loss: 22.340911865234375, Perplexity: 1.0000027926178825


Epoch 18

Batch Processing: 100%|                                  | 1/1
[00:08<00:00,  8.96s/it]
Validation Processing: 100%|                               | 1/1
[00:01<00:00,  1.49s/it]

Train Loss: 21.672889709472656, Perplexity: 1.0000027091148833
Val Loss: 22.0950984954834, Perplexity: 1.000002761891126


Epoch 19

Batch Processing: 100%|                                  | 1/1
[00:08<00:00,  8.38s/it]
Validation Processing: 100%|                               | 1/1
[00:01<00:00,  1.49s/it]

Train Loss: 21.450183868408203, Perplexity: 1.000002681276578
Val Loss: 21.855587005615234, Perplexity: 1.0000027319521074



TRAINING DONE at epoch 19, best epoch 19
Train Loss = 21.450183868408203, Perplexity = 1.000002681276578
Val Loss = 21.855587005615234, Perplexity = 1.0000027319521074
Train Time: 194.59818959236145
```

[7]:
```python
import time
# Define the model
untrained_model3 = SimpleAddEmbed(spreadsheet_wvs).to(DEVICE3)

# Call the function to train the model
start = time.time()
trained_model3 = train_model(
    untrained_model3, train_loader, val_loader, DEVICE3,
    batch_size=800, lr=8e-4, mu=0.25, max_epochs=20, patience=3,
    save_int=0, save_dir='../models/', save_name = 'simpleaddembed_big'
)
print(f'Train Time: {time.time() - start}')
```

```
Epoch 0

Batch Processing: 100%|                                  | 1/1
[00:08<00:00,  8.57s/it]
```

```
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.53s/it]

Train Loss: 7.814233303070068, Perplexity: 1.0000009767796398
Val Loss: 6.606494426727295, Perplexity: 1.0000008258121442


Epoch 1

Batch Processing: 100%|                             | 1/1
[00:08<00:00,  8.15s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.43s/it]

Train Loss: 6.831081390380859, Perplexity: 1.0000008538855383
Val Loss: 5.872827529907227, Perplexity: 1.0000007341037107


Epoch 2

Batch Processing: 100%|                             | 1/1
[00:08<00:00,  8.42s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.34s/it]

Train Loss: 6.153233051300049, Perplexity: 1.0000007691544273
Val Loss: 5.274695873260498, Perplexity: 1.0000006593372015


Epoch 3

Batch Processing: 100%|                             | 1/1
[00:08<00:00,  8.13s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.53s/it]

Train Loss: 5.623179912567139, Perplexity: 1.000000702897736
Val Loss: 4.758563995361328, Perplexity: 1.0000005948206763


Epoch 4

Batch Processing: 100%|                             | 1/1
[00:08<00:00,  8.26s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.64s/it]

Train Loss: 5.161204814910889, Perplexity: 1.0000006451508099
Val Loss: 4.298678874969482, Perplexity: 1.0000005373350038


Epoch 5
```

```
Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.18s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.45s/it]

Train Loss: 4.749096870422363, Perplexity: 1.000000593637285
Val Loss: 3.881603717803955, Perplexity: 1.0000004852005824


Epoch 6

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.24s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.35s/it]

Train Loss: 4.414058685302734, Perplexity: 1.000000551757488
Val Loss: 3.499978542327881, Perplexity: 1.0000004374974134


Epoch 7

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.11s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.61s/it]

Train Loss: 4.091704845428467, Perplexity: 1.0000005114632364
Val Loss: 3.14788556098938, Perplexity: 1.0000003934857726


Epoch 8

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.21s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.36s/it]

Train Loss: 3.8045382499694824, Perplexity: 1.0000004755673944
Val Loss: 2.8228774070739746, Perplexity: 1.000000352859738


Epoch 9

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.06s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.45s/it]

Train Loss: 3.5383529663085938, Perplexity: 1.0000004422942186
Val Loss: 2.522982597351074, Perplexity: 1.0000003153728745
```

```
Epoch 10

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.19s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.40s/it]

Train Loss: 3.3110973834991455, Perplexity: 1.0000004138872587
Val Loss: 2.2480432987213135, Perplexity: 1.0000002810054518


Epoch 11

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.19s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.32s/it]

Train Loss: 3.0932867527008057, Perplexity: 1.0000003866609188
Val Loss: 1.997337818145752, Perplexity: 1.0000002496672584


Epoch 12

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.13s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.36s/it]

Train Loss: 2.9001190662384033, Perplexity: 1.000000362514949
Val Loss: 1.7714049816131592, Perplexity: 1.0000002214256472


Epoch 13

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.19s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.42s/it]

Train Loss: 2.7175405025482178, Perplexity: 1.0000003396926205
Val Loss: 1.569845199584961, Perplexity: 1.0000001962306693


Epoch 14

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.22s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.39s/it]
```

```
Train Loss: 2.552405834197998, Perplexity: 1.0000003190507802
Val Loss: 1.3927302360534668, Perplexity: 1.0000001740912947


Epoch 15

Batch Processing: 100%|                              | 1/1
[00:07<00:00,  7.92s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.35s/it]

Train Loss: 2.4025003910064697, Perplexity: 1.000000300312594
Val Loss: 1.2392215728759766, Perplexity: 1.0000001549027087


Epoch 16

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.08s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.34s/it]

Train Loss: 2.2738664150238037, Perplexity: 1.0000002842333422
Val Loss: 1.108411192893982, Perplexity: 1.0000001385514088


Epoch 17

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.23s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.37s/it]

Train Loss: 2.147498846054077, Perplexity: 1.0000002684373919
Val Loss: 0.9979069828987122, Perplexity: 1.0000001247383807


Epoch 18

Batch Processing: 100%|                              | 1/1
[00:07<00:00,  7.84s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.37s/it]

Train Loss: 2.028663158416748, Perplexity: 1.0000002535829269
Val Loss: 0.9055291414260864, Perplexity: 1.0000001131911491


Epoch 19

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.12s/it]
```

```
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.30s/it]

Train Loss: 1.9318022727966309, Perplexity: 1.0000002414753133
Val Loss: 0.8294468522071838, Perplexity: 1.000000103680862



TRAINING DONE at epoch 19, best epoch 19
Train Loss = 1.9318022727966309, Perplexity = 1.0000002414753133
Val Loss = 0.8294468522071838, Perplexity = 1.000000103680862
Train Time: 193.05509042739868
```

[9]:
```python
import time
# Define the model
untrained_model4 = SimpleAddEmbed(spreadsheet_wvs).to(DEVICE4)

# Call the function to train the model
start = time.time()
trained_model4 = train_model(
    untrained_model4, train_loader, val_loader, DEVICE4,
    batch_size=800, lr=7e-4, mu=0.25, max_epochs=20, patience=3,
    save_int=0, save_dir='../models/', save_name = 'simpleaddembed_big'
)
print(f'Train Time: {time.time() - start}')
```

```
Epoch 0

Batch Processing: 100%|                             | 1/1
[00:08<00:00,  8.48s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.41s/it]

Train Loss: 19.758941650390625, Perplexity: 1.0000024698707564
Val Loss: 18.50708770751953, Perplexity: 1.0000023133886393


Epoch 1

Batch Processing: 100%|                             | 1/1
[00:08<00:00,  8.13s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.41s/it]

Train Loss: 18.565080642700195, Perplexity: 1.000002320637773
Val Loss: 17.581642150878906, Perplexity: 1.0000021977076838


Epoch 2
```

```
Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.04s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.35s/it]

Train Loss: 17.681896209716797, Perplexity: 1.0000022102394688
Val Loss: 16.827545166015625, Perplexity: 1.000002103445358


Epoch 3

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.20s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.42s/it]

Train Loss: 16.95948028564453, Perplexity: 1.0000021199372828
Val Loss: 16.17532730102539, Perplexity: 1.0000020219179566


Epoch 4

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.12s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.42s/it]

Train Loss: 16.418106079101562, Perplexity: 1.0000020522653659
Val Loss: 15.592869758605957, Perplexity: 1.0000019491106193


Epoch 5

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.14s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.44s/it]

Train Loss: 15.899230003356934, Perplexity: 1.0000019874057253
Val Loss: 15.062470436096191, Perplexity: 1.000001882810577


Epoch 6

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.10s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.49s/it]

Train Loss: 15.347228050231934, Perplexity: 1.0000019184053464
Val Loss: 14.572509765625, Perplexity: 1.0000018215653796
```

```
Epoch 7

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.04s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.42s/it]

Train Loss: 14.927724838256836, Perplexity: 1.0000018659673457
Val Loss: 14.115388870239258, Perplexity: 1.0000017644251653


Epoch 8

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.09s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.44s/it]

Train Loss: 14.47827434539795, Perplexity: 1.000001809785931
Val Loss: 13.685527801513672, Perplexity: 1.0000017106924384


Epoch 9

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.07s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.41s/it]

Train Loss: 14.092362403869629, Perplexity: 1.000001761546852
Val Loss: 13.278849601745605, Perplexity: 1.0000016598575778


Epoch 10

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.01s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.46s/it]

Train Loss: 13.692091941833496, Perplexity: 1.0000017115129574
Val Loss: 12.892354965209961, Perplexity: 1.0000016115456691


Epoch 11

Batch Processing: 100%|                              | 1/1
[00:07<00:00,  7.98s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.49s/it]
```

```
Train Loss: 13.392343521118164, Perplexity: 1.0000016740443414
Val Loss: 12.523514747619629, Perplexity: 1.0000015654405687


Epoch 12

Batch Processing: 100%|                              | 1/1
[00:07<00:00,  7.86s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.42s/it]

Train Loss: 13.002861976623535, Perplexity: 1.000001625359068
Val Loss: 12.170522689819336, Perplexity: 1.0000015213164934


Epoch 13

Batch Processing: 100%|                              | 1/1
[00:07<00:00,  7.92s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.39s/it]

Train Loss: 12.693572044372559, Perplexity: 1.0000015866977643
Val Loss: 11.831680297851562, Perplexity: 1.000001478961131


Epoch 14

Batch Processing: 100%|                              | 1/1
[00:07<00:00,  7.95s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.37s/it]

Train Loss: 12.416959762573242, Perplexity: 1.000001552121175
Val Loss: 11.505581855773926, Perplexity: 1.000001438198766


Epoch 15

Batch Processing: 100%|                              | 1/1
[00:07<00:00,  7.76s/it]
Validation Processing: 100%|                           | 1/1
[00:01<00:00,  1.35s/it]

Train Loss: 12.102110862731934, Perplexity: 1.0000015127650022
Val Loss: 11.19119930267334, Perplexity: 1.0000013989008913


Epoch 16

Batch Processing: 100%|                              | 1/1
[00:08<00:00,  8.08s/it]
```

```
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.37s/it]

Train Loss: 11.784562110900879, Perplexity: 1.000001473071349
Val Loss: 10.887514114379883, Perplexity: 1.0000013609401903


Epoch 17

Batch Processing: 100%|                             | 1/1
[00:07<00:00,  7.72s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.38s/it]

Train Loss: 11.498239517211914, Perplexity: 1.0000014372809725
Val Loss: 10.593857765197754, Perplexity: 1.0000013242330974


Epoch 18

Batch Processing: 100%|                             | 1/1
[00:07<00:00,  7.89s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.46s/it]

Train Loss: 11.280974388122559, Perplexity: 1.0000014101227928
Val Loss: 10.309378623962402, Perplexity: 1.0000012886731584


Epoch 19

Batch Processing: 100%|                             | 1/1
[00:07<00:00,  7.92s/it]
Validation Processing: 100%|                          | 1/1
[00:01<00:00,  1.46s/it]

Train Loss: 11.024375915527344, Perplexity: 1.0000013780479389
Val Loss: 10.03344440460205, Perplexity: 1.000001254181337



TRAINING DONE at epoch 19, best epoch 19
Train Loss = 11.024375915527344, Perplexity = 1.0000013780479389
Val Loss = 10.03344440460205, Perplexity = 1.000001254181337
Train Time: 189.5676281452179
```

[27]:
```
# del untrained_model
# del trained_model
```

4 Evaluation

4.1 Infer One Function - Single Example Evaluation

Performs evaluation on a single file chosen by index from the dataloader

4.1.1 Signature

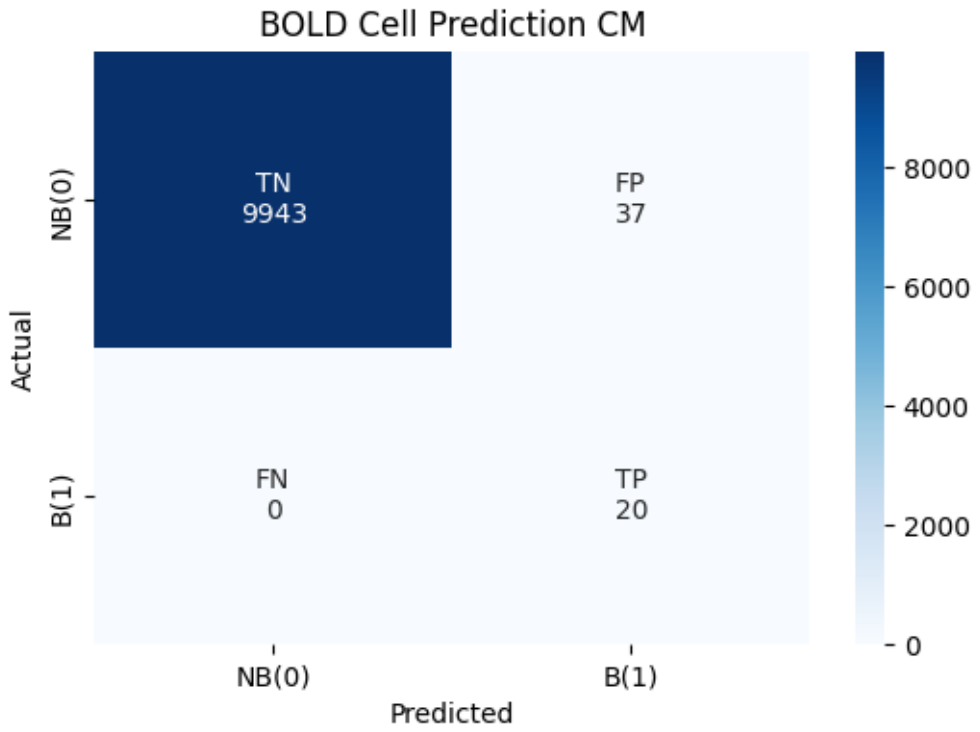
def infer_one(trained_model, infer_loader, loc=0, disp_max=False, device='cuda:0'):

```
"""
Takes a trained model and a dataloader, returns a 100x100 2D grid of predictions
(1 for bold, 0 for not bold) for the specified spreadsheet in the dataloader,
and calculates the accuracy, precision, recall, F1-score, and other metrics.

Args:
    trained_model (nn.Module): The trained PyTorch model.
    infer_loader (DataLoader): Dataloader object for the inference files.
    loc (int): Index of the spreadsheet in the dataloader to perform inference on.
    disp_max (bool): If True, displays the entire DataFrame without truncation. Default is Fals
    device (str or torch.device, optional): Device string (e.g., 'cuda:0') or torch.device. De
"""
```

[10]:
```
# Training Data
infer_one(trained_model, train_loader, loc=0, threshold=0.5, disp_max = True,␣
 ↪device = DEVICE)
infer_one(trained_model2, train_loader, loc=0, threshold=0.5, disp_max = True,␣
 ↪device = DEVICE2)
infer_one(trained_model3, train_loader, loc=0, threshold=0.5, disp_max = True,␣
 ↪device = DEVICE3)
infer_one(trained_model4, train_loader, loc=0, threshold=0.5, disp_max = True,␣
 ↪device = DEVICE4)
```

```
Filename: ../../data/farzan/train_big/postvax_odp_data-dictionary_5p.xlsx

Raw Logit Predictions:
tensor([[[  3.6608,   4.5258,   4.5258,  …, -11.4981, -11.4981, -11.4981],
         [  5.2789,   4.5742,   4.5775,  …, -11.4981, -11.4981, -11.4981],
         [  4.4642,   4.4642,   4.2475,  …, -11.4981, -11.4981, -11.4981],
         …,
         [-11.4981, -11.4981, -11.4981,  …, -11.4981, -11.4981, -11.4981],
         [-11.4981, -11.4981, -11.4981,  …, -11.4981, -11.4981, -11.4981],
         [-11.4981, -11.4981, -11.4981,  …, -11.4981, -11.4981, -11.4981]]],
       device='cuda:0')

Sigmoid Probabilities:
tensor([[9.7493e-01, 9.8929e-01, 9.8929e-01,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
```

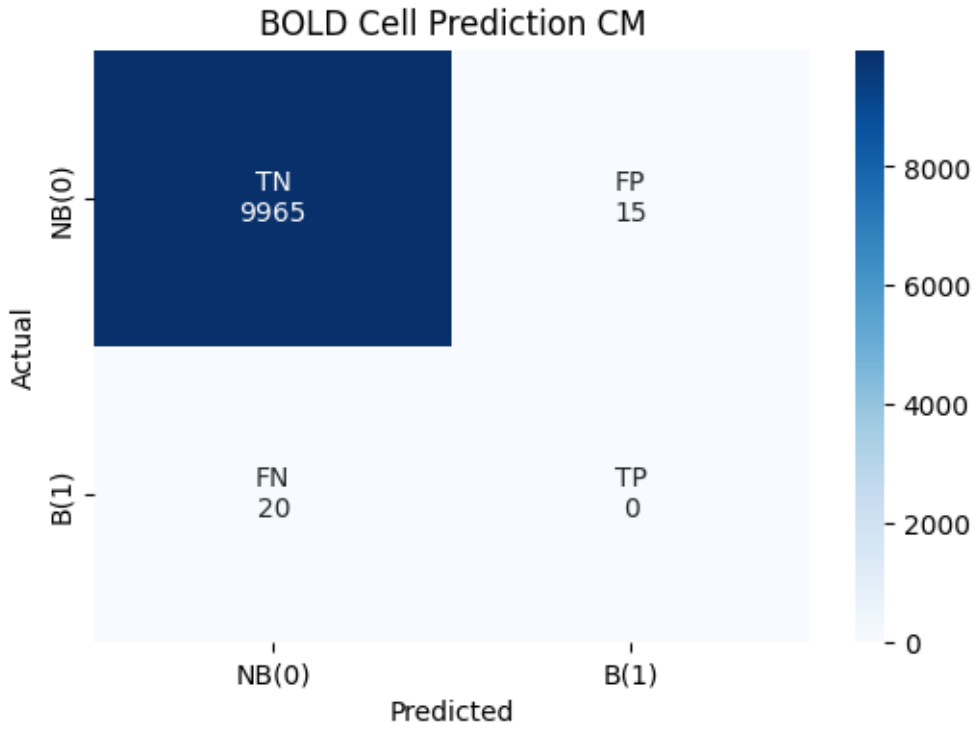
```
        [9.9493e-01, 9.8979e-01, 9.8982e-01,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
        [9.8862e-01, 9.8862e-01, 9.8590e-01,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
        …,
        [1.0150e-05, 1.0150e-05, 1.0150e-05,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
        [1.0150e-05, 1.0150e-05, 1.0150e-05,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
        [1.0150e-05, 1.0150e-05, 1.0150e-05,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05]], device='cuda:0')

NB to B ratio: Predicted = 9943:57 | Actual = 9980:20
Accuracy: 99.63% | Precision: 35.09% | Recall: 100.00% | F1-Score: 0.52
```




```
--- Predicted Grid (1 = Bold, 0 = Not Bold) ---

    0  1  2
0   1  1  1
1   1  1  1
2   1  1  1
3   1  1  1
```

```
4   1  1  1
5   1  1  1
6   1  1  1
7   1  1  1
8   1  1  1
9   1  1  1
10  1  1  1
11  1  1  1
12  1  1  1
13  1  1  1
14  1  1  1
15  1  1  1
16  1  1  1
17  1  1  1
18  1  1  1


--- Actual Grid (1 = Bold, 0 = Not Bold) ---

    0  1  2
1   1  1  1
2   1  0  0
3   1  0  0
4   1  0  0
5   1  0  0
6   1  0  0
7   1  0  0
8   1  0  0
9   1  0  0
10  1  0  0
11  1  0  0
12  1  0  0
13  1  0  0
14  1  0  0
15  1  0  0
16  1  0  0
17  1  0  0
18  1  0  0


Filename: ../../data/farzan/train_big/postvax_odp_data-dictionary_5p.xlsx

Raw Logit Predictions:
tensor([[[-20.6194, -25.1106, -25.1106,  …, -42.5887, -42.5887, -42.5887],
         [-23.2254, -24.6717, -25.1309,  …, -42.5887, -42.5887, -42.5887],
         [-24.9975, -24.9975, -12.8878,  …, -42.5887, -42.5887, -42.5887],
         …,
         [-42.5887, -42.5887, -42.5887,  …, -42.5887, -42.5887, -42.5887],
         [-42.5887, -42.5887, -42.5887,  …, -42.5887, -42.5887, -42.5887],
```

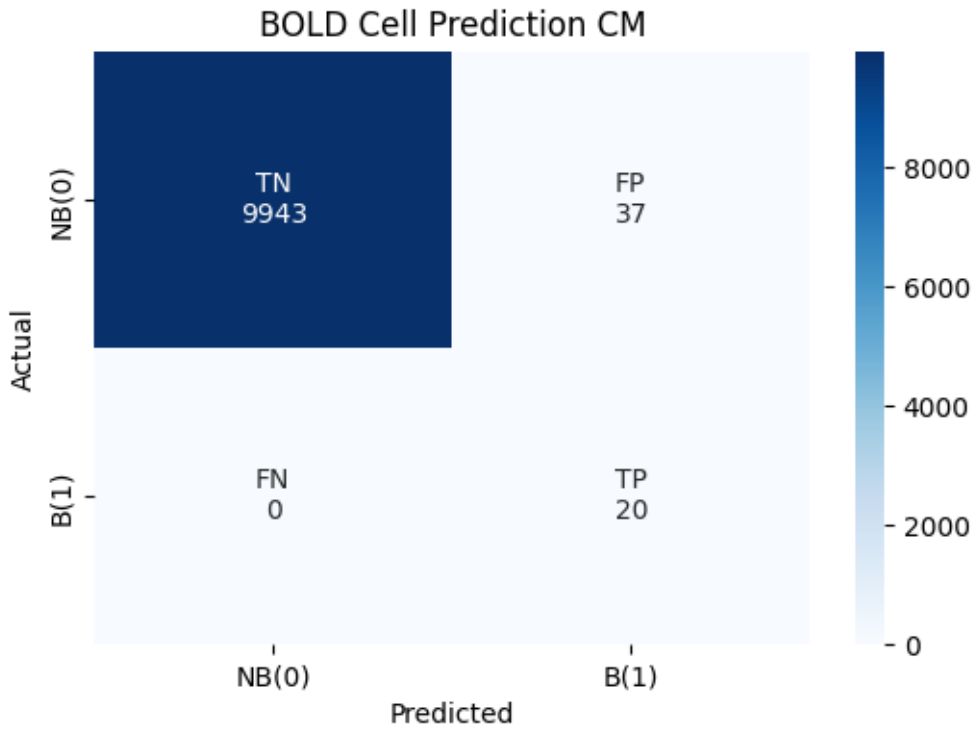
```
         [-42.5887, -42.5887, -42.5887,  …, -42.5887, -42.5887, -42.5887]]],
       device='cuda:1')

Sigmoid Probabilities:
tensor([[1.1094e-09, 1.2434e-11, 1.2434e-11,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        [8.1914e-11, 1.9285e-11, 1.2184e-11,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        [1.3923e-11, 1.3923e-11, 2.5288e-06,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        …,
        [3.1912e-19, 3.1912e-19, 3.1912e-19,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        [3.1912e-19, 3.1912e-19, 3.1912e-19,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        [3.1912e-19, 3.1912e-19, 3.1912e-19,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19]], device='cuda:1')

NB to B ratio: Predicted = 9985:15 | Actual = 9980:20
Accuracy: 99.65% | Precision: 0.00% | Recall: 0.00% | F1-Score: 0.00
```




```
--- Predicted Grid (1 = Bold, 0 = Not Bold) ---
```

```
    2
4   1
5   1
6   1
7   1
8   1
9   1
10  1
11  1
12  1
13  1
14  1
15  1
16  1
17  1
18  1


--- Actual Grid (1 = Bold, 0 = Not Bold) ---

    0  1  2
1   1  1  1
2   1  0  0
3   1  0  0
4   1  0  0
5   1  0  0
6   1  0  0
7   1  0  0
8   1  0  0
9   1  0  0
10  1  0  0
11  1  0  0
12  1  0  0
13  1  0  0
14  1  0  0
15  1  0  0
16  1  0  0
17  1  0  0
18  1  0  0


Filename: ../../data/farzan/train_big/postvax_odp_data-dictionary_5p.xlsx

Raw Logit Predictions:
tensor([[[ 4.6721,  4.5256,  4.5256,  …, -0.8889, -0.8889, -0.8889],
         [ 4.5927,  3.8967,  4.0882,  …, -0.8889, -0.8889, -0.8889],
         [ 4.5853,  4.5853,  3.6167,  …, -0.8889, -0.8889, -0.8889],
         …,
         [-0.8889, -0.8889, -0.8889,  …, -0.8889, -0.8889, -0.8889],
```

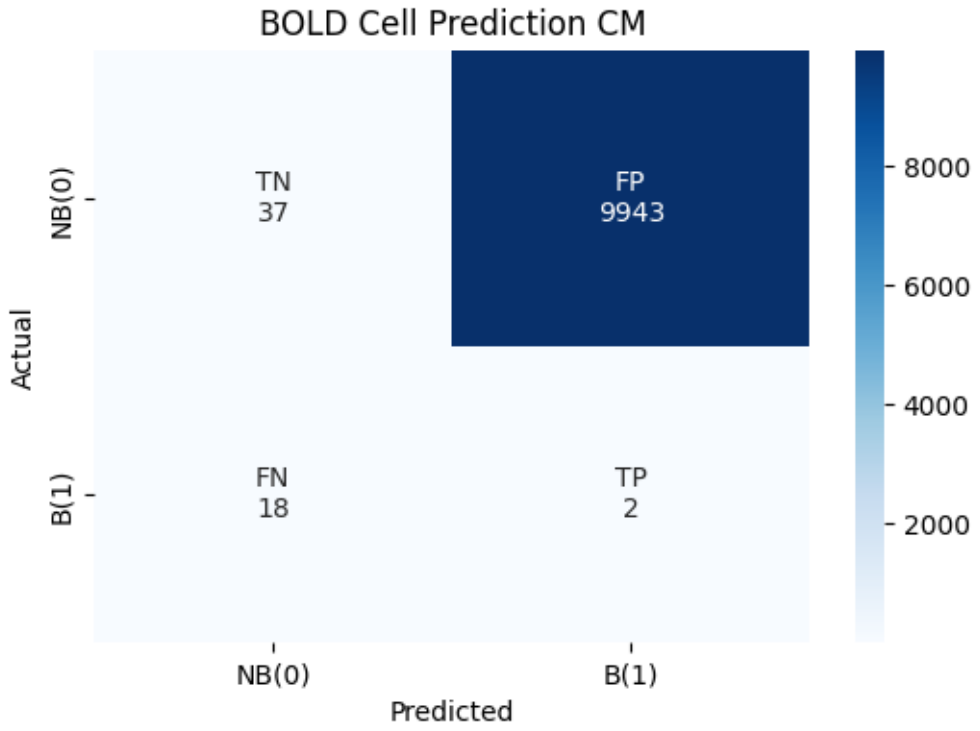
```
          [-0.8889, -0.8889, -0.8889,  …, -0.8889, -0.8889, -0.8889],
          [-0.8889, -0.8889, -0.8889,  …, -0.8889, -0.8889, -0.8889]]],
        device='cuda:2')

Sigmoid Probabilities:
tensor([[[0.9907, 0.9893, 0.9893,  …, 0.2913, 0.2913, 0.2913],
         [0.9900, 0.9801, 0.9835,  …, 0.2913, 0.2913, 0.2913],
         [0.9899, 0.9899, 0.9738,  …, 0.2913, 0.2913, 0.2913],
         …,
         [0.2913, 0.2913, 0.2913,  …, 0.2913, 0.2913, 0.2913],
         [0.2913, 0.2913, 0.2913,  …, 0.2913, 0.2913, 0.2913],
         [0.2913, 0.2913, 0.2913,  …, 0.2913, 0.2913, 0.2913]]],
        device='cuda:2')

NB to B ratio: Predicted = 9943:57 | Actual = 9980:20
Accuracy: 99.63% | Precision: 35.09% | Recall: 100.00% | F1-Score: 0.52
```




```
--- Predicted Grid (1 = Bold, 0 = Not Bold) ---

    0  1  2
0   1  1  1
1   1  1  1
```

```
2   1  1  1
3   1  1  1
4   1  1  1
5   1  1  1
6   1  1  1
7   1  1  1
8   1  1  1
9   1  1  1
10  1  1  1
11  1  1  1
12  1  1  1
13  1  1  1
14  1  1  1
15  1  1  1
16  1  1  1
17  1  1  1
18  1  1  1


--- Actual Grid (1 = Bold, 0 = Not Bold) ---

    0  1  2
1   1  1  1
2   1  0  0
3   1  0  0
4   1  0  0
5   1  0  0
6   1  0  0
7   1  0  0
8   1  0  0
9   1  0  0
10  1  0  0
11  1  0  0
12  1  0  0
13  1  0  0
14  1  0  0
15  1  0  0
16  1  0  0
17  1  0  0
18  1  0  0


Filename: ../../data/farzan/train_big/postvax_odp_data-dictionary_5p.xlsx

Raw Logit Predictions:
tensor([[[-2.3161, -2.1848, -2.1848,  …,  8.9047,  8.9047,  8.9047],
         [-1.7120, -2.2248, -2.2266,  …,  8.9047,  8.9047,  8.9047],
         [-2.3634, -2.3634, -3.3090,  …,  8.9047,  8.9047,  8.9047],
         …,
```

```
          [ 8.9047,  8.9047,  8.9047,  …,  8.9047,  8.9047,  8.9047],
          [ 8.9047,  8.9047,  8.9047,  …,  8.9047,  8.9047,  8.9047],
          [ 8.9047,  8.9047,  8.9047,  …,  8.9047,  8.9047,  8.9047]]],
       device='cuda:3')

Sigmoid Probabilities:
tensor([[[0.0898, 0.1011, 0.1011,  …, 0.9999, 0.9999, 0.9999],
         [0.1529, 0.0975, 0.0974,  …, 0.9999, 0.9999, 0.9999],
         [0.0860, 0.0860, 0.0353,  …, 0.9999, 0.9999, 0.9999],
         …,
         [0.9999, 0.9999, 0.9999,  …, 0.9999, 0.9999, 0.9999],
         [0.9999, 0.9999, 0.9999,  …, 0.9999, 0.9999, 0.9999],
         [0.9999, 0.9999, 0.9999,  …, 0.9999, 0.9999, 0.9999]]],
       device='cuda:3')

NB to B ratio: Predicted = 55:9945 | Actual = 9980:20
Accuracy: 0.39% | Precision: 0.02% | Recall: 10.00% | F1-Score: 0.00
```




```
--- Predicted Grid (1 = Bold, 0 = Not Bold) ---
    0   1   2   3   4   5   6   7   8   9   10  11  12  13  14  15  16  17  \
0    0   0   0   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1
```

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2	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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9	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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14	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	\
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98   1   1   1   1   1   1   1   1   1   1
99   1   1   1   1   1   1   1   1   1   1

--- Actual Grid (1 = Bold, 0 = Not Bold) ---

    0  1  2
1   1  1  1
2   1  0  0
3   1  0  0
4   1  0  0
5   1  0  0
6   1  0  0
7   1  0  0
8   1  0  0
9   1  0  0
10  1  0  0
11  1  0  0
```

```
12  1  0  0
13  1  0  0
14  1  0  0
15  1  0  0
16  1  0  0
17  1  0  0
18  1  0  0
```

[11]:
```
# Validation Data
infer_one(trained_model, val_loader, loc=0, threshold=0.5, disp_max = False,␣
 ↪device = DEVICE)
infer_one(trained_model2, val_loader, loc=0, threshold=0.5, disp_max = False,␣
 ↪device = DEVICE2)
infer_one(trained_model3, val_loader, loc=0, threshold=0.5, disp_max = False,␣
 ↪device = DEVICE3)
infer_one(trained_model4, val_loader, loc=0, threshold=0.5, disp_max = False,␣
 ↪device = DEVICE4)
```

```
Filename: ../../data/farzan/val_big/Hill%20et%20al%20Toxicol%20Sci_Table%203%20N
PV%20of%20subchronic%20to%20tumor%20v6.xlsx

Raw Logit Predictions:
tensor([[[  7.7347,   4.5258,   4.5258,  …, -11.4981, -11.4981, -11.4981],
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         [  5.1274,   4.5258,   4.5258,  …, -11.4981, -11.4981, -11.4981],
         …,
         [-11.4981, -11.4981, -11.4981,  …, -11.4981, -11.4981, -11.4981],
         [-11.4981, -11.4981, -11.4981,  …, -11.4981, -11.4981, -11.4981],
         [-11.4981, -11.4981, -11.4981,  …, -11.4981, -11.4981, -11.4981]]],
       device='cuda:0')

Sigmoid Probabilities:
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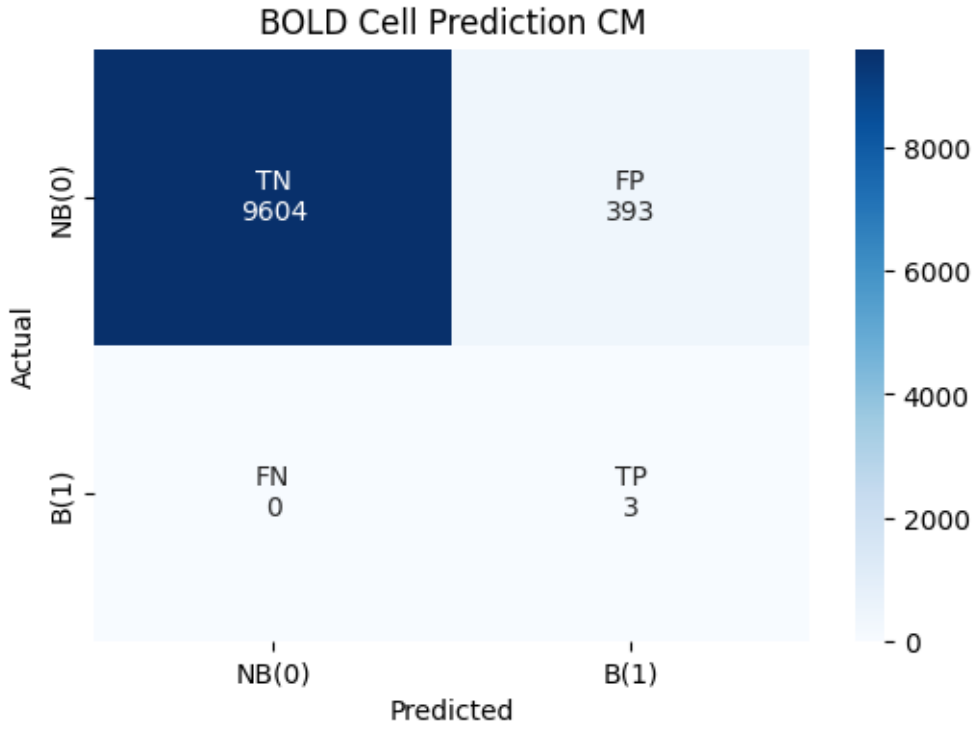
         1.0150e-05],
        [9.9410e-01, 9.8929e-01, 9.8929e-01,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
        …,
        [1.0150e-05, 1.0150e-05, 1.0150e-05,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
        [1.0150e-05, 1.0150e-05, 1.0150e-05,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
        [1.0150e-05, 1.0150e-05, 1.0150e-05,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05]], device='cuda:0')
```

```
NB to B ratio: Predicted = 9604:396 | Actual = 9997:3
Accuracy: 96.07% | Precision: 0.76% | Recall: 100.00% | F1-Score: 0.02
```




```
--- Predicted Grid (1 = Bold, 0 = Not Bold) ---
```

	0	1	2	3	4	5	6	7	8
0	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1

```
16  1  1  1  1  1  1  1  1  1
17  1  1  1  1  1  1  1  1  1
18  1  1  1  1  1  1  1  1  1
19  1  1  1  1  1  1  1  1  1
20  1  1  1  1  1  1  1  1  1
21  1  1  1  1  1  1  1  1  1
22  1  1  1  1  1  1  1  1  1
23  1  1  1  1  1  1  1  1  1
24  1  1  1  1  1  1  1  1  1
25  1  1  1  1  1  1  1  1  1
26  1  1  1  1  1  1  1  1  1
27  1  1  1  1  1  1  1  1  1
28  1  1  1  1  1  1  1  1  1
29  1  1  1  1  1  1  1  1  1
30  1  1  1  1  1  1  1  1  1
31  1  1  1  1  1  1  1  1  1
32  1  1  1  1  1  1  1  1  1
33  1  1  1  1  1  1  1  1  1
34  1  1  1  1  1  1  1  1  1
35  1  1  1  1  1  1  1  1  1
36  1  1  1  1  1  1  1  1  1
37  1  1  1  1  1  1  1  1  1
38  1  1  1  1  1  1  1  1  1
39  1  1  1  1  1  1  1  1  1
40  1  1  1  1  1  1  1  1  1
41  1  1  1  1  1  1  1  1  1
42  1  1  1  1  1  1  1  1  1
43  1  1  1  1  1  1  1  1  1


--- Actual Grid (1 = Bold, 0 = Not Bold) ---

    0
2   1
12  1
22  1

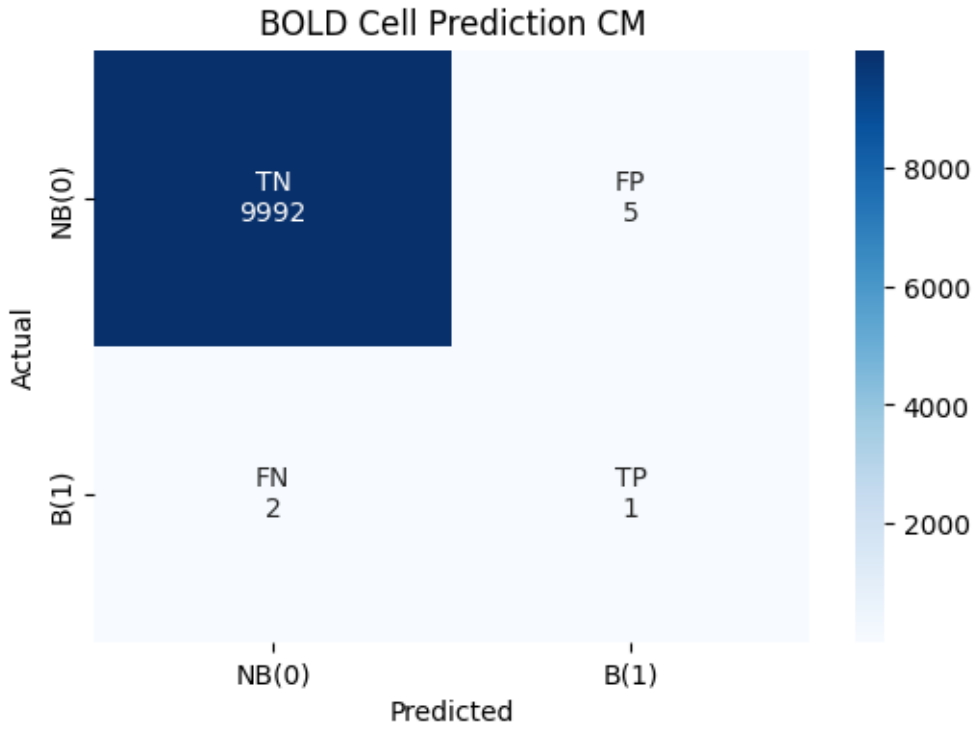

Filename: ../../data/farzan/val_big/Hill%20et%20al%20Toxicol%20Sci_Table%203%20N
PV%20of%20subchronic%20to%20tumor%20v6.xlsx

Raw Logit Predictions:
tensor([[[  4.5215, -25.1106, -25.1106,  …, -42.5887, -42.5887, -42.5887],
         [-25.1106, -25.1106, -25.1106,  …, -42.5887, -42.5887, -42.5887],
         [ -5.9436, -25.1106, -25.1106,  …, -42.5887, -42.5887, -42.5887],
         …,
         [-42.5887, -42.5887, -42.5887,  …, -42.5887, -42.5887, -42.5887],
         [-42.5887, -42.5887, -42.5887,  …, -42.5887, -42.5887, -42.5887],
         [-42.5887, -42.5887, -42.5887,  …, -42.5887, -42.5887, -42.5887]]],
```

```
       device='cuda:1')

Sigmoid Probabilities:
tensor([[9.8924e-01, 1.2434e-11, 1.2434e-11,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        [1.2434e-11, 1.2434e-11, 1.2434e-11,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        [2.6158e-03, 1.2434e-11, 1.2434e-11,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        …,
        [3.1912e-19, 3.1912e-19, 3.1912e-19,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        [3.1912e-19, 3.1912e-19, 3.1912e-19,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        [3.1912e-19, 3.1912e-19, 3.1912e-19,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19]], device='cuda:1')

NB to B ratio: Predicted = 9994:6 | Actual = 9997:3
Accuracy: 99.93% | Precision: 16.67% | Recall: 33.33% | F1-Score: 0.22
```




```
--- Predicted Grid (1 = Bold, 0 = Not Bold) ---
```

```
    0
0   1
22  1
33  1
34  1
35  1
36  1

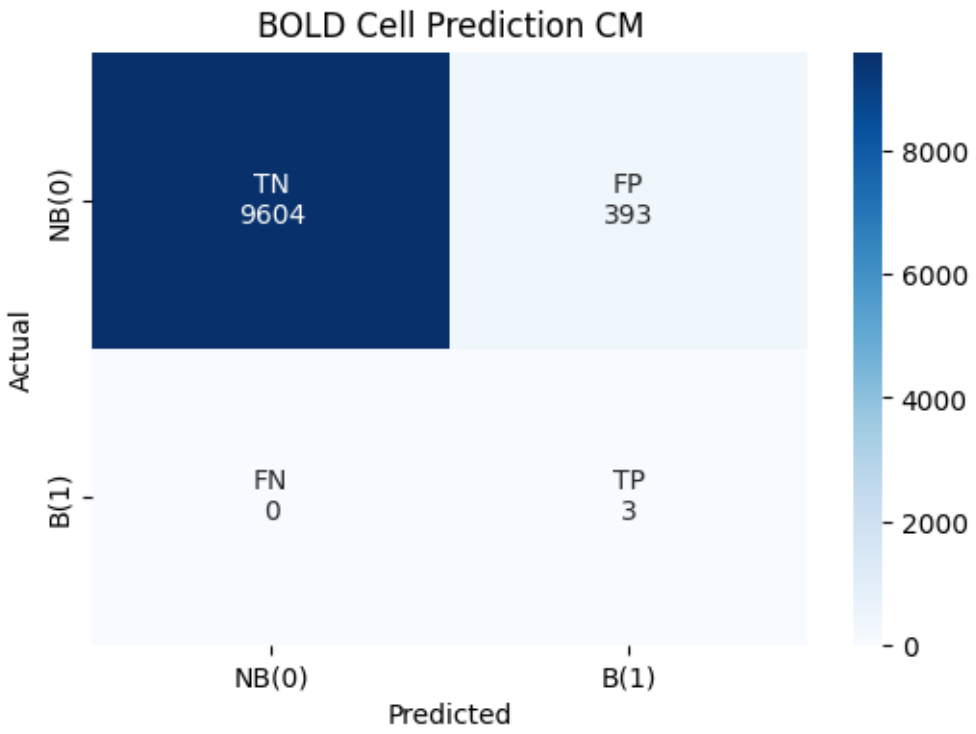

--- Actual Grid (1 = Bold, 0 = Not Bold) ---
    0
2   1
12  1
22  1


Filename: ../../data/farzan/val_big/Hill%20et%20al%20Toxicol%20Sci_Table%203%20N
PV%20of%20subchronic%20to%20tumor%20v6.xlsx

Raw Logit Predictions:
tensor([[[ 9.3473,  4.5256,  4.5256,  …, -0.8889, -0.8889, -0.8889],
         [ 4.5256,  4.5256,  4.5256,  …, -0.8889, -0.8889, -0.8889],
         [ 6.5399,  4.5256,  4.5256,  …, -0.8889, -0.8889, -0.8889],
         …,
         [-0.8889, -0.8889, -0.8889,  …, -0.8889, -0.8889, -0.8889],
         [-0.8889, -0.8889, -0.8889,  …, -0.8889, -0.8889, -0.8889],
         [-0.8889, -0.8889, -0.8889,  …, -0.8889, -0.8889, -0.8889]]],
       device='cuda:2')

Sigmoid Probabilities:
tensor([[0.9999, 0.9893, 0.9893,  …, 0.2913, 0.2913, 0.2913],
        [0.9893, 0.9893, 0.9893,  …, 0.2913, 0.2913, 0.2913],
        [0.9986, 0.9893, 0.9893,  …, 0.2913, 0.2913, 0.2913],
        …,
        [0.2913, 0.2913, 0.2913,  …, 0.2913, 0.2913, 0.2913],
        [0.2913, 0.2913, 0.2913,  …, 0.2913, 0.2913, 0.2913],
        [0.2913, 0.2913, 0.2913,  …, 0.2913, 0.2913, 0.2913]],
       device='cuda:2')

NB to B ratio: Predicted = 9604:396 | Actual = 9997:3
Accuracy: 96.07% | Precision: 0.76% | Recall: 100.00% | F1-Score: 0.02
```




```
--- Predicted Grid (1 = Bold, 0 = Not Bold) ---
    0  1  2  3  4  5  6  7  8
0   1  1  1  1  1  1  1  1  1
1   1  1  1  1  1  1  1  1  1
2   1  1  1  1  1  1  1  1  1
3   1  1  1  1  1  1  1  1  1
4   1  1  1  1  1  1  1  1  1
5   1  1  1  1  1  1  1  1  1
6   1  1  1  1  1  1  1  1  1
7   1  1  1  1  1  1  1  1  1
8   1  1  1  1  1  1  1  1  1
9   1  1  1  1  1  1  1  1  1
10  1  1  1  1  1  1  1  1  1
11  1  1  1  1  1  1  1  1  1
12  1  1  1  1  1  1  1  1  1
13  1  1  1  1  1  1  1  1  1
14  1  1  1  1  1  1  1  1  1
15  1  1  1  1  1  1  1  1  1
16  1  1  1  1  1  1  1  1  1
17  1  1  1  1  1  1  1  1  1
18  1  1  1  1  1  1  1  1  1
19  1  1  1  1  1  1  1  1  1
```

```
20  1  1  1  1  1  1  1  1  1
21  1  1  1  1  1  1  1  1  1
22  1  1  1  1  1  1  1  1  1
23  1  1  1  1  1  1  1  1  1
24  1  1  1  1  1  1  1  1  1
25  1  1  1  1  1  1  1  1  1
26  1  1  1  1  1  1  1  1  1
27  1  1  1  1  1  1  1  1  1
28  1  1  1  1  1  1  1  1  1
29  1  1  1  1  1  1  1  1  1
30  1  1  1  1  1  1  1  1  1
31  1  1  1  1  1  1  1  1  1
32  1  1  1  1  1  1  1  1  1
33  1  1  1  1  1  1  1  1  1
34  1  1  1  1  1  1  1  1  1
35  1  1  1  1  1  1  1  1  1
36  1  1  1  1  1  1  1  1  1
37  1  1  1  1  1  1  1  1  1
38  1  1  1  1  1  1  1  1  1
39  1  1  1  1  1  1  1  1  1
40  1  1  1  1  1  1  1  1  1
41  1  1  1  1  1  1  1  1  1
42  1  1  1  1  1  1  1  1  1
43  1  1  1  1  1  1  1  1  1


--- Actual Grid (1 = Bold, 0 = Not Bold) ---
    0
2   1
12  1
22  1

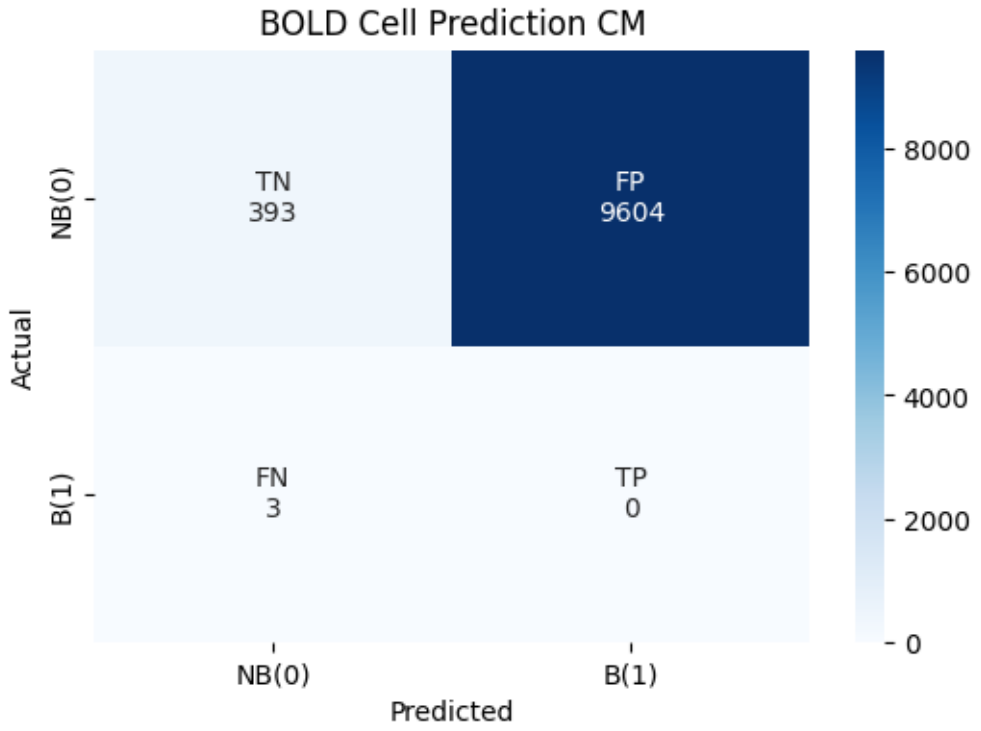

Filename: ../../data/farzan/val_big/Hill%20et%20al%20Toxicol%20Sci_Table%203%20N
PV%20of%20subchronic%20to%20tumor%20v6.xlsx

Raw Logit Predictions:
tensor([[[-2.2584, -2.1848, -2.1848,  …,  8.9047,  8.9047,  8.9047],
         [-2.1848, -2.1848, -2.1848,  …,  8.9047,  8.9047,  8.9047],
         [-1.8509, -2.1848, -2.1848,  …,  8.9047,  8.9047,  8.9047],
         …,
         [ 8.9047,  8.9047,  8.9047,  …,  8.9047,  8.9047,  8.9047],
         [ 8.9047,  8.9047,  8.9047,  …,  8.9047,  8.9047,  8.9047],
         [ 8.9047,  8.9047,  8.9047,  …,  8.9047,  8.9047,  8.9047]]],
       device='cuda:3')

Sigmoid Probabilities:
tensor([[0.0946, 0.1011, 0.1011,  …, 0.9999, 0.9999, 0.9999],
```

```
        [0.1011, 0.1011, 0.1011,  …, 0.9999, 0.9999, 0.9999],
        [0.1358, 0.1011, 0.1011,  …, 0.9999, 0.9999, 0.9999],
        …,
        [0.9999, 0.9999, 0.9999,  …, 0.9999, 0.9999, 0.9999],
        [0.9999, 0.9999, 0.9999,  …, 0.9999, 0.9999, 0.9999],
        [0.9999, 0.9999, 0.9999,  …, 0.9999, 0.9999, 0.9999]],
       device='cuda:3')

NB to B ratio: Predicted = 396:9604 | Actual = 9997:3
Accuracy: 3.93% | Precision: 0.00% | Recall: 0.00% | F1-Score: 0.00
```




```
--- Predicted Grid (1 = Bold, 0 = Not Bold) ---
    0   1   2   3   4   5   6   7   8   9   …  90  91  92  93  94  95  96  \
0    0   0   0   0   0   0   0   0   0   1  …   1   1   1   1   1   1   1
1    0   0   0   0   0   0   0   0   0   1  …   1   1   1   1   1   1   1
2    0   0   0   0   0   0   0   0   0   1  …   1   1   1   1   1   1   1
3    0   0   0   0   0   0   0   0   0   1  …   1   1   1   1   1   1   1
4    0   0   0   0   0   0   0   0   0   1  …   1   1   1   1   1   1   1
..  ..  ..  ..  ..  ..  ..  ..  ..  ..  ..  …  ..  ..  ..  ..  ..  ..  ..
95   1   1   1   1   1   1   1   1   1   1  …   1   1   1   1   1   1   1
96   1   1   1   1   1   1   1   1   1   1  …   1   1   1   1   1   1   1
```

```
97   1   1   1   1   1   1   1   1   1   1  …   1   1   1   1   1   1   1
98   1   1   1   1   1   1   1   1   1   1  …   1   1   1   1   1   1   1
99   1   1   1   1   1   1   1   1   1   1  …   1   1   1   1   1   1   1

    97  98  99
0    1   1   1
1    1   1   1
2    1   1   1
3    1   1   1
4    1   1   1
..  ..  ..  ..
95   1   1   1
96   1   1   1
97   1   1   1
98   1   1   1
99   1   1   1

[100 rows x 100 columns]


--- Actual Grid (1 = Bold, 0 = Not Bold) ---

    0
2   1
12  1
22  1
```

[12]:
```
# Testing Data
infer_one(trained_model, test_loader, loc=0, threshold=0.5, disp_max = True,␣
 ↪device = DEVICE)
infer_one(trained_model2, test_loader, loc=0, threshold=0.5, disp_max = True,␣
 ↪device = DEVICE2)
infer_one(trained_model3, test_loader, loc=0, threshold=0.5, disp_max = True,␣
 ↪device = DEVICE3)
infer_one(trained_model4, test_loader, loc=0, threshold=0.5, disp_max = True,␣
 ↪device = DEVICE4)
```

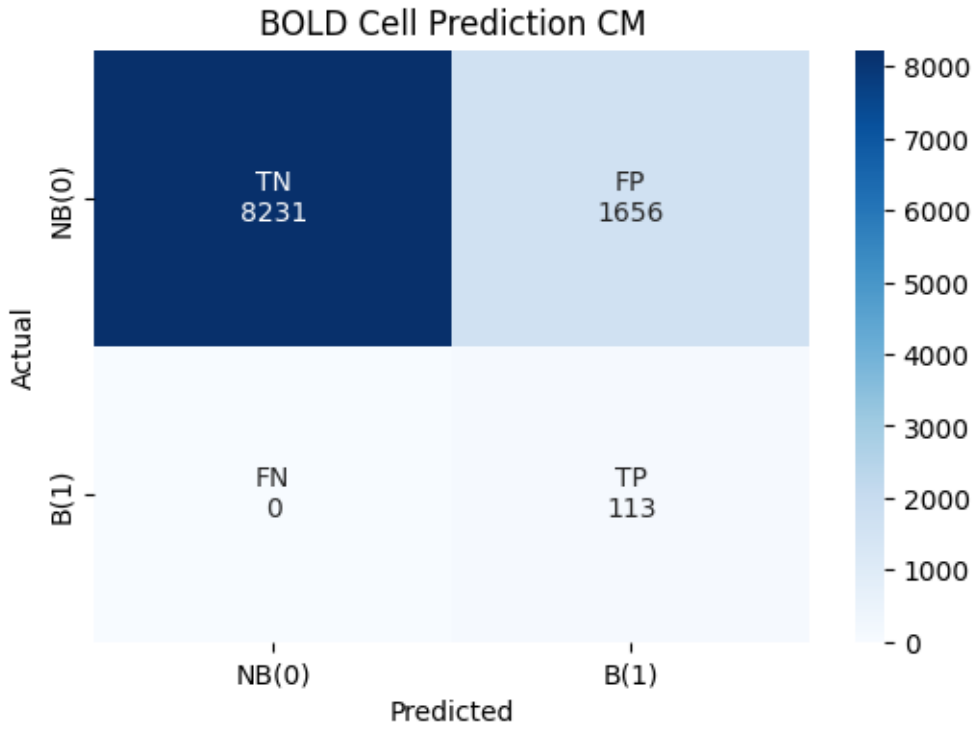
```
Filename: ../../data/farzan/test_big/michelle_lokay_000_1_2_1.pst.780.xls

Raw Logit Predictions:
tensor([[[  4.5258,   5.4966,   4.5258,  …, -11.4981, -11.4981, -11.4981],
         [  4.5258,   4.7475,   4.5258,  …, -11.4981, -11.4981, -11.4981],
         [  4.5258,   5.4836,   4.5258,  …, -11.4981, -11.4981, -11.4981],
         …,
         [-11.4981, -11.4981, -11.4981,  …, -11.4981, -11.4981, -11.4981],
         [-11.4981, -11.4981, -11.4981,  …, -11.4981, -11.4981, -11.4981],
         [-11.4981, -11.4981, -11.4981,  …, -11.4981, -11.4981, -11.4981]]],
```

```
       device='cuda:0')

Sigmoid Probabilities:
tensor([[9.8929e-01, 9.9592e-01, 9.8929e-01,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
        [9.8929e-01, 9.9140e-01, 9.8929e-01,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
        [9.8929e-01, 9.9586e-01, 9.8929e-01,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
        …,
        [1.0150e-05, 1.0150e-05, 1.0150e-05,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
        [1.0150e-05, 1.0150e-05, 1.0150e-05,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05],
        [1.0150e-05, 1.0150e-05, 1.0150e-05,  …, 1.0150e-05, 1.0150e-05,
         1.0150e-05]], device='cuda:0')

NB to B ratio: Predicted = 8231:1769 | Actual = 9887:113
Accuracy: 83.44% | Precision: 6.39% | Recall: 100.00% | F1-Score: 0.12
```




```
--- Predicted Grid (1 = Bold, 0 = Not Bold) ---
```

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	\
0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
14	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
24	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
25	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
26	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
27	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
28	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
29	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
31	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
32	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
33	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
36	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
37	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
38	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
39	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
40	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
41	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
42	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
43	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
44	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
45	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	
46	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	

47	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
48	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
49	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
50	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
51	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
52	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
53	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
54	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
55	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
56	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
57	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
58	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
59	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
60	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	18	19	20	21	22	23	24	25	26	27	28
0	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1	1	1	1
17	1	1	1	1	1	1	1	1	1	1	1
18	1	1	1	1	1	1	1	1	1	1	1
19	1	1	1	1	1	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1	1	1	1
21	1	1	1	1	1	1	1	1	1	1	1
22	1	1	1	1	1	1	1	1	1	1	1
23	1	1	1	1	1	1	1	1	1	1	1
24	1	1	1	1	1	1	1	1	1	1	1
25	1	1	1	1	1	1	1	1	1	1	1
26	1	1	1	1	1	1	1	1	1	1	1
27	1	1	1	1	1	1	1	1	1	1	1
28	1	1	1	1	1	1	1	1	1	1	1
29	1	1	1	1	1	1	1	1	1	1	1
30	1	1	1	1	1	1	1	1	1	1	1
31	1	1	1	1	1	1	1	1	1	1	1

```
32   1   1   1   1   1   1   1   1   1   1   1
33   1   1   1   1   1   1   1   1   1   1   1
34   1   1   1   1   1   1   1   1   1   1   1
35   1   1   1   1   1   1   1   1   1   1   1
36   1   1   1   1   1   1   1   1   1   1   1
37   1   1   1   1   1   1   1   1   1   1   1
38   1   1   1   1   1   1   1   1   1   1   1
39   1   1   1   1   1   1   1   1   1   1   1
40   1   1   1   1   1   1   1   1   1   1   1
41   1   1   1   1   1   1   1   1   1   1   1
42   1   1   1   1   1   1   1   1   1   1   1
43   1   1   1   1   1   1   1   1   1   1   1
44   1   1   1   1   1   1   1   1   1   1   1
45   1   1   1   1   1   1   1   1   1   1   1
46   1   1   1   1   1   1   1   1   1   1   1
47   1   1   1   1   1   1   1   1   1   1   1
48   1   1   1   1   1   1   1   1   1   1   1
49   1   1   1   1   1   1   1   1   1   1   1
50   1   1   1   1   1   1   1   1   1   1   1
51   1   1   1   1   1   1   1   1   1   1   1
52   1   1   1   1   1   1   1   1   1   1   1
53   1   1   1   1   1   1   1   1   1   1   1
54   1   1   1   1   1   1   1   1   1   1   1
55   1   1   1   1   1   1   1   1   1   1   1
56   1   1   1   1   1   1   1   1   1   1   1
57   1   1   1   1   1   1   1   1   1   1   1
58   1   1   1   1   1   1   1   1   1   1   1
59   1   1   1   1   1   1   1   1   1   1   1
60   1   1   1   1   1   1   1   1   1   1   1


--- Actual Grid (1 = Bold, 0 = Not Bold) ---

    1   8   13  22  28
0    1   0   0   0   1
1    1   0   0   0   1
2    1   0   0   0   0
11   0   1   1   1   0
12   0   1   1   1   0
13   0   1   1   1   0
14   0   1   1   1   0
15   0   1   1   1   0
16   0   1   1   1   0
23   0   1   1   1   0
24   0   1   1   1   0
25   0   1   1   1   0
26   0   1   1   1   0
27   0   1   1   1   0
28   0   1   1   1   0
```

```
29   0   1   1   1   0
30   0   1   1   1   0
31   0   1   1   1   0
32   0   1   1   1   0
33   0   1   1   1   0
34   0   1   1   1   0
35   0   1   1   1   0
36   0   1   1   1   0
37   0   1   1   1   0
38   0   1   1   1   0
39   0   1   1   1   0
40   0   1   1   1   0
41   0   1   1   1   0
42   0   1   1   1   0
43   0   1   1   1   0
44   0   1   1   1   0
45   0   1   1   1   0
46   0   1   1   1   0
47   0   1   1   1   0
48   0   1   1   1   0
49   0   1   1   1   0
50   0   1   1   1   0
51   0   1   1   1   0
52   0   1   1   1   0

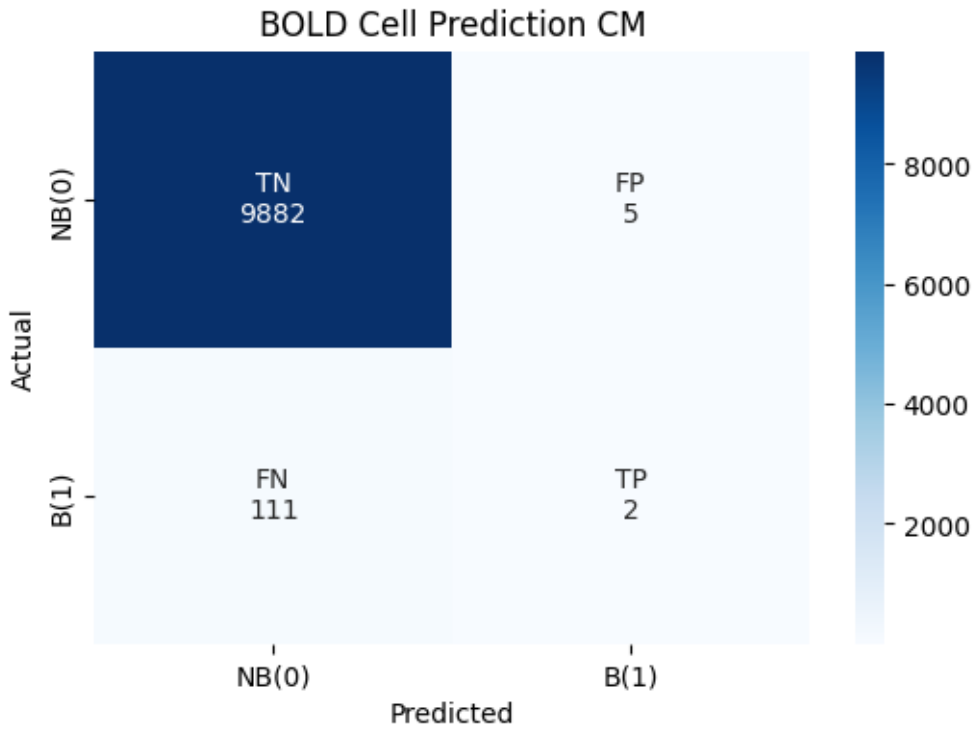

Filename: ../../data/farzan/test_big/michelle_lokay_000_1_2_1.pst.780.xls

Raw Logit Predictions:
tensor([[[-25.1106, -18.4859, -25.1106,  …, -42.5887, -42.5887, -42.5887],
         [-25.1106, -18.5313, -25.1106,  …, -42.5887, -42.5887, -42.5887],
         [-25.1106, -15.2246, -25.1106,  …, -42.5887, -42.5887, -42.5887],
         …,
         [-42.5887, -42.5887, -42.5887,  …, -42.5887, -42.5887, -42.5887],
         [-42.5887, -42.5887, -42.5887,  …, -42.5887, -42.5887, -42.5887],
         [-42.5887, -42.5887, -42.5887,  …, -42.5887, -42.5887, -42.5887]]],
       device='cuda:1')

Sigmoid Probabilities:
tensor([[1.2434e-11, 9.3685e-09, 1.2434e-11,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        [1.2434e-11, 8.9527e-09, 1.2434e-11,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        [1.2434e-11, 2.4436e-07, 1.2434e-11,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        …,
        [3.1912e-19, 3.1912e-19, 3.1912e-19,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
```

```
        [3.1912e-19, 3.1912e-19, 3.1912e-19,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19],
        [3.1912e-19, 3.1912e-19, 3.1912e-19,  …, 3.1912e-19, 3.1912e-19,
         3.1912e-19]], device='cuda:1')

NB to B ratio: Predicted = 9993:7 | Actual = 9887:113
Accuracy: 98.84% | Precision: 28.57% | Recall: 1.77% | F1-Score: 0.03
```




```
--- Predicted Grid (1 = Bold, 0 = Not Bold) ---

    0   1   28
0    0   0   1
1    0   0   1
5    1   0   0
54   0   1   0
55   0   1   0
59   0   1   0
60   0   1   0

--- Actual Grid (1 = Bold, 0 = Not Bold) ---

    1   8   13  22  28
```

```
0    1   0   0   0   1
1    1   0   0   0   1
2    1   0   0   0   0
11   0   1   1   1   0
12   0   1   1   1   0
13   0   1   1   1   0
14   0   1   1   1   0
15   0   1   1   1   0
16   0   1   1   1   0
23   0   1   1   1   0
24   0   1   1   1   0
25   0   1   1   1   0
26   0   1   1   1   0
27   0   1   1   1   0
28   0   1   1   1   0
29   0   1   1   1   0
30   0   1   1   1   0
31   0   1   1   1   0
32   0   1   1   1   0
33   0   1   1   1   0
34   0   1   1   1   0
35   0   1   1   1   0
36   0   1   1   1   0
37   0   1   1   1   0
38   0   1   1   1   0
39   0   1   1   1   0
40   0   1   1   1   0
41   0   1   1   1   0
42   0   1   1   1   0
43   0   1   1   1   0
44   0   1   1   1   0
45   0   1   1   1   0
46   0   1   1   1   0
47   0   1   1   1   0
48   0   1   1   1   0
49   0   1   1   1   0
50   0   1   1   1   0
51   0   1   1   1   0
52   0   1   1   1   0

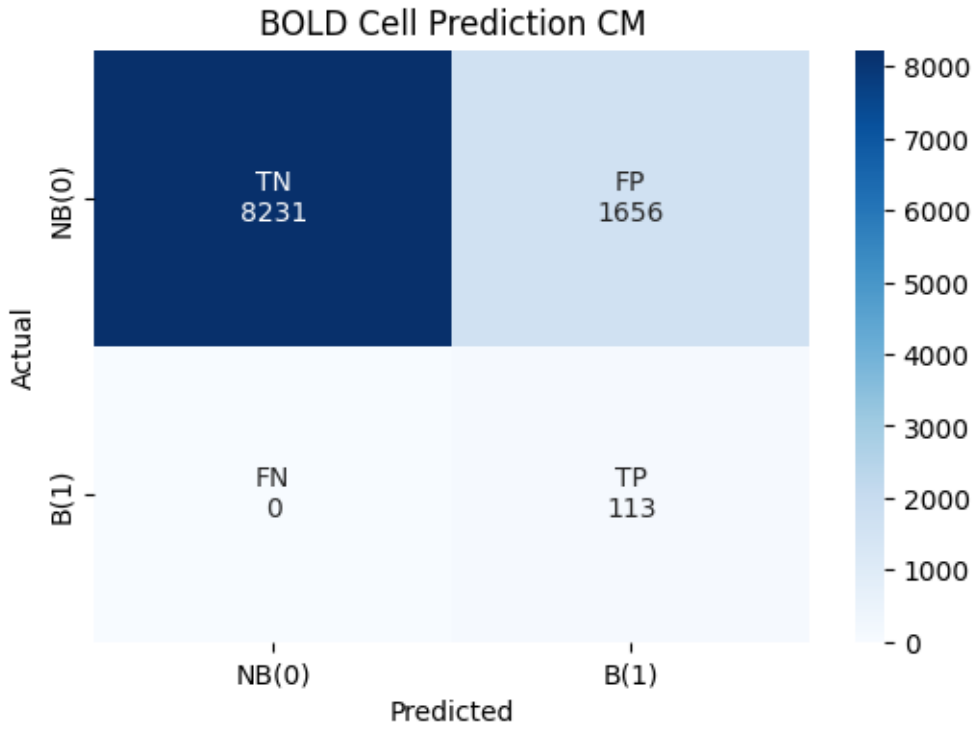

Filename: ../../data/farzan/test_big/michelle_lokay_000_1_2_1.pst.780.xls

Raw Logit Predictions:
tensor([[[ 4.5256,  5.1298,  4.5256,  …, -0.8889, -0.8889, -0.8889],
         [ 4.5256,  5.1156,  4.5256,  …, -0.8889, -0.8889, -0.8889],
         [ 4.5256,  7.2948,  4.5256,  …, -0.8889, -0.8889, -0.8889],
         …,
```

```
          [-0.8889, -0.8889, -0.8889,  …, -0.8889, -0.8889, -0.8889],
          [-0.8889, -0.8889, -0.8889,  …, -0.8889, -0.8889, -0.8889],
          [-0.8889, -0.8889, -0.8889,  …, -0.8889, -0.8889, -0.8889]]],
       device='cuda:2')

Sigmoid Probabilities:
tensor([[[0.9893, 0.9941, 0.9893,  …, 0.2913, 0.2913, 0.2913],
         [0.9893, 0.9940, 0.9893,  …, 0.2913, 0.2913, 0.2913],
         [0.9893, 0.9993, 0.9893,  …, 0.2913, 0.2913, 0.2913],
         …,
         [0.2913, 0.2913, 0.2913,  …, 0.2913, 0.2913, 0.2913],
         [0.2913, 0.2913, 0.2913,  …, 0.2913, 0.2913, 0.2913],
         [0.2913, 0.2913, 0.2913,  …, 0.2913, 0.2913, 0.2913]]],
       device='cuda:2')

NB to B ratio: Predicted = 8231:1769 | Actual = 9887:113
Accuracy: 83.44% | Precision: 6.39% | Recall: 100.00% | F1-Score: 0.12
```




```
--- Predicted Grid (1 = Bold, 0 = Not Bold) ---
    0   1   2   3   4   5   6   7   8   9   10  11  12  13  14  15  16  17  \
0    1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1   1
```

1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
17	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
18	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
19	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
21	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
22	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
23	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
24	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
25	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
26	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
27	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
28	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
29	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
30	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
31	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
32	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
33	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
34	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
35	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
36	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
37	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
38	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
39	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
40	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
41	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
42	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
43	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
44	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
45	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
46	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
47	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
48	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

49	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
50	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
51	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
52	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
53	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
54	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
55	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
56	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
57	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
58	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
59	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
60	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	18	19	20	21	22	23	24	25	26	27	28
0	1	1	1	1	1	1	1	1	1	1	1
1	1	1	1	1	1	1	1	1	1	1	1
2	1	1	1	1	1	1	1	1	1	1	1
3	1	1	1	1	1	1	1	1	1	1	1
4	1	1	1	1	1	1	1	1	1	1	1
5	1	1	1	1	1	1	1	1	1	1	1
6	1	1	1	1	1	1	1	1	1	1	1
7	1	1	1	1	1	1	1	1	1	1	1
8	1	1	1	1	1	1	1	1	1	1	1
9	1	1	1	1	1	1	1	1	1	1	1
10	1	1	1	1	1	1	1	1	1	1	1
11	1	1	1	1	1	1	1	1	1	1	1
12	1	1	1	1	1	1	1	1	1	1	1
13	1	1	1	1	1	1	1	1	1	1	1
14	1	1	1	1	1	1	1	1	1	1	1
15	1	1	1	1	1	1	1	1	1	1	1
16	1	1	1	1	1	1	1	1	1	1	1
17	1	1	1	1	1	1	1	1	1	1	1
18	1	1	1	1	1	1	1	1	1	1	1
19	1	1	1	1	1	1	1	1	1	1	1
20	1	1	1	1	1	1	1	1	1	1	1
21	1	1	1	1	1	1	1	1	1	1	1
22	1	1	1	1	1	1	1	1	1	1	1
23	1	1	1	1	1	1	1	1	1	1	1
24	1	1	1	1	1	1	1	1	1	1	1
25	1	1	1	1	1	1	1	1	1	1	1
26	1	1	1	1	1	1	1	1	1	1	1
27	1	1	1	1	1	1	1	1	1	1	1
28	1	1	1	1	1	1	1	1	1	1	1
29	1	1	1	1	1	1	1	1	1	1	1
30	1	1	1	1	1	1	1	1	1	1	1
31	1	1	1	1	1	1	1	1	1	1	1
32	1	1	1	1	1	1	1	1	1	1	1
33	1	1	1	1	1	1	1	1	1	1	1

34	1	1	1	1	1	1	1	1	1	1	1
35	1	1	1	1	1	1	1	1	1	1	1
36	1	1	1	1	1	1	1	1	1	1	1
37	1	1	1	1	1	1	1	1	1	1	1
38	1	1	1	1	1	1	1	1	1	1	1
39	1	1	1	1	1	1	1	1	1	1	1
40	1	1	1	1	1	1	1	1	1	1	1
41	1	1	1	1	1	1	1	1	1	1	1
42	1	1	1	1	1	1	1	1	1	1	1
43	1	1	1	1	1	1	1	1	1	1	1
44	1	1	1	1	1	1	1	1	1	1	1
45	1	1	1	1	1	1	1	1	1	1	1
46	1	1	1	1	1	1	1	1	1	1	1
47	1	1	1	1	1	1	1	1	1	1	1
48	1	1	1	1	1	1	1	1	1	1	1
49	1	1	1	1	1	1	1	1	1	1	1
50	1	1	1	1	1	1	1	1	1	1	1
51	1	1	1	1	1	1	1	1	1	1	1
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53	1	1	1	1	1	1	1	1	1	1	1
54	1	1	1	1	1	1	1	1	1	1	1
55	1	1	1	1	1	1	1	1	1	1	1
56	1	1	1	1	1	1	1	1	1	1	1
57	1	1	1	1	1	1	1	1	1	1	1
58	1	1	1	1	1	1	1	1	1	1	1
59	1	1	1	1	1	1	1	1	1	1	1
60	1	1	1	1	1	1	1	1	1	1	1

--- Actual Grid (1 = Bold, 0 = Not Bold) ---

	1	8	13	22	28
0	1	0	0	0	1
1	1	0	0	0	1
2	1	0	0	0	0
11	0	1	1	1	0
12	0	1	1	1	0
13	0	1	1	1	0
14	0	1	1	1	0
15	0	1	1	1	0
16	0	1	1	1	0
23	0	1	1	1	0
24	0	1	1	1	0
25	0	1	1	1	0
26	0	1	1	1	0
27	0	1	1	1	0
28	0	1	1	1	0
29	0	1	1	1	0
30	0	1	1	1	0

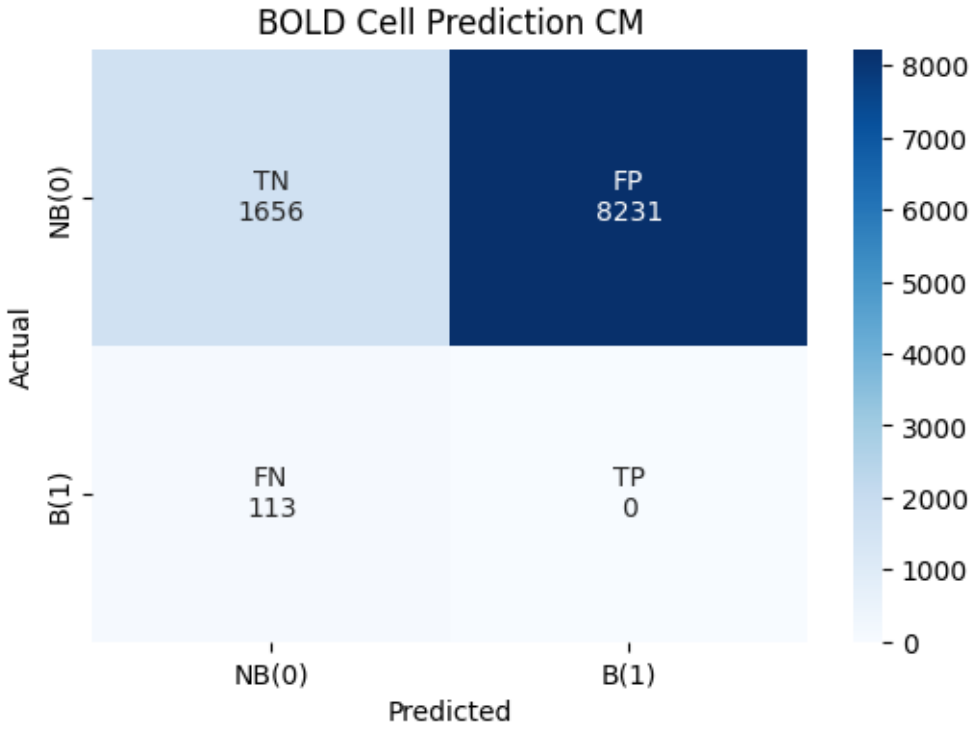
```
31   0   1   1   1   0
32   0   1   1   1   0
33   0   1   1   1   0
34   0   1   1   1   0
35   0   1   1   1   0
36   0   1   1   1   0
37   0   1   1   1   0
38   0   1   1   1   0
39   0   1   1   1   0
40   0   1   1   1   0
41   0   1   1   1   0
42   0   1   1   1   0
43   0   1   1   1   0
44   0   1   1   1   0
45   0   1   1   1   0
46   0   1   1   1   0
47   0   1   1   1   0
48   0   1   1   1   0
49   0   1   1   1   0
50   0   1   1   1   0
51   0   1   1   1   0
52   0   1   1   1   0


Filename: ../../data/farzan/test_big/michelle_lokay_000_1_2_1.pst.780.xls

Raw Logit Predictions:
tensor([[[-2.1848, -2.5798, -2.1848,  …,  8.9047,  8.9047,  8.9047],
         [-2.1848, -3.0839, -2.1848,  …,  8.9047,  8.9047,  8.9047],
         [-2.1848, -3.4144, -2.1848,  …,  8.9047,  8.9047,  8.9047],
         …,
         [ 8.9047,  8.9047,  8.9047,  …,  8.9047,  8.9047,  8.9047],
         [ 8.9047,  8.9047,  8.9047,  …,  8.9047,  8.9047,  8.9047],
         [ 8.9047,  8.9047,  8.9047,  …,  8.9047,  8.9047,  8.9047]]],
       device='cuda:3')

Sigmoid Probabilities:
tensor([[0.1011, 0.0705, 0.1011,  …, 0.9999, 0.9999, 0.9999],
        [0.1011, 0.0438, 0.1011,  …, 0.9999, 0.9999, 0.9999],
        [0.1011, 0.0318, 0.1011,  …, 0.9999, 0.9999, 0.9999],
        …,
        [0.9999, 0.9999, 0.9999,  …, 0.9999, 0.9999, 0.9999],
        [0.9999, 0.9999, 0.9999,  …, 0.9999, 0.9999, 0.9999],
        [0.9999, 0.9999, 0.9999,  …, 0.9999, 0.9999, 0.9999]],
       device='cuda:3')

NB to B ratio: Predicted = 1769:8231 | Actual = 9887:113
Accuracy: 16.56% | Precision: 0.00% | Recall: 0.00% | F1-Score: 0.00
```



--- Predicted Grid (1 = Bold, 0 = Not Bold) ---

	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	\
0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
6	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
10	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
11	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	

18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
38	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
39	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
40	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
45	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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49	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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54	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
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93	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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98	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
99	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	\
0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
1	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
2	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
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6	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
7	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
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9	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
10	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	
11	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	

12	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
13	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
14	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
15	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
16	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
17	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
18	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
19	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
20	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
21	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
22	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
23	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
24	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
25	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
26	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
27	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
28	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
29	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
30	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
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86   1   1   1   1   1   1   1   1   1   1
87   1   1   1   1   1   1   1   1   1   1
88   1   1   1   1   1   1   1   1   1   1
89   1   1   1   1   1   1   1   1   1   1
90   1   1   1   1   1   1   1   1   1   1
91   1   1   1   1   1   1   1   1   1   1
92   1   1   1   1   1   1   1   1   1   1
93   1   1   1   1   1   1   1   1   1   1
94   1   1   1   1   1   1   1   1   1   1
95   1   1   1   1   1   1   1   1   1   1
96   1   1   1   1   1   1   1   1   1   1
97   1   1   1   1   1   1   1   1   1   1
98   1   1   1   1   1   1   1   1   1   1
99   1   1   1   1   1   1   1   1   1   1


--- Actual Grid (1 = Bold, 0 = Not Bold) ---
    1   8   13  22  28
0    1   0   0   0   1
1    1   0   0   0   1
2    1   0   0   0   0
11   0   1   1   1   0
12   0   1   1   1   0
13   0   1   1   1   0
14   0   1   1   1   0
15   0   1   1   1   0
16   0   1   1   1   0
23   0   1   1   1   0
24   0   1   1   1   0
25   0   1   1   1   0
26   0   1   1   1   0
27   0   1   1   1   0
28   0   1   1   1   0
29   0   1   1   1   0
30   0   1   1   1   0
31   0   1   1   1   0
32   0   1   1   1   0
33   0   1   1   1   0
34   0   1   1   1   0
35   0   1   1   1   0
36   0   1   1   1   0
37   0   1   1   1   0
38   0   1   1   1   0
39   0   1   1   1   0
40   0   1   1   1   0
41   0   1   1   1   0
```

```
42   0   1   1   1   0
43   0   1   1   1   0
44   0   1   1   1   0
45   0   1   1   1   0
46   0   1   1   1   0
47   0   1   1   1   0
48   0   1   1   1   0
49   0   1   1   1   0
50   0   1   1   1   0
51   0   1   1   1   0
52   0   1   1   1   0
```

4.2 Infer Full Function - All Examples Evaluation

Performs evaluation across all files in the dataloader and averages/sums relevant metrics for comprehensive performance analysis

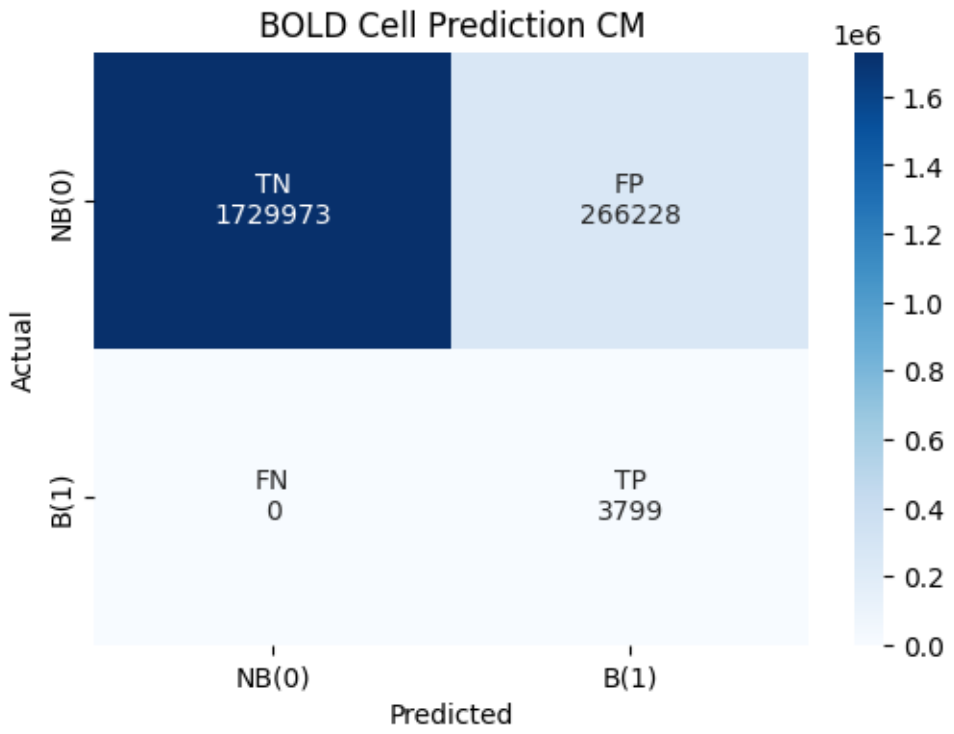
[13]:
```
infer_full(trained_model, train_loader, is_subset = True, subset_size = 200,␣
 ↪threshold = 0.5, device=DEVICE)
infer_full(trained_model2, train_loader, is_subset = True, subset_size = 200,␣
 ↪threshold = 0.5, device=DEVICE2)
infer_full(trained_model3, train_loader, is_subset = True, subset_size = 200,␣
 ↪threshold = 0.5, device=DEVICE3)
infer_full(trained_model4, train_loader, is_subset = True, subset_size = 200,␣
 ↪threshold = 0.5, device=DEVICE4)
```

```
Processing files: 100%|                                | 200/200
[04:41<00:00,  1.41s/it]


--- Average Metrics Across All Files ---

Total Files Processed: 200

NB to B ratio: Predicted = 1729973:270027 | Actual = 1996201:3799
Accuracy: 86.69% | Precision: 3.42% | Recall: 76.50% | F1-Score: 0.06
```

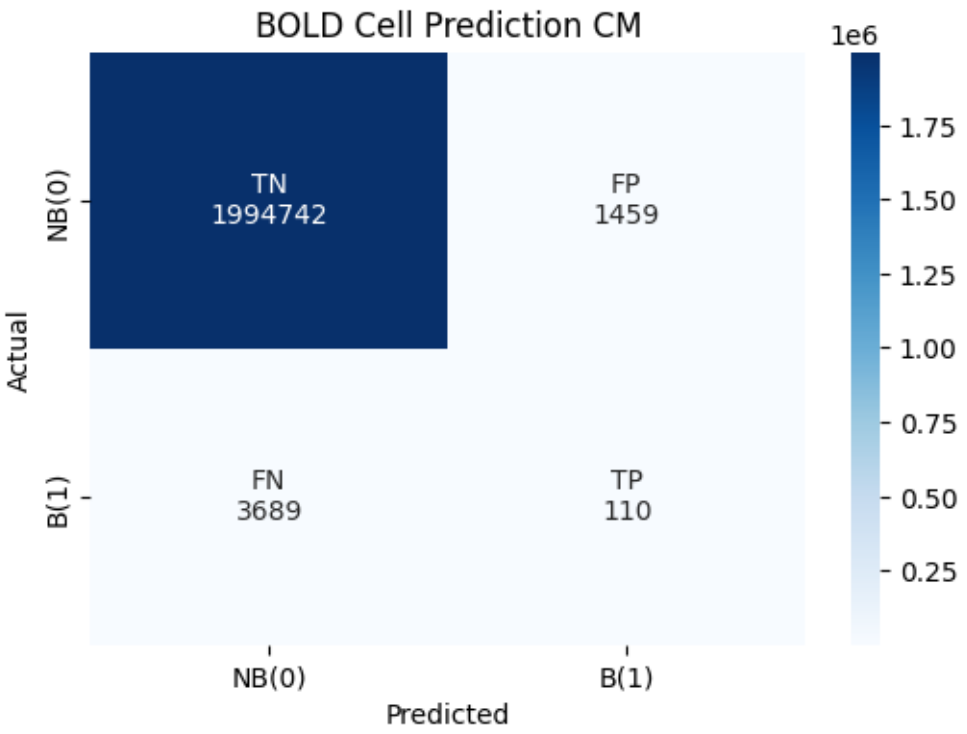



```
Processing files: 100%|                                  | 200/200
[04:39<00:00,  1.40s/it]

--- Average Metrics Across All Files ---

Total Files Processed: 200

NB to B ratio: Predicted = 1998431:1569 | Actual = 1996201:3799
Accuracy: 99.74% | Precision: 12.36% | Recall: 2.77% | F1-Score: 0.04
```

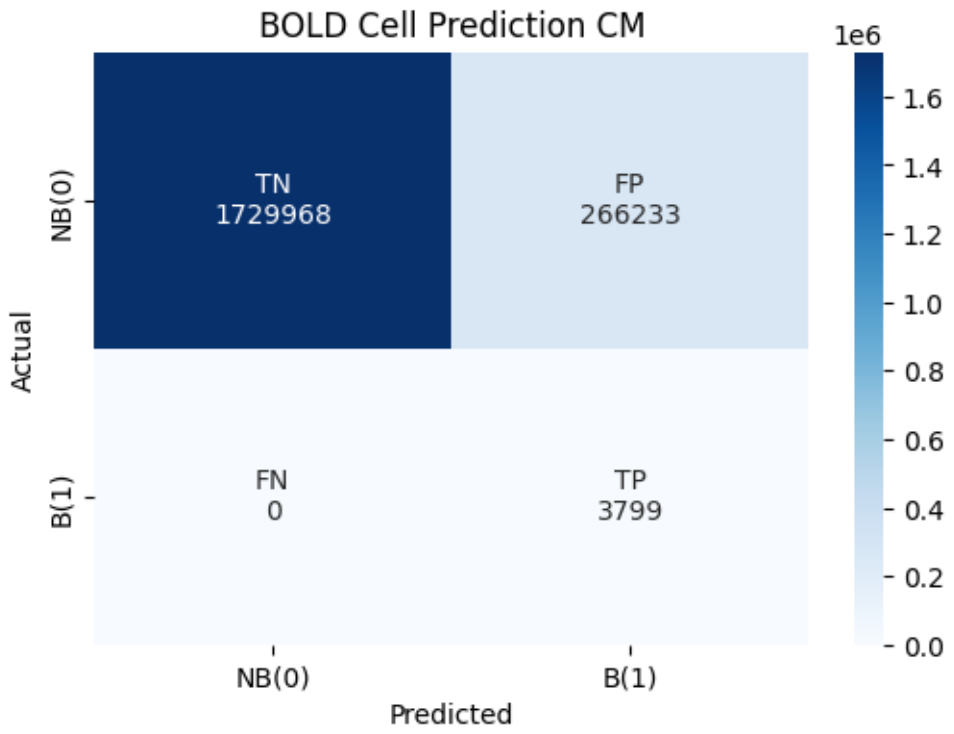



```
Processing files: 100%|                                  | 200/200
[05:08<00:00,  1.54s/it]

--- Average Metrics Across All Files ---

Total Files Processed: 200

NB to B ratio: Predicted = 1729968:270032 | Actual = 1996201:3799
Accuracy: 86.69% | Precision: 3.42% | Recall: 76.50% | F1-Score: 0.06
```

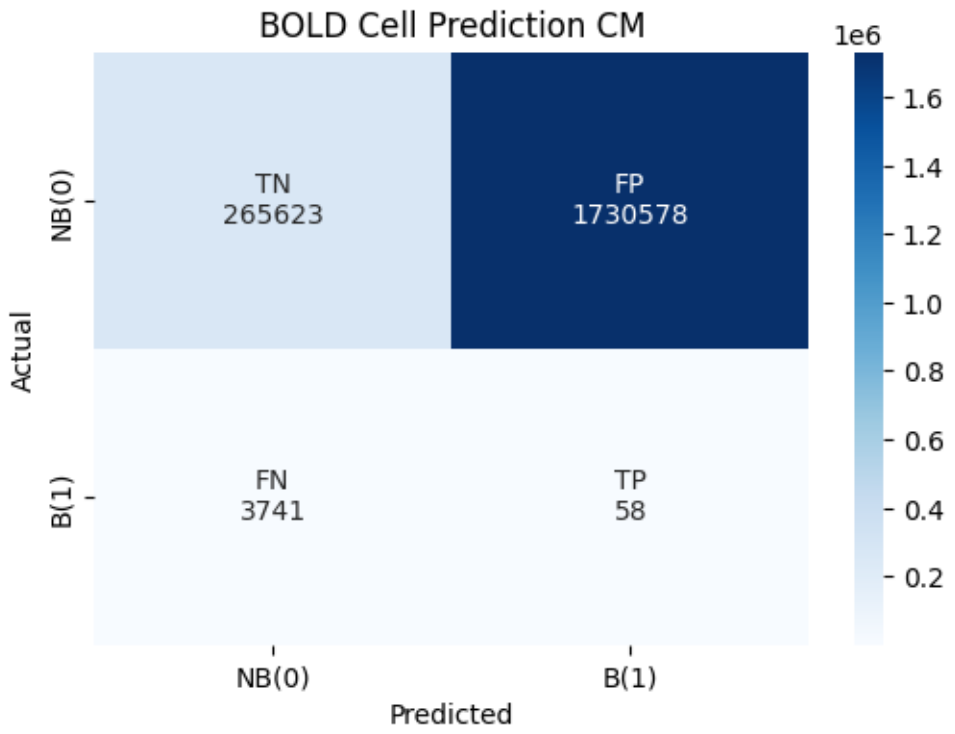



```
Processing files: 100%|                                  | 200/200
[05:49<00:00,  1.75s/it]

--- Average Metrics Across All Files ---

Total Files Processed: 200

NB to B ratio: Predicted = 269364:1730636 | Actual = 1996201:3799
Accuracy: 13.28% | Precision: 0.50% | Recall: 0.80% | F1-Score: 0.00
```



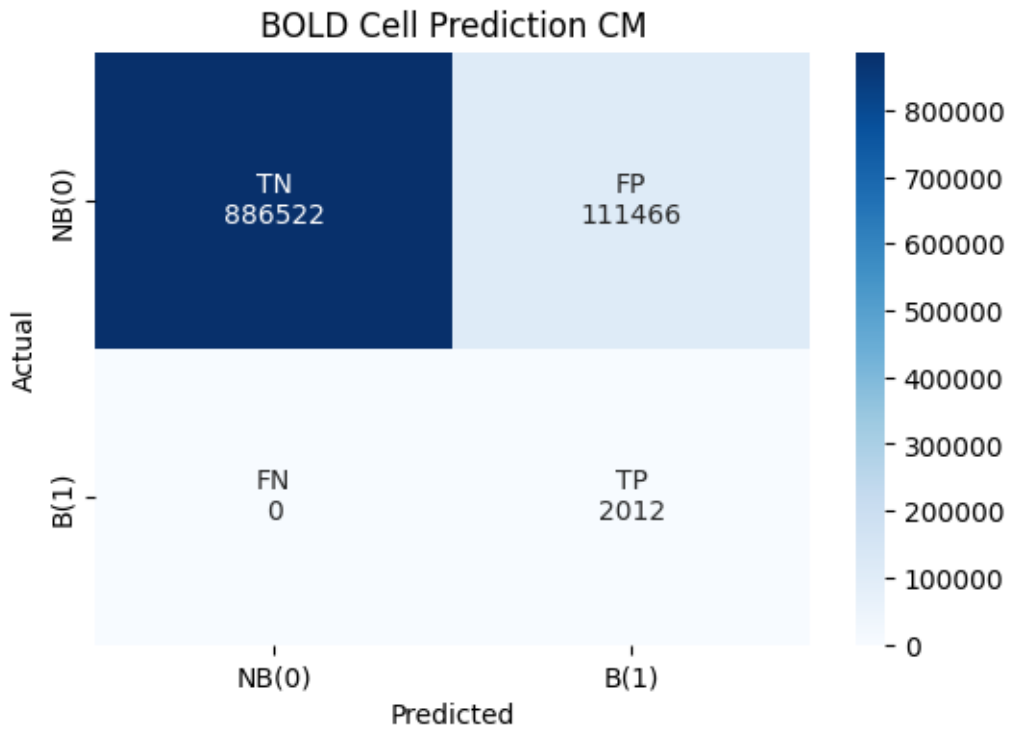
[14]:
```
infer_full(trained_model, val_loader, is_subset = True, subset_size = 200,␣
 ↪threshold = 0.5, device=DEVICE)
infer_full(trained_model2, val_loader, is_subset = True, subset_size = 200,␣
 ↪threshold = 0.5, device=DEVICE2)
infer_full(trained_model3, val_loader, is_subset = True, subset_size = 200,␣
 ↪threshold = 0.5, device=DEVICE3)
infer_full(trained_model4, val_loader, is_subset = True, subset_size = 200,␣
 ↪threshold = 0.5, device=DEVICE4)
```

```
Processing files: 100%|                          | 100/100
[02:58<00:00,  1.79s/it]


--- Average Metrics Across All Files ---

Total Files Processed: 100

NB to B ratio: Predicted = 886522:113478 | Actual = 997988:2012
Accuracy: 88.85% | Precision: 3.13% | Recall: 75.00% | F1-Score: 0.06
```

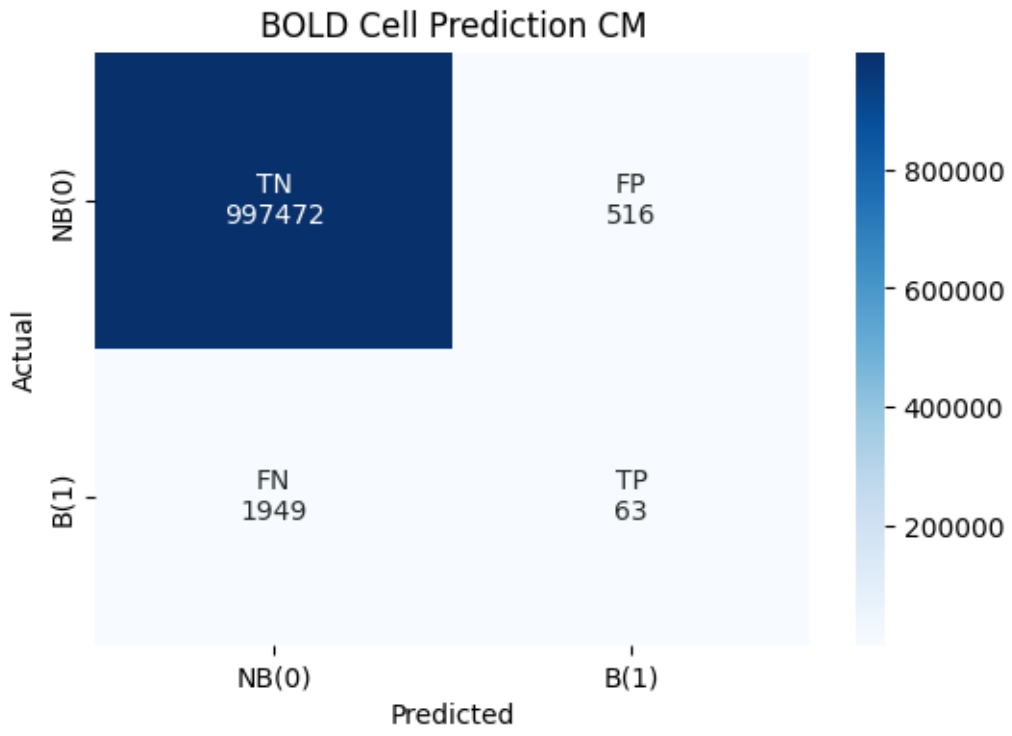



```
Processing files: 100%|                                  | 100/100
[03:04<00:00,  1.84s/it]

--- Average Metrics Across All Files ---

Total Files Processed: 100

NB to B ratio: Predicted = 999421:579 | Actual = 997988:2012
Accuracy: 99.75% | Precision: 12.42% | Recall: 12.02% | F1-Score: 0.09
```

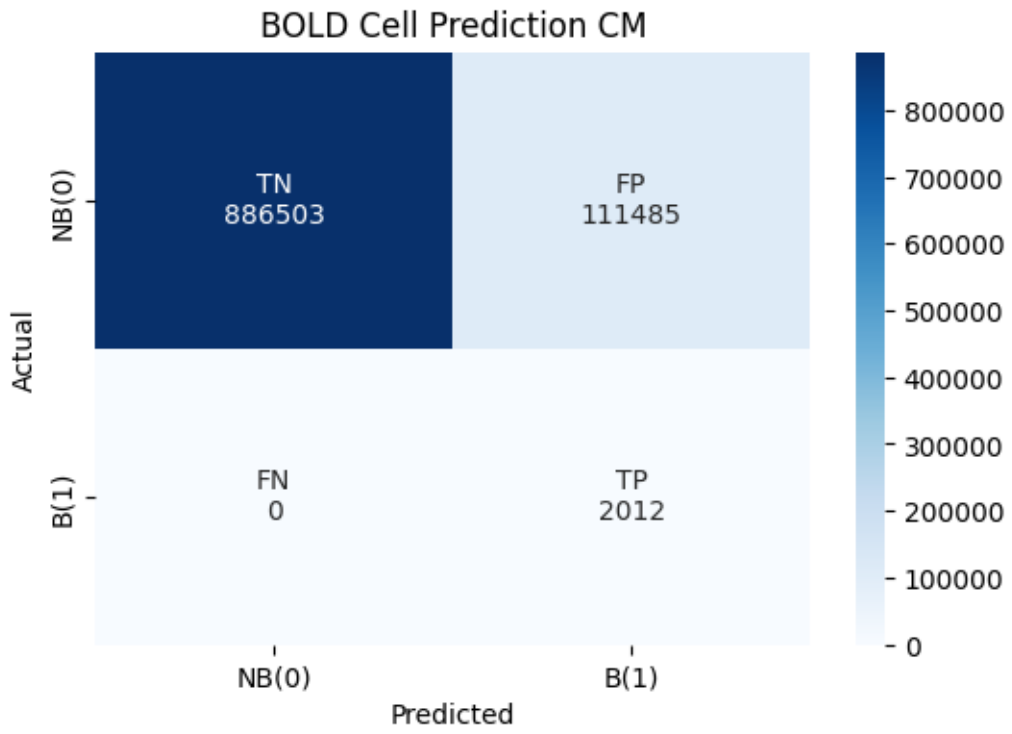



```
Processing files: 100%|                                  | 100/100
[02:57<00:00,  1.78s/it]

--- Average Metrics Across All Files ---

Total Files Processed: 100

NB to B ratio: Predicted = 886503:113497 | Actual = 997988:2012
Accuracy: 88.85% | Precision: 3.13% | Recall: 75.00% | F1-Score: 0.06
```

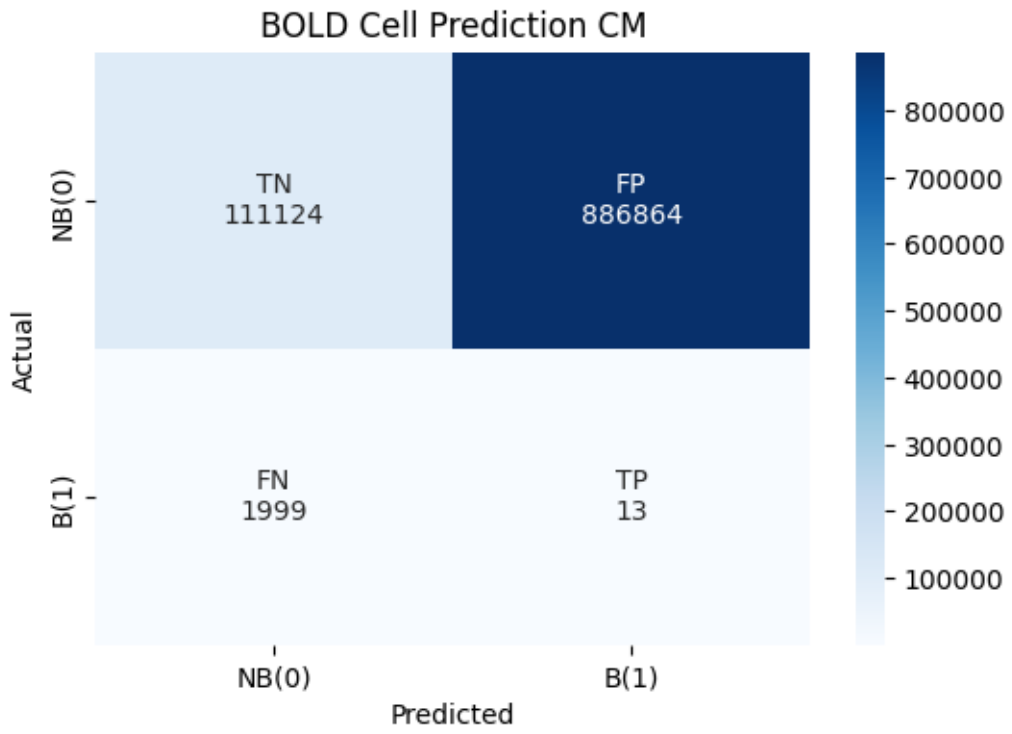



```
Processing files: 100%|                                  | 100/100
[02:55<00:00,  1.76s/it]

--- Average Metrics Across All Files ---

Total Files Processed: 100

NB to B ratio: Predicted = 113123:886877 | Actual = 997988:2012
Accuracy: 11.11% | Precision: 0.00% | Recall: 0.88% | F1-Score: 0.00
```



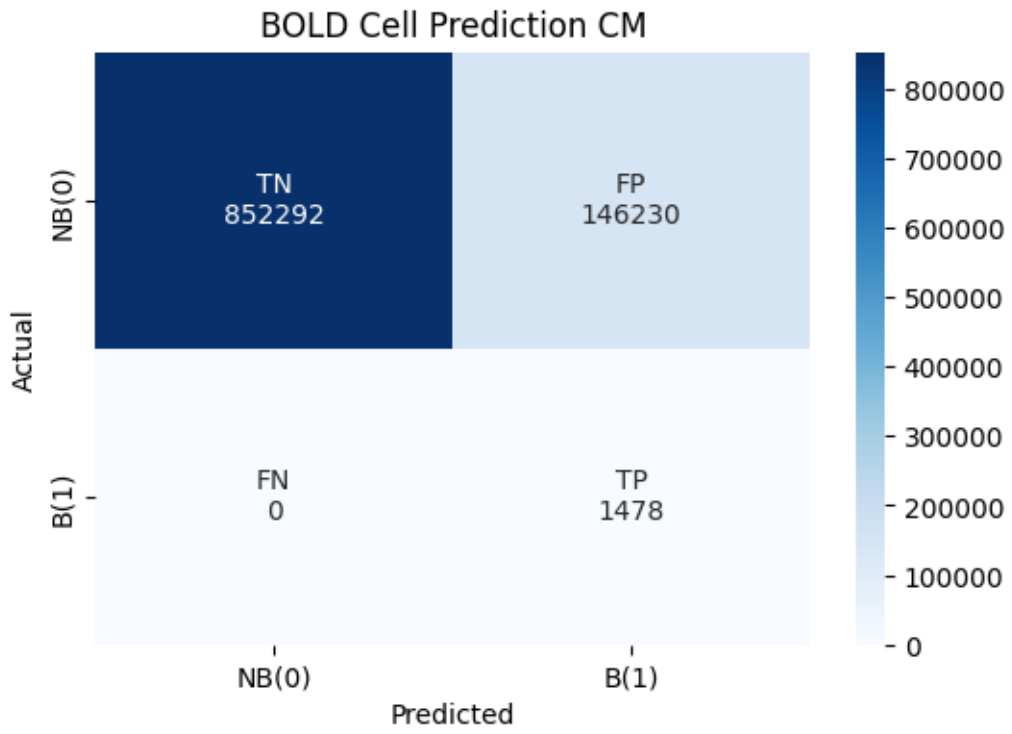
[15]:
```
infer_full(trained_model, test_loader, is_subset = True, subset_size = 200,␣
 ↪threshold = 0.5, device=DEVICE)
infer_full(trained_model2, test_loader, is_subset = True, subset_size = 200,␣
 ↪threshold = 0.5, device=DEVICE2)
infer_full(trained_model3, test_loader, is_subset = True, subset_size = 200,␣
 ↪threshold = 0.5, device=DEVICE3)
infer_full(trained_model4, test_loader, is_subset = True, subset_size = 200,␣
 ↪threshold = 0.5, device=DEVICE4)
```

```
Processing files: 100%|                          | 100/100
[02:54<00:00,  1.75s/it]


--- Average Metrics Across All Files ---

Total Files Processed: 100

NB to B ratio: Predicted = 852292:147708 | Actual = 998522:1478
Accuracy: 85.38% | Precision: 3.38% | Recall: 69.00% | F1-Score: 0.06
```

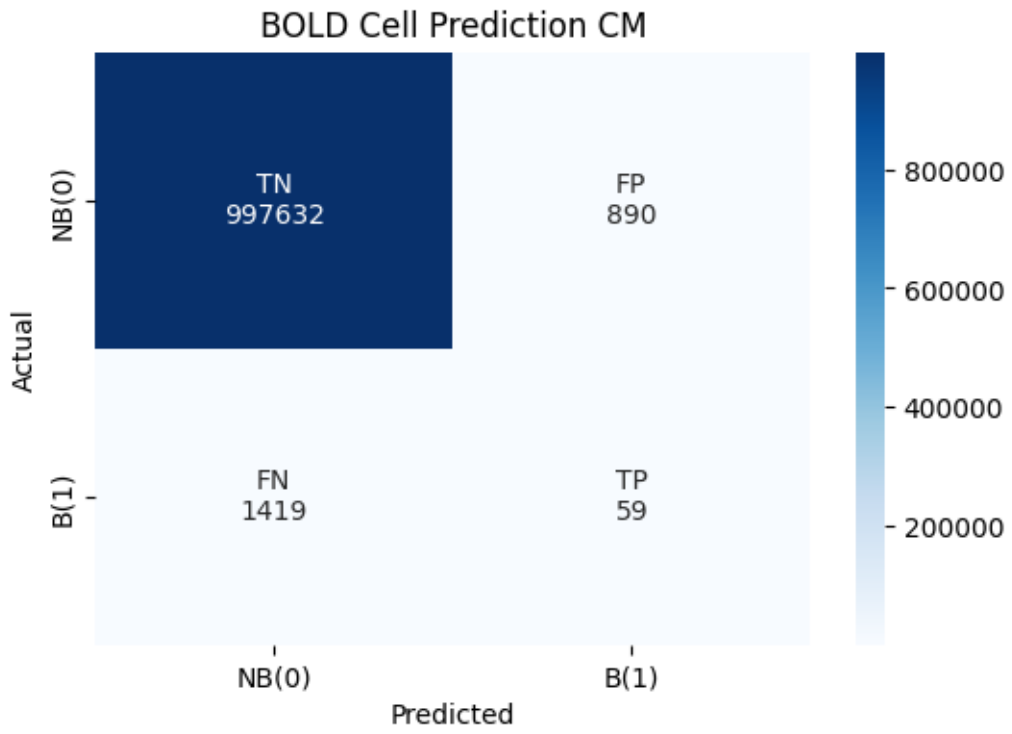



```
Processing files: 100%|                                  | 100/100
[02:55<00:00,  1.76s/it]

--- Average Metrics Across All Files ---

Total Files Processed: 100

NB to B ratio: Predicted = 999051:949 | Actual = 998522:1478
Accuracy: 99.77% | Precision: 10.01% | Recall: 4.43% | F1-Score: 0.05
```

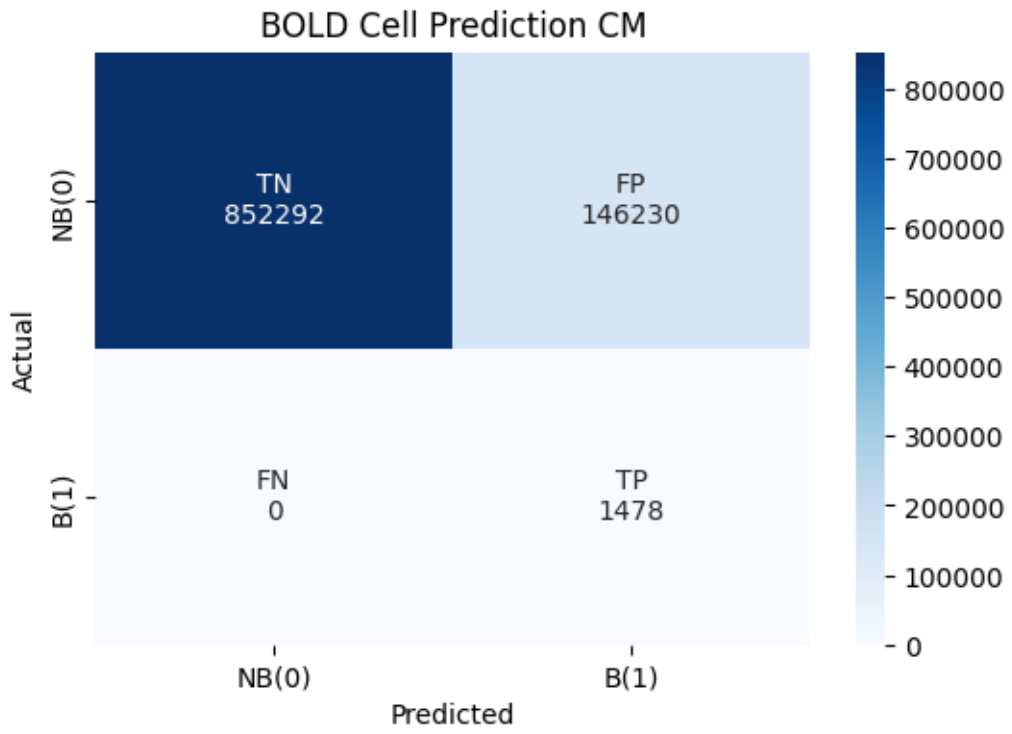



```
Processing files: 100%|                                  | 100/100
[02:53<00:00,  1.73s/it]

--- Average Metrics Across All Files ---

Total Files Processed: 100

NB to B ratio: Predicted = 852292:147708 | Actual = 998522:1478
Accuracy: 85.38% | Precision: 3.38% | Recall: 69.00% | F1-Score: 0.06
```

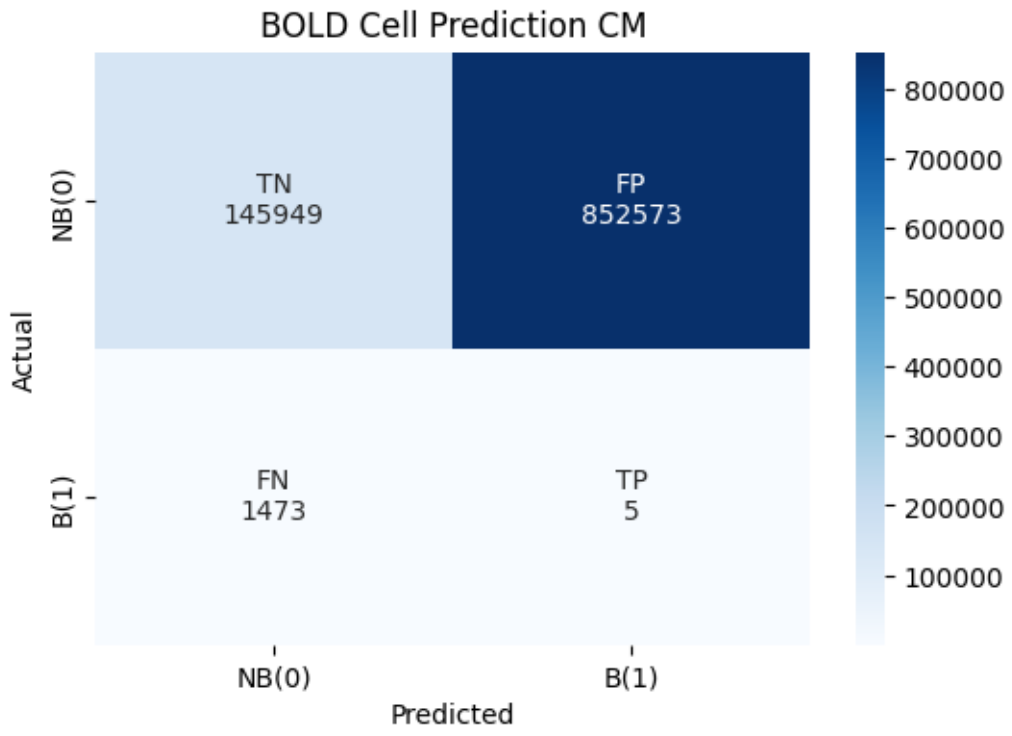



```
Processing files: 100%|                                  | 100/100
[02:52<00:00,  1.73s/it]

--- Average Metrics Across All Files ---

Total Files Processed: 100

NB to B ratio: Predicted = 147422:852578 | Actual = 998522:1478
Accuracy: 14.60% | Precision: 0.00% | Recall: 0.40% | F1-Score: 0.00
```


BOLD Cell Prediction CM
TN
145949
FP
852573
FN
1473
TP
5
NB(0)
B(1)
Actual
NB(0)
B(1)
Predicted
800000
700000
600000
500000
400000
300000
200000
100000

[ ]: