task-1

March 28, 2023

[1]:
```
import torch
import torch.nn as nn
import torch.optim as optim
from torch.utils.data import Dataset, DataLoader
import numpy as np
from torch.nn.utils.rnn import pad_sequence, pack_padded_sequence,␣
 ↪pad_packed_sequence
from torch.nn.modules import padding
from torch.optim.lr_scheduler import StepLR
```

0.1 Finding the distribution of TAGS

[2]:
```
with open('train', "r") as f:
  d={}
  for line in f:
    line = line.strip()
    if len(line) != 0:
      parts = line.split(" ")
      label = parts[2]
      d[label]=1+d.get(label,0)

d
```

[2]:
```
{'B-ORG': 6321,
 'O': 170524,
 'B-MISC': 3438,
 'B-PER': 6600,
 'I-PER': 4528,
 'B-LOC': 7140,
 'I-ORG': 3704,
 'I-MISC': 1155,
 'I-LOC': 1157}
```

0.2 Creating Custom Dataset loader for Train and Dev

[3]:
```
class NERDataset(Dataset):
    def __init__(self, filename):
        self.data = []
        self.word2idx = {'<unk>':1,'<unkcap>':2}
        self.label2idx = {}
        self.max_sent_len = 0
        self.wordCounter={}

        with open(filename, "r") as f:
            sentence = []
            labels = []
            for line in f:
                line = line.strip()
                if len(line) != 0:
                    parts = line.split(" ")
                    word = parts[1]
                    self.wordCounter[word]=1+self.wordCounter.get(word,0)

        for word,count in self.wordCounter.items():
          if count>1 and word not in self.word2idx:
            self.word2idx[word]=len(self.word2idx)

        with open(filename, "r") as f:
            sentence = []
            labels = []
            for line in f:
                line = line.strip()
                if len(line) == 0:
                    if len(sentence) > self.max_sent_len:
                        self.max_sent_len = len(sentence)

                    self.data.append((sentence, labels))
                    sentence = []
                    labels = []
                else:
                    parts = line.split(" ")
                    word = parts[1]
                    label = parts[2]
                    if word not in self.word2idx:
                      if word[0].isupper():
                        word='<unkcap>'
                      else:
                        word='<unk>'
```

```
                    if label not in self.label2idx:
                        self.label2idx[label] = len(self.label2idx)

                    sentence.append(self.word2idx[word])
                    labels.append(self.label2idx[label])

        if len(sentence) > 0:
            if len(sentence) > self.max_sent_len:
                self.max_sent_len = len(sentence)

            self.data.append((sentence, labels))


        self.word2idx['<PAD>'] = len(self.word2idx)
        self.pad_idx = self.word2idx['<PAD>']



        # Pad sentences
        self.x = [torch.tensor(s) for s, _ in self.data]
        self.x = pad_sequence(self.x, batch_first=True, padding_value=self.
↪pad_idx)

        # Pad labels
        self.y = [torch.tensor(l) for _, l in self.data]
        self.y = pad_sequence(self.y, batch_first=True,padding_value=self.
↪pad_idx)

        # Calculate lengths
        self.lengths = [len(s) for s, _ in self.data]

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

    def __getitem__(self, index):
        return self.x[index], self.lengths[index], self.y[index]
```

[4]:
```
class ValidateNERDataset(Dataset):
    def __init__(self, filename,word2idx,label2idx):
        self.data = []
        self.word2idx = word2idx
        self.label2idx = label2idx
        self.max_sent_len = 0

        with open(filename, "r") as f:
            sentence = []
            labels = []
            for line in f:
```

```
            line = line.strip()
            if len(line) == 0:
                if len(sentence) > self.max_sent_len:
                    self.max_sent_len = len(sentence)

                self.data.append((sentence, labels))
                sentence = []
                labels = []
            else:
                parts = line.split(" ")
                word = parts[1]
                label = parts[2]
                if word not in self.word2idx:
                  if word[0].isupper():
                    word = '<unkcap>'
                  else:
                    word='<unk>'

                sentence.append(self.word2idx[word])
                labels.append(self.label2idx[label])

        if len(sentence) > 0:
            if len(sentence) > self.max_sent_len:
                self.max_sent_len = len(sentence)

            self.data.append((sentence, labels))


        self.pad_idx = self.word2idx['<PAD>']

        # Pad sentences
        self.x = [torch.tensor(s) for s, _ in self.data]
        self.x = pad_sequence(self.x, batch_first=True,padding_value=self.
↪pad_idx)

        # Pad labels
        self.y = [torch.tensor(l) for _, l in self.data]
        self.y = pad_sequence(self.y, batch_first=True,padding_value=self.
↪pad_idx)

        # Calculate lengths
        self.lengths = [len(s) for s, _ in self.data]

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

    def __getitem__(self, index):
```

```
        return self.x[index], self.lengths[index], self.y[index]
```

0.3 BLSTM Model

[5]:
```
class BLSTM(nn.Module):
    def __init__(self, vocab_size, embedding_dim, hidden_dim, output_dim,␣
 ↪dropout, label_dim):
        super().__init__()
        self.embedding = nn.Embedding(vocab_size, embedding_dim,␣
 ↪padding_idx=train_dataset.pad_idx)
        self.lstm = nn.LSTM(embedding_dim, hidden_dim, batch_first=True␣
 ↪,bidirectional=True)
        self.dropout = nn.Dropout(dropout)
        self.fc = nn.Linear(hidden_dim * 2, output_dim)
        self.act = nn.ELU(alpha=0.75)
        self.classifier = nn.Linear(output_dim,label_dim)

    def forward(self, x, x_lengths):
        embedded = self.embedding(x)
        packed_embedded = nn.utils.rnn.pack_padded_sequence(embedded,␣
 ↪x_lengths, batch_first=True,enforce_sorted=False)
        packed_output, (hidden, cell) = self.lstm(packed_embedded)
        output, output_lengths = nn.utils.rnn.
 ↪pad_packed_sequence(packed_output, batch_first=True)
        output = self.dropout(output)
        output=self.fc(output)
        output = self.act(output)
        output=self.classifier(output)
        output = output.permute(0, 2, 1)
        return output
```

0.4 Setting the hyperparameter

[56]:
```
batch_size = 8
train_dataset = NERDataset('train')

# Hyperparameters
EMBEDDING_DIM = 100
HIDDEN_DIM = 256
OUTPUT_DIM = 128
OUTPUT_LABEL_DIM = len(train_dataset.label2idx)
DROPOUT = 0.33
#learning rate .1 is best
LEARNING_RATE = .005
EPOCHS = 50
STEP_SIZE = 20
```

```
GAMMA = 1
```

[57]:
```
device = torch.device('cuda' if torch.cuda.is_available() else 'cpu')
model = BLSTM(len(train_dataset.word2idx), EMBEDDING_DIM, HIDDEN_DIM,␣
↪OUTPUT_DIM, DROPOUT, OUTPUT_LABEL_DIM).to(device)
train_loader = DataLoader(train_dataset, batch_size=batch_size, shuffle=True,␣
↪pin_memory=True)
optimizer = optim.SGD(model.parameters(), lr=LEARNING_RATE,momentum=.95)
scheduler = StepLR(optimizer, step_size=STEP_SIZE, gamma=GAMMA)
#freq=list(d.values())
#sum_freq = sum(freq)
#result = [(1.5 - f/sum_freq) for f in freq]
#class_weights = torch.tensor(result).to(device)
#class_weights = torch.tensor([1.6, .5, 1.6, 1.1, 1.4, 1.1, 1.6, 2.1, 2.1]).
↪to(device)

#class_weights = torch.tensor([1.6, .7, 1.6, 1.8, 1.7, 1.6, 1.7, 1.6, 1.6]).
↪to(device)
class_weights = torch.tensor([1.7, .75, 1.5, 1.8, 1.7, 1.8, 1.7, 1.6, 1.5]).
↪to(device)

#class_weights = torch.tensor([2, .5, 2, 1.1, 1.4, 1.1, 1.6, 2.1, 2.1]).
↪to(device)

criterion = nn.CrossEntropyLoss(ignore_index=train_dataset.
↪pad_idx,weight=class_weights).to(device)
```

[8]:
```
train_dataset.label2idx
```

[8]:
```
{'B-ORG': 0,
 'O': 1,
 'B-MISC': 2,
 'B-PER': 3,
 'I-PER': 4,
 'B-LOC': 5,
 'I-ORG': 6,
 'I-MISC': 7,
 'I-LOC': 8}
```

[9]:
```
dev_dataset = ValidateNERDataset('dev',train_dataset.word2idx,train_dataset.
↪label2idx)
dev_loader = DataLoader(dev_dataset)
```

0.5 Training the Model

[58]:
```
min_val_loss=5
# Train the model
for epoch in range(EPOCHS):
    model.train()

    for batch_idx, (x, lengths, y) in enumerate(train_loader):
        optimizer.zero_grad()

        target_packed_embedded = nn.utils.rnn.pack_padded_sequence(y.
 ↪to(device), lengths, batch_first=True, enforce_sorted=False)
        target, target_lengths = nn.utils.rnn.
 ↪pad_packed_sequence(target_packed_embedded, batch_first=True)


        #output = model(x.to(device), lengths.to(device))
        output = model(x.to(device), lengths.cpu())

        loss = criterion(output, target.to(device))
        loss.backward()
        optimizer.step()
        scheduler.step()

        if batch_idx % 100 == 0:
            print(f"Epoch {epoch}, Batch {batch_idx}, Loss {loss.item()}")

        # Compute and print the validation loss
        if batch_idx % 2000 == 0:
            model.eval()  # Set the model to evaluation mode
            with torch.no_grad():
                val_loss = 0
                for val_x, val_lengths, val_y in dev_loader:
                    val_target_packed_embedded = nn.utils.rnn.
 ↪pack_padded_sequence(val_y.to(device), val_lengths, batch_first=True,␣
 ↪enforce_sorted=False)
                    val_target, val_target_lengths = nn.utils.rnn.
 ↪pad_packed_sequence(val_target_packed_embedded, batch_first=True)

                    val_output = model(val_x.to(device), val_lengths.cpu())
                    val_loss += criterion(val_output, val_target.to(device)).
 ↪item()

                print(f"Epoch {epoch}, Batch {batch_idx}, Validation Loss␣
 ↪{val_loss/len(dev_loader)}")
                if min_val_loss>val_loss/len(dev_loader):
                  min_val_loss=val_loss/len(dev_loader)
```

```python
                torch.save(model.state_dict(), 'task_minloss.pt')


            model.train()  # Set the model back to training model
```

```
Epoch 0, Batch 0, Loss 2.2467987537384033
Epoch 0, Batch 0, Validation Loss 2.1530335838232024
Epoch 0, Batch 100, Loss 0.5747454166412354
Epoch 0, Batch 200, Loss 0.3972536027431488
Epoch 0, Batch 300, Loss 0.2924852967262268
Epoch 0, Batch 400, Loss 0.27404943108558655
Epoch 0, Batch 500, Loss 0.22460637986660004
Epoch 0, Batch 600, Loss 0.3476652204990387
Epoch 0, Batch 700, Loss 0.21437563002109528
Epoch 0, Batch 800, Loss 0.276003360748291
Epoch 0, Batch 900, Loss 0.2197766900062561
Epoch 0, Batch 1000, Loss 0.32000187039375305
Epoch 0, Batch 1100, Loss 0.2562519609928131
Epoch 0, Batch 1200, Loss 0.8866047263145447
Epoch 0, Batch 1300, Loss 0.19038942456245422
Epoch 0, Batch 1400, Loss 0.16637755930423737
Epoch 0, Batch 1500, Loss 0.738795816898346
Epoch 0, Batch 1600, Loss 0.7032221555709839
Epoch 0, Batch 1700, Loss 0.30590152740478516
Epoch 0, Batch 1800, Loss 0.3025318682193756
Epoch 1, Batch 0, Loss 0.2271697074174881
Epoch 1, Batch 0, Validation Loss 0.9779573119639388
Epoch 1, Batch 100, Loss 0.188228577375412
Epoch 1, Batch 200, Loss 0.25845086574554443
Epoch 1, Batch 300, Loss 0.5732181072235107
Epoch 1, Batch 400, Loss 0.47560781240463257
Epoch 1, Batch 500, Loss 0.3026306927204132
Epoch 1, Batch 600, Loss 0.2636333107948303
Epoch 1, Batch 700, Loss 0.1620873361825943
Epoch 1, Batch 800, Loss 0.13483232259750366
Epoch 1, Batch 900, Loss 0.0808730497956276
Epoch 1, Batch 1000, Loss 0.23824191093444824
Epoch 1, Batch 1100, Loss 0.20465555787086487
Epoch 1, Batch 1200, Loss 0.2690538167953491
Epoch 1, Batch 1300, Loss 0.285736083984375
Epoch 1, Batch 1400, Loss 0.4800832271575928
Epoch 1, Batch 1500, Loss 0.10531609505414963
Epoch 1, Batch 1600, Loss 0.22168803215026855
Epoch 1, Batch 1700, Loss 0.2624880373477936
Epoch 1, Batch 1800, Loss 0.44203421473503113
Epoch 2, Batch 0, Loss 0.13332118093967438
Epoch 2, Batch 0, Validation Loss 0.8257529791659501
```

```
Epoch 2, Batch 100, Loss 0.21448923647403717
Epoch 2, Batch 200, Loss 0.2091418206691742
Epoch 2, Batch 300, Loss 0.22005398571491241
Epoch 2, Batch 400, Loss 0.13896553218364716
Epoch 2, Batch 500, Loss 0.15091553330421448
Epoch 2, Batch 600, Loss 0.17139217257499695
Epoch 2, Batch 700, Loss 0.19270844757556915
Epoch 2, Batch 800, Loss 0.13928020000457764
Epoch 2, Batch 900, Loss 0.25396794080734253
Epoch 2, Batch 1000, Loss 0.2896393835544586
Epoch 2, Batch 1100, Loss 0.46319591999053955
Epoch 2, Batch 1200, Loss 0.13066035509109497
Epoch 2, Batch 1300, Loss 0.3024241030216217
Epoch 2, Batch 1400, Loss 0.16198554635047913
Epoch 2, Batch 1500, Loss 0.1454496681690216
Epoch 2, Batch 1600, Loss 0.199619323015213
Epoch 2, Batch 1700, Loss 0.3811242878437042
Epoch 2, Batch 1800, Loss 0.29208019375801086
Epoch 3, Batch 0, Loss 0.22863663733005524
Epoch 3, Batch 0, Validation Loss 0.7131404940856312
Epoch 3, Batch 100, Loss 0.30172207951545715
Epoch 3, Batch 200, Loss 0.43450647592544556
Epoch 3, Batch 300, Loss 0.26929497718811035
Epoch 3, Batch 400, Loss 0.23557955026626587
Epoch 3, Batch 500, Loss 0.07875192165374756
Epoch 3, Batch 600, Loss 0.1882663071155548
Epoch 3, Batch 700, Loss 0.2585316002368927
Epoch 3, Batch 800, Loss 0.19841432571411133
Epoch 3, Batch 900, Loss 0.17867664992809296
Epoch 3, Batch 1000, Loss 0.2923671007156372
Epoch 3, Batch 1100, Loss 0.13303512334823608
Epoch 3, Batch 1200, Loss 0.46129435300827026
Epoch 3, Batch 1300, Loss 0.2564007639884949
Epoch 3, Batch 1400, Loss 0.2348671704530716
Epoch 3, Batch 1500, Loss 0.19420841336250305
Epoch 3, Batch 1600, Loss 0.45639514923095703
Epoch 3, Batch 1700, Loss 0.10272443294525146
Epoch 3, Batch 1800, Loss 0.06176889315247536
Epoch 4, Batch 0, Loss 0.20407620072364807
Epoch 4, Batch 0, Validation Loss 0.6374870179891715
Epoch 4, Batch 100, Loss 0.2765561044216156
Epoch 4, Batch 200, Loss 0.15558063983917236
Epoch 4, Batch 300, Loss 0.23321184515953064
Epoch 4, Batch 400, Loss 0.35759514570236206
Epoch 4, Batch 500, Loss 0.3848417401313782
Epoch 4, Batch 600, Loss 0.16536937654018402
Epoch 4, Batch 700, Loss 0.17327021062374115
Epoch 4, Batch 800, Loss 0.26535284519195557
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Epoch 4, Batch 900, Loss 0.15526174008846283
Epoch 4, Batch 1000, Loss 0.25845128297805786
Epoch 4, Batch 1100, Loss 0.2191464602947235
Epoch 4, Batch 1200, Loss 0.18356741964817047
Epoch 4, Batch 1300, Loss 0.22480317950248718
Epoch 4, Batch 1400, Loss 0.31517475843429565
Epoch 4, Batch 1500, Loss 0.2393524944782257
Epoch 4, Batch 1600, Loss 0.09737680107355118
Epoch 4, Batch 1700, Loss 0.07556015253067017
Epoch 4, Batch 1800, Loss 0.2794700562953949
Epoch 5, Batch 0, Loss 0.07936917245388031
Epoch 5, Batch 0, Validation Loss 0.5662990838525181
Epoch 5, Batch 100, Loss 0.10408347100019455
Epoch 5, Batch 200, Loss 0.1119004637002945
Epoch 5, Batch 300, Loss 0.16903828084468842
Epoch 5, Batch 400, Loss 0.2619238495826721
Epoch 5, Batch 500, Loss 0.19662462174892426
Epoch 5, Batch 600, Loss 0.1830054670572281
Epoch 5, Batch 700, Loss 0.1227228119969368
Epoch 5, Batch 800, Loss 0.2149682193994522
Epoch 5, Batch 900, Loss 0.09734497219324112
Epoch 5, Batch 1000, Loss 0.09554368257522583
Epoch 5, Batch 1100, Loss 0.20116807520389557
Epoch 5, Batch 1200, Loss 0.12772580981254578
Epoch 5, Batch 1300, Loss 0.279792457818985
Epoch 5, Batch 1400, Loss 0.18832647800445557
Epoch 5, Batch 1500, Loss 0.06791342794895172
Epoch 5, Batch 1600, Loss 0.36114272475242615
Epoch 5, Batch 1700, Loss 0.1210186555981636
Epoch 5, Batch 1800, Loss 0.11089294403791428
Epoch 6, Batch 0, Loss 0.18253566324710846
Epoch 6, Batch 0, Validation Loss 0.5004145449087339
Epoch 6, Batch 100, Loss 0.2007526308298111
Epoch 6, Batch 200, Loss 0.10156048834323883
Epoch 6, Batch 300, Loss 0.2297937124967575
Epoch 6, Batch 400, Loss 0.06641627103090286
Epoch 6, Batch 500, Loss 0.1452811360359192
Epoch 6, Batch 600, Loss 0.19057150185108185
Epoch 6, Batch 700, Loss 0.06720320135354996
Epoch 6, Batch 800, Loss 0.15411654114723206
Epoch 6, Batch 900, Loss 0.21262772381305695
Epoch 6, Batch 1000, Loss 0.22732232511043549
Epoch 6, Batch 1100, Loss 0.2630687654018402
Epoch 6, Batch 1200, Loss 0.15403170883655548
Epoch 6, Batch 1300, Loss 0.06146189197897911
Epoch 6, Batch 1400, Loss 0.1427360326051712
Epoch 6, Batch 1500, Loss 0.06456330418586731
Epoch 6, Batch 1600, Loss 0.15916569530963898
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Epoch 6, Batch 1700, Loss 0.2195957601070404
Epoch 6, Batch 1800, Loss 0.176566481590271
Epoch 7, Batch 0, Loss 0.09609535336494446
Epoch 7, Batch 0, Validation Loss 0.4587673276315663
Epoch 7, Batch 100, Loss 0.1491001397371292
Epoch 7, Batch 200, Loss 0.1374945044517517
Epoch 7, Batch 300, Loss 0.07268303632736206
Epoch 7, Batch 400, Loss 0.1415235996246338
Epoch 7, Batch 500, Loss 0.14927378296852112
Epoch 7, Batch 600, Loss 0.10626259446144104
Epoch 7, Batch 700, Loss 0.2015487402677536
Epoch 7, Batch 800, Loss 0.10408079624176025
Epoch 7, Batch 900, Loss 0.10781732946634293
Epoch 7, Batch 1000, Loss 0.11697878688573837
Epoch 7, Batch 1100, Loss 0.2434253841638565
Epoch 7, Batch 1200, Loss 0.20431847870349884
Epoch 7, Batch 1300, Loss 0.08505631238222122
Epoch 7, Batch 1400, Loss 0.10875890403985977
Epoch 7, Batch 1500, Loss 0.07594679296016693
Epoch 7, Batch 1600, Loss 0.17256192862987518
Epoch 7, Batch 1700, Loss 0.11831734329462051
Epoch 7, Batch 1800, Loss 0.0601741187274456
Epoch 8, Batch 0, Loss 0.3003526031970978
Epoch 8, Batch 0, Validation Loss 0.4189145497039828
Epoch 8, Batch 100, Loss 0.11951681226491928
Epoch 8, Batch 200, Loss 0.08513219654560089
Epoch 8, Batch 300, Loss 0.12461874634027481
Epoch 8, Batch 400, Loss 0.1389780342578888
Epoch 8, Batch 500, Loss 0.16669906675815582
Epoch 8, Batch 600, Loss 0.15272685885429382
Epoch 8, Batch 700, Loss 0.1665341854095459
Epoch 8, Batch 800, Loss 0.11598549783229828
Epoch 8, Batch 900, Loss 0.11365815997123718
Epoch 8, Batch 1000, Loss 0.12409999221563339
Epoch 8, Batch 1100, Loss 0.11380653083324432
Epoch 8, Batch 1200, Loss 0.0762694850564003
Epoch 8, Batch 1300, Loss 0.1557466685771942
Epoch 8, Batch 1400, Loss 0.13961459696292877
Epoch 8, Batch 1500, Loss 0.17488205432891846
Epoch 8, Batch 1600, Loss 0.23938515782356262
Epoch 8, Batch 1700, Loss 0.0922258123755455
Epoch 8, Batch 1800, Loss 0.04149429872632027
Epoch 9, Batch 0, Loss 0.11672808229923248
Epoch 9, Batch 0, Validation Loss 0.3817907231593344
Epoch 9, Batch 100, Loss 0.04702385887503624
Epoch 9, Batch 200, Loss 0.037036698311567307
Epoch 9, Batch 300, Loss 0.07400259375572205
Epoch 9, Batch 400, Loss 0.06945805996656418
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Epoch 9, Batch 500, Loss 0.13740846514701843
Epoch 9, Batch 600, Loss 0.0319710373878479
Epoch 9, Batch 700, Loss 0.098317950963974
Epoch 9, Batch 800, Loss 0.054491255432367325
Epoch 9, Batch 900, Loss 0.10119257122278214
Epoch 9, Batch 1000, Loss 0.09972687065601349
Epoch 9, Batch 1100, Loss 0.12689277529716492
Epoch 9, Batch 1200, Loss 0.12201926857233047
Epoch 9, Batch 1300, Loss 0.11152833700180054
Epoch 9, Batch 1400, Loss 0.11285129934549332
Epoch 9, Batch 1500, Loss 0.09939275681972504
Epoch 9, Batch 1600, Loss 0.06210295110940933
Epoch 9, Batch 1700, Loss 0.02379193715751171
Epoch 9, Batch 1800, Loss 0.05130456015467644
Epoch 10, Batch 0, Loss 0.1037725955247879
Epoch 10, Batch 0, Validation Loss 0.35519221302909376
Epoch 10, Batch 100, Loss 0.10573700815439224
Epoch 10, Batch 200, Loss 0.06455600261688232
Epoch 10, Batch 300, Loss 0.14859648048877716
Epoch 10, Batch 400, Loss 0.06176622211933136
Epoch 10, Batch 500, Loss 0.1025996208190918
Epoch 10, Batch 600, Loss 0.09285499155521393
Epoch 10, Batch 700, Loss 0.07364750653505325
Epoch 10, Batch 800, Loss 0.10379678755998611
Epoch 10, Batch 900, Loss 0.14991584420204163
Epoch 10, Batch 1000, Loss 0.14336048066616058
Epoch 10, Batch 1100, Loss 0.21035981178283691
Epoch 10, Batch 1200, Loss 0.0723126232624054
Epoch 10, Batch 1300, Loss 0.029954897239804268
Epoch 10, Batch 1400, Loss 0.17997696995735168
Epoch 10, Batch 1500, Loss 0.14095310866832733
Epoch 10, Batch 1600, Loss 0.062396515160799026
Epoch 10, Batch 1700, Loss 0.1501711755990982
Epoch 10, Batch 1800, Loss 0.07771683484315872
Epoch 11, Batch 0, Loss 0.07938337326049805
Epoch 11, Batch 0, Validation Loss 0.32758587613347534
Epoch 11, Batch 100, Loss 0.11992458254098892
Epoch 11, Batch 200, Loss 0.14211814105510712
Epoch 11, Batch 300, Loss 0.0521809458732605
Epoch 11, Batch 400, Loss 0.05556419864296913
Epoch 11, Batch 500, Loss 0.10300775617361069
Epoch 11, Batch 600, Loss 0.16305845975875854
Epoch 11, Batch 700, Loss 0.1770542562007904
Epoch 11, Batch 800, Loss 0.07335423678159714
Epoch 11, Batch 900, Loss 0.06437753885984421
Epoch 11, Batch 1000, Loss 0.08288323879241943
Epoch 11, Batch 1100, Loss 0.1484157294034958
Epoch 11, Batch 1200, Loss 0.11262065917253494
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Epoch 11, Batch 1300, Loss 0.08042243868112564
Epoch 11, Batch 1400, Loss 0.10981710255146027
Epoch 11, Batch 1500, Loss 0.04687344282865524
Epoch 11, Batch 1600, Loss 0.0801275297999382
Epoch 11, Batch 1700, Loss 0.07598191499710083
Epoch 11, Batch 1800, Loss 0.03982032090425491
Epoch 12, Batch 0, Loss 0.06184924393892288
Epoch 12, Batch 0, Validation Loss 0.32059952854299256
Epoch 12, Batch 100, Loss 0.09419762343168259
Epoch 12, Batch 200, Loss 0.1820274144411087
Epoch 12, Batch 300, Loss 0.08140411227941513
Epoch 12, Batch 400, Loss 0.2524007558822632
Epoch 12, Batch 500, Loss 0.17331774532794952
Epoch 12, Batch 600, Loss 0.05088638886809349
Epoch 12, Batch 700, Loss 0.06208612397313118
Epoch 12, Batch 800, Loss 0.07633735984563828
Epoch 12, Batch 900, Loss 0.16185401380062103
Epoch 12, Batch 1000, Loss 0.11430453509092331
Epoch 12, Batch 1100, Loss 0.11665311455726624
Epoch 12, Batch 1200, Loss 0.02429070882499218
Epoch 12, Batch 1300, Loss 0.04413195326924324
Epoch 12, Batch 1400, Loss 0.1681220978498459
Epoch 12, Batch 1500, Loss 0.10572013258934021
Epoch 12, Batch 1600, Loss 0.061557501554489136
Epoch 12, Batch 1700, Loss 0.09484822303056717
Epoch 12, Batch 1800, Loss 0.026680175215005875
Epoch 13, Batch 0, Loss 0.015125062316656113
Epoch 13, Batch 0, Validation Loss 0.2920546589327014
Epoch 13, Batch 100, Loss 0.048343636095523834
Epoch 13, Batch 200, Loss 0.07748477160930634
Epoch 13, Batch 300, Loss 0.07209204882383347
Epoch 13, Batch 400, Loss 0.091408871114254
Epoch 13, Batch 500, Loss 0.07022440433502197
Epoch 13, Batch 600, Loss 0.19548411667346954
Epoch 13, Batch 700, Loss 0.13515350222587585
Epoch 13, Batch 800, Loss 0.07871818542480469
Epoch 13, Batch 900, Loss 0.15337571501731873
Epoch 13, Batch 1000, Loss 0.06739784777164459
Epoch 13, Batch 1100, Loss 0.12133472412824631
Epoch 13, Batch 1200, Loss 0.023477910086512566
Epoch 13, Batch 1300, Loss 0.08968847244977951
Epoch 13, Batch 1400, Loss 0.10570932924747467
Epoch 13, Batch 1500, Loss 0.08630269020795822
Epoch 13, Batch 1600, Loss 0.038958046585321426
Epoch 13, Batch 1700, Loss 0.026231585070490837
Epoch 13, Batch 1800, Loss 0.17640727758407593
Epoch 14, Batch 0, Loss 0.07059359550476074
Epoch 14, Batch 0, Validation Loss 0.28115582251652466
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Epoch 14, Batch 100, Loss 0.05106010660529137
Epoch 14, Batch 200, Loss 0.16798317432403564
Epoch 14, Batch 300, Loss 0.13460209965705872
Epoch 14, Batch 400, Loss 0.085304856300354
Epoch 14, Batch 500, Loss 0.0766729786992073
Epoch 14, Batch 600, Loss 0.03559689596295357
Epoch 14, Batch 700, Loss 0.28365713357925415
Epoch 14, Batch 800, Loss 0.0712871253490448
Epoch 14, Batch 900, Loss 0.08337335288524628
Epoch 14, Batch 1000, Loss 0.05842281132936478
Epoch 14, Batch 1100, Loss 0.03114369325339794
Epoch 14, Batch 1200, Loss 0.07904843986034393
Epoch 14, Batch 1300, Loss 0.02817062847316265
Epoch 14, Batch 1400, Loss 0.05470994859933853
Epoch 14, Batch 1500, Loss 0.04760793596506119
Epoch 14, Batch 1600, Loss 0.021784411743283272
Epoch 14, Batch 1700, Loss 0.04060012102127075
Epoch 14, Batch 1800, Loss 0.07451733201742172
Epoch 15, Batch 0, Loss 0.06382890045642853
Epoch 15, Batch 0, Validation Loss 0.2692164604486669
Epoch 15, Batch 100, Loss 0.06943883746862411
Epoch 15, Batch 200, Loss 0.01769212633371353
Epoch 15, Batch 300, Loss 0.013543208129703999
Epoch 15, Batch 400, Loss 0.05929357558488846
Epoch 15, Batch 500, Loss 0.028034809976816177
Epoch 15, Batch 600, Loss 0.007189398165792227
Epoch 15, Batch 700, Loss 0.02897472120821476
Epoch 15, Batch 800, Loss 0.051084261387586594
Epoch 15, Batch 900, Loss 0.09783235937356949
Epoch 15, Batch 1000, Loss 0.07343324273824692
Epoch 15, Batch 1100, Loss 0.07980456203222275
Epoch 15, Batch 1200, Loss 0.11640782654285431
Epoch 15, Batch 1300, Loss 0.05187978595495224
Epoch 15, Batch 1400, Loss 0.14460764825344086
Epoch 15, Batch 1500, Loss 0.08019427955150604
Epoch 15, Batch 1600, Loss 0.08387338370084763
Epoch 15, Batch 1700, Loss 0.01799321174621582
Epoch 15, Batch 1800, Loss 0.0544838085770607
Epoch 16, Batch 0, Loss 0.04034394025802612
Epoch 16, Batch 0, Validation Loss 0.2564718814454204
Epoch 16, Batch 100, Loss 0.03956501558423042
Epoch 16, Batch 200, Loss 0.0658891350030899
Epoch 16, Batch 300, Loss 0.04963094741106033
Epoch 16, Batch 400, Loss 0.11862848699092865
Epoch 16, Batch 500, Loss 0.02953493595123291
Epoch 16, Batch 600, Loss 0.04773204028606415
Epoch 16, Batch 700, Loss 0.07790886610746384
Epoch 16, Batch 800, Loss 0.06240898743271828
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Epoch 16, Batch 900, Loss 0.14063061773777008
Epoch 16, Batch 1000, Loss 0.0967077687382698
Epoch 16, Batch 1100, Loss 0.11914514750242233
Epoch 16, Batch 1200, Loss 0.04061715304851532
Epoch 16, Batch 1300, Loss 0.1021168902516365
Epoch 16, Batch 1400, Loss 0.12035612761974335
Epoch 16, Batch 1500, Loss 0.08280784636735916
Epoch 16, Batch 1600, Loss 0.05092557892203331
Epoch 16, Batch 1700, Loss 0.04994342103600502
Epoch 16, Batch 1800, Loss 0.046034075319767
Epoch 17, Batch 0, Loss 0.020493028685450554
Epoch 17, Batch 0, Validation Loss 0.26769391427657657
Epoch 17, Batch 100, Loss 0.03184641897678375
Epoch 17, Batch 200, Loss 0.03654196113348007
Epoch 17, Batch 300, Loss 0.07983583211898804
Epoch 17, Batch 400, Loss 0.022982247173786163
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Epoch 17, Batch 600, Loss 0.02702292613685131
Epoch 17, Batch 700, Loss 0.1271274834871292
Epoch 17, Batch 800, Loss 0.04350189119577408
Epoch 17, Batch 900, Loss 0.012059426866471767
Epoch 17, Batch 1000, Loss 0.08355630934238434
Epoch 17, Batch 1100, Loss 0.0287178922444582
Epoch 17, Batch 1200, Loss 0.03311901539564133
Epoch 17, Batch 1300, Loss 0.025597194209694862
Epoch 17, Batch 1400, Loss 0.06106317788362503
Epoch 17, Batch 1500, Loss 0.035822298377752304
Epoch 17, Batch 1600, Loss 0.01658862829208374
Epoch 17, Batch 1700, Loss 0.04815424606204033
Epoch 17, Batch 1800, Loss 0.08082082122564316
Epoch 18, Batch 0, Loss 0.047724124044179916
Epoch 18, Batch 0, Validation Loss 0.24336735726034317
Epoch 18, Batch 100, Loss 0.05029311403632164
Epoch 18, Batch 200, Loss 0.07585671544075012
Epoch 18, Batch 300, Loss 0.05090991035103798
Epoch 18, Batch 400, Loss 0.060030341148376465
Epoch 18, Batch 500, Loss 0.04509042948484421
Epoch 18, Batch 600, Loss 0.043469928205013275
Epoch 18, Batch 700, Loss 0.024189133197069168
Epoch 18, Batch 800, Loss 0.024078277871012688
Epoch 18, Batch 900, Loss 0.03480019047856331
Epoch 18, Batch 1000, Loss 0.04319576919078827
Epoch 18, Batch 1100, Loss 0.06482231616973877
Epoch 18, Batch 1200, Loss 0.029589364305138588
Epoch 18, Batch 1300, Loss 0.06785007566213608
Epoch 18, Batch 1400, Loss 0.027589142322540283
Epoch 18, Batch 1500, Loss 0.10919898748397827
Epoch 18, Batch 1600, Loss 0.08309780061244965
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Epoch 18, Batch 1700, Loss 0.3154008686542511
Epoch 18, Batch 1800, Loss 0.1869318187236786
Epoch 19, Batch 0, Loss 0.022147124633193016
Epoch 19, Batch 0, Validation Loss 0.2515422634323856
Epoch 19, Batch 100, Loss 0.03195851668715477
Epoch 19, Batch 200, Loss 0.14917011559009552
Epoch 19, Batch 300, Loss 0.0751456543803215
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Epoch 19, Batch 500, Loss 0.05236239358782768
Epoch 19, Batch 600, Loss 0.043905019760131836
Epoch 19, Batch 700, Loss 0.044727351516485214
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Epoch 19, Batch 900, Loss 0.0703897476196289
Epoch 19, Batch 1000, Loss 0.07296272367238998
Epoch 19, Batch 1100, Loss 0.029996061697602272
Epoch 19, Batch 1200, Loss 0.015745095908641815
Epoch 19, Batch 1300, Loss 0.07263316959142685
Epoch 19, Batch 1400, Loss 0.03136203810572624
Epoch 19, Batch 1500, Loss 0.08526603132486343
Epoch 19, Batch 1600, Loss 0.10125400871038437
Epoch 19, Batch 1700, Loss 0.035910602658987045
Epoch 19, Batch 1800, Loss 0.07193384319543839
Epoch 20, Batch 0, Loss 0.03766849637031555
Epoch 20, Batch 0, Validation Loss 0.2500736036043265
Epoch 20, Batch 100, Loss 0.03092874214053154
Epoch 20, Batch 200, Loss 0.044215478003025055
Epoch 20, Batch 300, Loss 0.06352640688419342
Epoch 20, Batch 400, Loss 0.03769572079181671
Epoch 20, Batch 500, Loss 0.025049179792404175
Epoch 20, Batch 600, Loss 0.041472576558589935
Epoch 20, Batch 700, Loss 0.015519369393587112
Epoch 20, Batch 800, Loss 0.02234438993036747
Epoch 20, Batch 900, Loss 0.0745508149266243
Epoch 20, Batch 1000, Loss 0.06227707117795944
Epoch 20, Batch 1100, Loss 0.055607642978429794
Epoch 20, Batch 1200, Loss 0.11382174491882324
Epoch 20, Batch 1300, Loss 0.05170445516705513
Epoch 20, Batch 1400, Loss 0.05761825293302536
Epoch 20, Batch 1500, Loss 0.033323176205158234
Epoch 20, Batch 1600, Loss 0.06411397457122803
Epoch 20, Batch 1700, Loss 0.08200991898775101
Epoch 20, Batch 1800, Loss 0.029899684712290764
Epoch 21, Batch 0, Loss 0.07027751207351685
Epoch 21, Batch 0, Validation Loss 0.24055116087238243
Epoch 21, Batch 100, Loss 0.038375526666641235
Epoch 21, Batch 200, Loss 0.009299498051404953
Epoch 21, Batch 300, Loss 0.17514976859092712
Epoch 21, Batch 400, Loss 0.0664982795715332
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Epoch 21, Batch 500, Loss 0.11762002855539322
Epoch 21, Batch 600, Loss 0.023351864889264107
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Epoch 21, Batch 800, Loss 0.013243654742836952
Epoch 21, Batch 900, Loss 0.01635531708598137
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Epoch 21, Batch 1200, Loss 0.10970988124608994
Epoch 21, Batch 1300, Loss 0.026377998292446136
Epoch 21, Batch 1400, Loss 0.09144935011863708
Epoch 21, Batch 1500, Loss 0.04512413963675499
Epoch 21, Batch 1600, Loss 0.059807635843753815
Epoch 21, Batch 1700, Loss 0.028757546097040176
Epoch 21, Batch 1800, Loss 0.02803198993206024
Epoch 22, Batch 0, Loss 0.06002616509795189
Epoch 22, Batch 0, Validation Loss 0.2223017852466536
Epoch 22, Batch 100, Loss 0.07384287565946579
Epoch 22, Batch 200, Loss 0.03794955089688301
Epoch 22, Batch 300, Loss 0.01844317652285099
Epoch 22, Batch 400, Loss 0.028159143403172493
Epoch 22, Batch 500, Loss 0.074176125228405
Epoch 22, Batch 600, Loss 0.02365902066230774
Epoch 22, Batch 700, Loss 0.08676757663488388
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Epoch 22, Batch 1000, Loss 0.09329210221767426
Epoch 22, Batch 1100, Loss 0.015339972451329231
Epoch 22, Batch 1200, Loss 0.06369661539793015
Epoch 22, Batch 1300, Loss 0.05142686888575554
Epoch 22, Batch 1400, Loss 0.07871433347463608
Epoch 22, Batch 1500, Loss 0.044672779738903046
Epoch 22, Batch 1600, Loss 0.016383422538638115
Epoch 22, Batch 1700, Loss 0.0887053832411766
Epoch 22, Batch 1800, Loss 0.012844324111938477
Epoch 23, Batch 0, Loss 0.03212219104170799
Epoch 23, Batch 0, Validation Loss 0.22330913183041715
Epoch 23, Batch 100, Loss 0.09102480113506317
Epoch 23, Batch 200, Loss 0.04293946549296379
Epoch 23, Batch 300, Loss 0.019177811220288277
Epoch 23, Batch 400, Loss 0.085164375603199
Epoch 23, Batch 500, Loss 0.031235672533512115
Epoch 23, Batch 600, Loss 0.09302211552858353
Epoch 23, Batch 700, Loss 0.028801361098885536
Epoch 23, Batch 800, Loss 0.04089367389678955
Epoch 23, Batch 900, Loss 0.007014173548668623
Epoch 23, Batch 1000, Loss 0.05244547501206398
Epoch 23, Batch 1100, Loss 0.02504034712910652
Epoch 23, Batch 1200, Loss 0.024365397170186043
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Epoch 23, Batch 1300, Loss 0.026884768158197403
Epoch 23, Batch 1400, Loss 0.03908161818981171
Epoch 23, Batch 1500, Loss 0.03296460956335068
Epoch 23, Batch 1600, Loss 0.026263831183314323
Epoch 23, Batch 1700, Loss 0.012914319522678852
Epoch 23, Batch 1800, Loss 0.02029886655509472
Epoch 24, Batch 0, Loss 0.009594548493623734
Epoch 24, Batch 0, Validation Loss 0.23475190515789154
Epoch 24, Batch 100, Loss 0.0162326879799366
Epoch 24, Batch 200, Loss 0.012115662917494774
Epoch 24, Batch 300, Loss 0.01312224566936493
Epoch 24, Batch 400, Loss 0.011339096352458
Epoch 24, Batch 500, Loss 0.02177335135638714
Epoch 24, Batch 600, Loss 0.02012052573263645
Epoch 24, Batch 700, Loss 0.0142291858792305
Epoch 24, Batch 800, Loss 0.01342003047466278
Epoch 24, Batch 900, Loss 0.02970913052558899
Epoch 24, Batch 1000, Loss 0.04884859174489975
Epoch 24, Batch 1100, Loss 0.01493280753493309
Epoch 24, Batch 1200, Loss 0.017438434064388275
Epoch 24, Batch 1300, Loss 0.01638597995042801
Epoch 24, Batch 1400, Loss 0.06789017468690872
Epoch 24, Batch 1500, Loss 0.03567858785390854
Epoch 24, Batch 1600, Loss 0.053938113152980804
Epoch 24, Batch 1700, Loss 0.010747894644737244
Epoch 24, Batch 1800, Loss 0.055236056447029114
Epoch 25, Batch 0, Loss 0.02104882337152958
Epoch 25, Batch 0, Validation Loss 0.2289459264197563
Epoch 25, Batch 100, Loss 0.023696009069681168
Epoch 25, Batch 200, Loss 0.11626526713371277
Epoch 25, Batch 300, Loss 0.015039042569696903
Epoch 25, Batch 400, Loss 0.01393035240471363
Epoch 25, Batch 500, Loss 0.016573501750826836
Epoch 25, Batch 600, Loss 0.02557813934981823
Epoch 25, Batch 700, Loss 0.01160935964435339
Epoch 25, Batch 800, Loss 0.021962786093354225
Epoch 25, Batch 900, Loss 0.043071337044239044
Epoch 25, Batch 1000, Loss 0.12397047132253647
Epoch 25, Batch 1100, Loss 0.024386947974562645
Epoch 25, Batch 1200, Loss 0.020234987139701843
Epoch 25, Batch 1300, Loss 0.013508175499737263
Epoch 25, Batch 1400, Loss 0.016674106940627098
Epoch 25, Batch 1500, Loss 0.011822172440588474
Epoch 25, Batch 1600, Loss 0.03068116493523121
Epoch 25, Batch 1700, Loss 0.04285630211234093
Epoch 25, Batch 1800, Loss 0.0337807722389698
Epoch 26, Batch 0, Loss 0.03447393700480461
Epoch 26, Batch 0, Validation Loss 0.23305978778016526
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Epoch 26, Batch 100, Loss 0.02335200086236
Epoch 26, Batch 200, Loss 0.05359356477856636
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Epoch 26, Batch 400, Loss 0.016202975064516068
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Epoch 26, Batch 600, Loss 0.01143350824713707
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Epoch 26, Batch 1000, Loss 0.04904180392622948
Epoch 26, Batch 1100, Loss 0.05041860416531563
Epoch 26, Batch 1200, Loss 0.049235302954912186
Epoch 26, Batch 1300, Loss 0.011540563777089119
Epoch 26, Batch 1400, Loss 0.049782004207372665
Epoch 26, Batch 1500, Loss 0.045186225324869156
Epoch 26, Batch 1600, Loss 0.03804987296462059
Epoch 26, Batch 1700, Loss 0.03537118434906006
Epoch 26, Batch 1800, Loss 0.11591817438602448
Epoch 27, Batch 0, Loss 0.016130270436406136
Epoch 27, Batch 0, Validation Loss 0.21464871791369264
Epoch 27, Batch 100, Loss 0.020431818440556526
Epoch 27, Batch 200, Loss 0.03330223634839058
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Epoch 27, Batch 400, Loss 0.014270336367189884
Epoch 27, Batch 500, Loss 0.031160306185483932
Epoch 27, Batch 600, Loss 0.05548519268631935
Epoch 27, Batch 700, Loss 0.012917321175336838
Epoch 27, Batch 800, Loss 0.0394771546125412
Epoch 27, Batch 900, Loss 0.008940689265727997
Epoch 27, Batch 1000, Loss 0.04150766134262085
Epoch 27, Batch 1100, Loss 0.03223249688744545
Epoch 27, Batch 1200, Loss 0.047836847603321075
Epoch 27, Batch 1300, Loss 0.06125517189502716
Epoch 27, Batch 1400, Loss 0.020187586545944214
Epoch 27, Batch 1500, Loss 0.04836105555295944
Epoch 27, Batch 1600, Loss 0.035843655467033386
Epoch 27, Batch 1700, Loss 0.04289904981851578
Epoch 27, Batch 1800, Loss 0.0067330156452953815
Epoch 28, Batch 0, Loss 0.03127161040902138
Epoch 28, Batch 0, Validation Loss 0.22118662916143922
Epoch 28, Batch 100, Loss 0.09726354479789734
Epoch 28, Batch 200, Loss 0.02083716168999672
Epoch 28, Batch 300, Loss 0.009205899201333523
Epoch 28, Batch 400, Loss 0.021908175200223923
Epoch 28, Batch 500, Loss 0.021502695977687836
Epoch 28, Batch 600, Loss 0.008907283656299114
Epoch 28, Batch 700, Loss 0.03906087204813957
Epoch 28, Batch 800, Loss 0.006622492801398039
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Epoch 28, Batch 900, Loss 0.015664050355553627
Epoch 28, Batch 1000, Loss 0.005002114921808243
Epoch 28, Batch 1100, Loss 0.031496454030275345
Epoch 28, Batch 1200, Loss 0.04989632964134216
Epoch 28, Batch 1300, Loss 0.05210838094353676
Epoch 28, Batch 1400, Loss 0.021234074607491493
Epoch 28, Batch 1500, Loss 0.012320706620812416
Epoch 28, Batch 1600, Loss 0.03423824533820152
Epoch 28, Batch 1700, Loss 0.022662203758955002
Epoch 28, Batch 1800, Loss 0.023352550342679024
Epoch 29, Batch 0, Loss 0.005789414048194885
Epoch 29, Batch 0, Validation Loss 0.22687598357926084
Epoch 29, Batch 100, Loss 0.01682494767010212
Epoch 29, Batch 200, Loss 0.021590564399957657
Epoch 29, Batch 300, Loss 0.007807399146258831
Epoch 29, Batch 400, Loss 0.00891093909740448
Epoch 29, Batch 500, Loss 0.006915247067809105
Epoch 29, Batch 600, Loss 0.006497984752058983
Epoch 29, Batch 700, Loss 0.047029364854097366
Epoch 29, Batch 800, Loss 0.007562939543277025
Epoch 29, Batch 900, Loss 0.006956795696169138
Epoch 29, Batch 1000, Loss 0.015389258041977882
Epoch 29, Batch 1100, Loss 0.014137116260826588
Epoch 29, Batch 1200, Loss 0.01305637788027525
Epoch 29, Batch 1300, Loss 0.013023742474615574
Epoch 29, Batch 1400, Loss 0.1125974953174591
Epoch 29, Batch 1500, Loss 0.016047457233071327
Epoch 29, Batch 1600, Loss 0.006781259551644325
Epoch 29, Batch 1700, Loss 0.046499405056238174
Epoch 29, Batch 1800, Loss 0.003988121636211872
Epoch 30, Batch 0, Loss 0.017821136862039566
Epoch 30, Batch 0, Validation Loss 0.2239960567037369
Epoch 30, Batch 100, Loss 0.00921498704701662
Epoch 30, Batch 200, Loss 0.020388484001159668
Epoch 30, Batch 300, Loss 0.030651062726974487
Epoch 30, Batch 400, Loss 0.02791127935051918
Epoch 30, Batch 500, Loss 0.0008404291002079844
Epoch 30, Batch 600, Loss 0.02933233231306076
Epoch 30, Batch 700, Loss 0.030362505465745926
Epoch 30, Batch 800, Loss 0.055886730551719666
Epoch 30, Batch 900, Loss 0.022554436698555946
Epoch 30, Batch 1000, Loss 0.02014904096722603
Epoch 30, Batch 1100, Loss 0.0403021015226841
Epoch 30, Batch 1200, Loss 0.016655882820487022
Epoch 30, Batch 1300, Loss 0.0080352071672678
Epoch 30, Batch 1400, Loss 0.053731102496385574
Epoch 30, Batch 1500, Loss 0.038543201982975006
Epoch 30, Batch 1600, Loss 0.02766658365726471
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Epoch 30, Batch 1700, Loss 0.011750585399568081
Epoch 30, Batch 1800, Loss 0.016138043254613876
Epoch 31, Batch 0, Loss 0.009082704782485962
Epoch 31, Batch 0, Validation Loss 0.2135197534924718
Epoch 31, Batch 100, Loss 0.014770773239433765
Epoch 31, Batch 200, Loss 0.004622797016054392
Epoch 31, Batch 300, Loss 0.0013009392423555255
Epoch 31, Batch 400, Loss 0.03950627148151398
Epoch 31, Batch 500, Loss 0.017171377316117287
Epoch 31, Batch 600, Loss 0.07481458783149719
Epoch 31, Batch 700, Loss 0.08210770785808563
Epoch 31, Batch 800, Loss 0.0075347390957176685
Epoch 31, Batch 900, Loss 0.030306875705718994
Epoch 31, Batch 1000, Loss 0.04766792804002762
Epoch 31, Batch 1100, Loss 0.04811003804206848
Epoch 31, Batch 1200, Loss 0.061667945235967636
Epoch 31, Batch 1300, Loss 0.034620948135852814
Epoch 31, Batch 1400, Loss 0.0287628173828125
Epoch 31, Batch 1500, Loss 0.014785492792725563
Epoch 31, Batch 1600, Loss 0.040404368191957474
Epoch 31, Batch 1700, Loss 0.016607236117124557
Epoch 31, Batch 1800, Loss 0.014207564294338226
Epoch 32, Batch 0, Loss 0.0707070529460907
Epoch 32, Batch 0, Validation Loss 0.21605437942413902
Epoch 32, Batch 100, Loss 0.06759537756443024
Epoch 32, Batch 200, Loss 0.03468044102191925
Epoch 32, Batch 300, Loss 0.02191278338432312
Epoch 32, Batch 400, Loss 0.052886202931404114
Epoch 32, Batch 500, Loss 0.05177924409508705
Epoch 32, Batch 600, Loss 0.03621060401201248
Epoch 32, Batch 700, Loss 0.010839192196726799
Epoch 32, Batch 800, Loss 0.024717478081583977
Epoch 32, Batch 900, Loss 0.019296281039714813
Epoch 32, Batch 1000, Loss 0.023161303251981735
Epoch 32, Batch 1100, Loss 0.05835309997200966
Epoch 32, Batch 1200, Loss 0.00605830829590559
Epoch 32, Batch 1300, Loss 0.019510747864842415
Epoch 32, Batch 1400, Loss 0.01223570853471756
Epoch 32, Batch 1500, Loss 0.07565198093652725
Epoch 32, Batch 1600, Loss 0.02693234384059906
Epoch 32, Batch 1700, Loss 0.0030180765315890312
Epoch 32, Batch 1800, Loss 0.013708816841244698
Epoch 33, Batch 0, Loss 0.016312940046191216
Epoch 33, Batch 0, Validation Loss 0.21739109464335196
Epoch 33, Batch 100, Loss 0.01797451078891754
Epoch 33, Batch 200, Loss 0.05382939800620079
Epoch 33, Batch 300, Loss 0.067205511033535
Epoch 33, Batch 400, Loss 0.030369851738214493
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Epoch 33, Batch 500, Loss 0.024280229583382607
Epoch 33, Batch 600, Loss 0.01141324732452631
Epoch 33, Batch 700, Loss 0.030450452119112015
Epoch 33, Batch 800, Loss 0.03574267402291298
Epoch 33, Batch 900, Loss 0.021793203428387642
Epoch 33, Batch 1000, Loss 0.028540894389152527
Epoch 33, Batch 1100, Loss 0.005354049149900675
Epoch 33, Batch 1200, Loss 0.05382648855447769
Epoch 33, Batch 1300, Loss 0.019543413072824478
Epoch 33, Batch 1400, Loss 0.00940735824406147
Epoch 33, Batch 1500, Loss 0.02412489242851734
Epoch 33, Batch 1600, Loss 0.028409695252776146
Epoch 33, Batch 1700, Loss 0.010648876428604126
Epoch 33, Batch 1800, Loss 0.009466582909226418
Epoch 34, Batch 0, Loss 0.01625082641839981
Epoch 34, Batch 0, Validation Loss 0.22444544755171297
Epoch 34, Batch 100, Loss 0.01606122963130474
Epoch 34, Batch 200, Loss 0.034541986882686615
Epoch 34, Batch 300, Loss 0.01583649031817913
Epoch 34, Batch 400, Loss 0.00415912177413702
Epoch 34, Batch 500, Loss 0.04341466352343559
Epoch 34, Batch 600, Loss 0.01797505095601082
Epoch 34, Batch 700, Loss 0.015490432269871235
Epoch 34, Batch 800, Loss 0.00789731740951538
Epoch 34, Batch 900, Loss 0.0008832168532535434
Epoch 34, Batch 1000, Loss 0.026465829461812973
Epoch 34, Batch 1100, Loss 0.022448522970080376
Epoch 34, Batch 1200, Loss 0.03811817616224289
Epoch 34, Batch 1300, Loss 0.029843194410204887
Epoch 34, Batch 1400, Loss 0.010980761609971523
Epoch 34, Batch 1500, Loss 0.011593558825552464
Epoch 34, Batch 1600, Loss 0.041880056262016296
Epoch 34, Batch 1700, Loss 0.010156296193599701
Epoch 34, Batch 1800, Loss 0.011181908659636974
Epoch 35, Batch 0, Loss 0.03413408622145653
Epoch 35, Batch 0, Validation Loss 0.21897112691982087
Epoch 35, Batch 100, Loss 0.02827370911836624
Epoch 35, Batch 200, Loss 0.002395821735262871
Epoch 35, Batch 300, Loss 0.026660721749067307
Epoch 35, Batch 400, Loss 0.05002279579639435
Epoch 35, Batch 500, Loss 0.05217396095395088
Epoch 35, Batch 600, Loss 0.013744880445301533
Epoch 35, Batch 700, Loss 0.013757020235061646
Epoch 35, Batch 800, Loss 0.002319274703040719
Epoch 35, Batch 900, Loss 0.017252763733267784
Epoch 35, Batch 1000, Loss 0.016607271507382393
Epoch 35, Batch 1100, Loss 0.008374662138521671
Epoch 35, Batch 1200, Loss 0.002358641941100359
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Epoch 35, Batch 1300, Loss 0.014974637888371944
Epoch 35, Batch 1400, Loss 0.007057132199406624
Epoch 35, Batch 1500, Loss 0.018898656591773033
Epoch 35, Batch 1600, Loss 0.025922391563653946
Epoch 35, Batch 1700, Loss 0.023603463545441628
Epoch 35, Batch 1800, Loss 0.011669328436255455
Epoch 36, Batch 0, Loss 0.0474419891834259
Epoch 36, Batch 0, Validation Loss 0.22736590598198708
Epoch 36, Batch 100, Loss 0.04773088917136192
Epoch 36, Batch 200, Loss 0.010980311781167984
Epoch 36, Batch 300, Loss 0.041111059486866
Epoch 36, Batch 400, Loss 0.013363029807806015
Epoch 36, Batch 500, Loss 0.011670216917991638
Epoch 36, Batch 600, Loss 0.054316673427820206
Epoch 36, Batch 700, Loss 0.027227673679590225
Epoch 36, Batch 800, Loss 0.011728753335773945
Epoch 36, Batch 900, Loss 0.04917406290769577
Epoch 36, Batch 1000, Loss 0.0018234903691336513
Epoch 36, Batch 1100, Loss 0.008921720087528229
Epoch 36, Batch 1200, Loss 0.01726468652486801
Epoch 36, Batch 1300, Loss 0.06769486516714096
Epoch 36, Batch 1400, Loss 0.008666829206049442
Epoch 36, Batch 1500, Loss 0.028160270303487778
Epoch 36, Batch 1600, Loss 0.06178351491689682
Epoch 36, Batch 1700, Loss 0.02191794477403164
Epoch 36, Batch 1800, Loss 0.022437062114477158
Epoch 37, Batch 0, Loss 0.050000112503767014
Epoch 37, Batch 0, Validation Loss 0.23254970738774994
Epoch 37, Batch 100, Loss 0.021646203473210335
Epoch 37, Batch 200, Loss 0.005000113509595394
Epoch 37, Batch 300, Loss 0.021814744919538498
Epoch 37, Batch 400, Loss 0.0011640748707577586
Epoch 37, Batch 500, Loss 0.009087457321584225
Epoch 37, Batch 600, Loss 0.008609138429164886
Epoch 37, Batch 700, Loss 0.007998541928827763
Epoch 37, Batch 800, Loss 0.05303807556629181
Epoch 37, Batch 900, Loss 0.0421777069568634
Epoch 37, Batch 1000, Loss 0.05112447217106819
Epoch 37, Batch 1100, Loss 0.007525376044213772
Epoch 37, Batch 1200, Loss 0.045740339905023575
Epoch 37, Batch 1300, Loss 0.004570935852825642
Epoch 37, Batch 1400, Loss 0.026136178523302078
Epoch 37, Batch 1500, Loss 0.028172140941023827
Epoch 37, Batch 1600, Loss 0.004412894602864981
Epoch 37, Batch 1700, Loss 0.016333702951669693
Epoch 37, Batch 1800, Loss 0.014088512398302555
Epoch 38, Batch 0, Loss 0.028460128232836723
Epoch 38, Batch 0, Validation Loss 0.22355960320242127
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Epoch 38, Batch 100, Loss 0.015058749355375767
Epoch 38, Batch 200, Loss 0.010151134803891182
Epoch 38, Batch 300, Loss 0.01736038364470005
Epoch 38, Batch 400, Loss 0.04923202097415924
Epoch 38, Batch 500, Loss 0.026548050343990326
Epoch 38, Batch 600, Loss 0.004588425625115633
Epoch 38, Batch 700, Loss 0.029016554355621338
Epoch 38, Batch 800, Loss 0.032920125871896744
Epoch 38, Batch 900, Loss 0.01658175140619278
Epoch 38, Batch 1000, Loss 0.05139727517962456
Epoch 38, Batch 1100, Loss 0.03522685915231705
Epoch 38, Batch 1200, Loss 0.01051418948918581
Epoch 38, Batch 1300, Loss 0.0025606004055589437
Epoch 38, Batch 1400, Loss 0.016237720847129822
Epoch 38, Batch 1500, Loss 0.028176199644804
Epoch 38, Batch 1600, Loss 0.010847735218703747
Epoch 38, Batch 1700, Loss 0.03084947168827057
Epoch 38, Batch 1800, Loss 0.011472279205918312
Epoch 39, Batch 0, Loss 0.003028921550139785
Epoch 39, Batch 0, Validation Loss 0.2294476413134289
Epoch 39, Batch 100, Loss 0.016418687999248505
Epoch 39, Batch 200, Loss 0.005587361287325621
Epoch 39, Batch 300, Loss 0.024447612464427948
Epoch 39, Batch 400, Loss 0.029123825952410698
Epoch 39, Batch 500, Loss 0.013793873600661755
Epoch 39, Batch 600, Loss 0.03025314025580883
Epoch 39, Batch 700, Loss 0.0019018735038116574
Epoch 39, Batch 800, Loss 0.010202368721365929
Epoch 39, Batch 900, Loss 0.06564696878194809
Epoch 39, Batch 1000, Loss 0.01048697717487812
Epoch 39, Batch 1100, Loss 0.009900406934320927
Epoch 39, Batch 1200, Loss 0.025957664474844933
Epoch 39, Batch 1300, Loss 0.015273735858500004
Epoch 39, Batch 1400, Loss 0.020473193377256393
Epoch 39, Batch 1500, Loss 0.012155474163591862
Epoch 39, Batch 1600, Loss 0.008043992333114147
Epoch 39, Batch 1700, Loss 0.002077685669064522
Epoch 39, Batch 1800, Loss 0.029997387900948524
Epoch 40, Batch 0, Loss 0.04170982912182808
Epoch 40, Batch 0, Validation Loss 0.2175917953129447
Epoch 40, Batch 100, Loss 0.021800190210342407
Epoch 40, Batch 200, Loss 0.022950049489736557
Epoch 40, Batch 300, Loss 0.023555375635623932
Epoch 40, Batch 400, Loss 0.008792600594460964
Epoch 40, Batch 500, Loss 0.0215973611921072
Epoch 40, Batch 600, Loss 0.020399631932377815
Epoch 40, Batch 700, Loss 0.026895571500062943
Epoch 40, Batch 800, Loss 0.006660579238086939
```

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Epoch 40, Batch 900, Loss 0.029485095292329788
Epoch 40, Batch 1000, Loss 0.010005602613091469
Epoch 40, Batch 1100, Loss 0.009246445260941982
Epoch 40, Batch 1200, Loss 0.002656296594068408
Epoch 40, Batch 1300, Loss 0.02469390444457531
Epoch 40, Batch 1400, Loss 0.04131625220179558
Epoch 40, Batch 1500, Loss 0.010904927738010883
Epoch 40, Batch 1600, Loss 0.02806035242974758
Epoch 40, Batch 1700, Loss 0.011936861090362072
Epoch 40, Batch 1800, Loss 0.002219732850790024
Epoch 41, Batch 0, Loss 0.020030410960316658
Epoch 41, Batch 0, Validation Loss 0.2151000677479132
Epoch 41, Batch 100, Loss 0.02035657875239849
Epoch 41, Batch 200, Loss 0.020746266469359398
Epoch 41, Batch 300, Loss 0.04799213632941246
Epoch 41, Batch 400, Loss 0.011125502176582813
Epoch 41, Batch 500, Loss 0.018331114202737808
Epoch 41, Batch 600, Loss 0.012210732325911522
Epoch 41, Batch 700, Loss 0.0050561134703457355
Epoch 41, Batch 800, Loss 0.018073316663503647
Epoch 41, Batch 900, Loss 0.02022239938378334
Epoch 41, Batch 1000, Loss 0.012112726457417011
Epoch 41, Batch 1100, Loss 0.007135792635381222
Epoch 41, Batch 1200, Loss 0.03733742609620094
Epoch 41, Batch 1300, Loss 0.04745831713080406
Epoch 41, Batch 1400, Loss 0.03829367831349373
Epoch 41, Batch 1500, Loss 0.020368823781609535
Epoch 41, Batch 1600, Loss 0.022236455231904984
Epoch 41, Batch 1700, Loss 0.02272457629442215
Epoch 41, Batch 1800, Loss 0.010846358723938465
Epoch 42, Batch 0, Loss 0.008309673517942429
Epoch 42, Batch 0, Validation Loss 0.22294877016292566
Epoch 42, Batch 100, Loss 0.01778329536318779
Epoch 42, Batch 200, Loss 0.039093244820833206
Epoch 42, Batch 300, Loss 0.005404260009527206
Epoch 42, Batch 400, Loss 0.0031859686132520437
Epoch 42, Batch 500, Loss 0.026301676407456398
Epoch 42, Batch 600, Loss 0.041803181171417236
Epoch 42, Batch 700, Loss 0.02488560415804386
Epoch 42, Batch 800, Loss 0.004194892942905426
Epoch 42, Batch 900, Loss 0.02569451555609703
Epoch 42, Batch 1000, Loss 0.02610929124057293
Epoch 42, Batch 1100, Loss 0.01463839691132307
Epoch 42, Batch 1200, Loss 0.028183121234178543
Epoch 42, Batch 1300, Loss 0.0201349388808012
Epoch 42, Batch 1400, Loss 0.008212345652282238
Epoch 42, Batch 1500, Loss 0.027702324092388153
Epoch 42, Batch 1600, Loss 0.02144547365605831
```

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Epoch 42, Batch 1700, Loss 0.022460628300905228
Epoch 42, Batch 1800, Loss 0.005238496232777834
Epoch 43, Batch 0, Loss 0.009879386983811855
Epoch 43, Batch 0, Validation Loss 0.23644515110686318
Epoch 43, Batch 100, Loss 0.00421792920678854
Epoch 43, Batch 200, Loss 0.0023862957023084164
Epoch 43, Batch 300, Loss 0.0031851311214268208
Epoch 43, Batch 400, Loss 0.01840435527265072
Epoch 43, Batch 500, Loss 0.03169188275933266
Epoch 43, Batch 600, Loss 0.0031649312004446983
Epoch 43, Batch 700, Loss 0.04572496563196182
Epoch 43, Batch 800, Loss 0.02471069060266018
Epoch 43, Batch 900, Loss 0.008848386816680431
Epoch 43, Batch 1000, Loss 0.01370218861848116
Epoch 43, Batch 1100, Loss 0.036556046456098557
Epoch 43, Batch 1200, Loss 0.023128440603613853
Epoch 43, Batch 1300, Loss 0.025090724229812622
Epoch 43, Batch 1400, Loss 0.08232662826776505
Epoch 43, Batch 1500, Loss 0.009486147202551365
Epoch 43, Batch 1600, Loss 0.01595039665699005
Epoch 43, Batch 1700, Loss 0.01621733233332634
Epoch 43, Batch 1800, Loss 0.0034627215936779976
Epoch 44, Batch 0, Loss 0.01245071366429329
Epoch 44, Batch 0, Validation Loss 0.22512916487719184
Epoch 44, Batch 100, Loss 0.006794607732445002
Epoch 44, Batch 200, Loss 0.012590298429131508
Epoch 44, Batch 300, Loss 0.005458304192870855
Epoch 44, Batch 400, Loss 0.020930763334035873
Epoch 44, Batch 500, Loss 0.019667495042085648
Epoch 44, Batch 600, Loss 0.0037080857437103987
Epoch 44, Batch 700, Loss 0.046513043344020844
Epoch 44, Batch 800, Loss 0.0023037875071167946
Epoch 44, Batch 900, Loss 0.019203919917345047
Epoch 44, Batch 1000, Loss 0.015336127020418644
Epoch 44, Batch 1100, Loss 0.007009715307503939
Epoch 44, Batch 1200, Loss 0.03142821416258812
Epoch 44, Batch 1300, Loss 0.017926152795553207
Epoch 44, Batch 1400, Loss 0.005407337099313736
Epoch 44, Batch 1500, Loss 0.031701985746622086
Epoch 44, Batch 1600, Loss 0.027504438534379005
Epoch 44, Batch 1700, Loss 0.007208304479718208
Epoch 44, Batch 1800, Loss 0.032364048063755035
Epoch 45, Batch 0, Loss 0.004071938339620829
Epoch 45, Batch 0, Validation Loss 0.2244538157030533
Epoch 45, Batch 100, Loss 0.00445753475651145
Epoch 45, Batch 200, Loss 0.0008771125576458871
Epoch 45, Batch 300, Loss 0.01119028590619564
Epoch 45, Batch 400, Loss 0.014727558009326458
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Epoch 45, Batch 500, Loss 0.021048787981271744
Epoch 45, Batch 600, Loss 0.019548995420336723
Epoch 45, Batch 700, Loss 0.059151869267225266
Epoch 45, Batch 800, Loss 0.007170002907514572
Epoch 45, Batch 900, Loss 0.01928052492439747
Epoch 45, Batch 1000, Loss 0.025201085954904556
Epoch 45, Batch 1100, Loss 0.007651932071894407
Epoch 45, Batch 1200, Loss 0.0457867793738842
Epoch 45, Batch 1300, Loss 0.01372334361076355
Epoch 45, Batch 1400, Loss 0.014320624060928822
Epoch 45, Batch 1500, Loss 0.04621375352144241
Epoch 45, Batch 1600, Loss 0.02030172199010849
Epoch 45, Batch 1700, Loss 0.010361701250076294
Epoch 45, Batch 1800, Loss 0.001801633508875966
Epoch 46, Batch 0, Loss 0.029311925172805786
Epoch 46, Batch 0, Validation Loss 0.22731977877510287
Epoch 46, Batch 100, Loss 0.007622121833264828
Epoch 46, Batch 200, Loss 0.004921257961541414
Epoch 46, Batch 300, Loss 0.017603883519768715
Epoch 46, Batch 400, Loss 0.023500224575400352
Epoch 46, Batch 500, Loss 0.0036390521563589573
Epoch 46, Batch 600, Loss 0.02162461169064045
Epoch 46, Batch 700, Loss 0.009351593442261219
Epoch 46, Batch 800, Loss 0.0037467379588633776
Epoch 46, Batch 900, Loss 0.005208058748394251
Epoch 46, Batch 1000, Loss 0.003975552041083574
Epoch 46, Batch 1100, Loss 0.010219247080385685
Epoch 46, Batch 1200, Loss 0.0055900984443724155
Epoch 46, Batch 1300, Loss 0.026305370032787323
Epoch 46, Batch 1400, Loss 0.0031137452460825443
Epoch 46, Batch 1500, Loss 0.0499301478266716
Epoch 46, Batch 1600, Loss 0.005335706286132336
Epoch 46, Batch 1700, Loss 0.005113305523991585
Epoch 46, Batch 1800, Loss 0.011909027583897114
Epoch 47, Batch 0, Loss 0.013606727123260498
Epoch 47, Batch 0, Validation Loss 0.23514153281929248
Epoch 47, Batch 100, Loss 0.009694558568298817
Epoch 47, Batch 200, Loss 0.0008799670031294227
Epoch 47, Batch 300, Loss 0.0045702457427978516
Epoch 47, Batch 400, Loss 0.011648732237517834
Epoch 47, Batch 500, Loss 0.014090859331190586
Epoch 47, Batch 600, Loss 0.005326614249497652
Epoch 47, Batch 700, Loss 0.0049874866381287575
Epoch 47, Batch 800, Loss 0.005757666192948818
Epoch 47, Batch 900, Loss 0.028723308816552162
Epoch 47, Batch 1000, Loss 0.010574491694569588
Epoch 47, Batch 1100, Loss 0.009217663668096066
Epoch 47, Batch 1200, Loss 0.011303622275590897
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Epoch 47, Batch 1300, Loss 0.01190020889043808
Epoch 47, Batch 1400, Loss 0.006005876697599888
Epoch 47, Batch 1500, Loss 0.054156314581632614
Epoch 47, Batch 1600, Loss 0.021413074806332588
Epoch 47, Batch 1700, Loss 0.007578665390610695
Epoch 47, Batch 1800, Loss 0.010973572731018066
Epoch 48, Batch 0, Loss 0.014238303527235985
Epoch 48, Batch 0, Validation Loss 0.2401193021447972
Epoch 48, Batch 100, Loss 0.000610014540143311
Epoch 48, Batch 200, Loss 0.0032523085828870535
Epoch 48, Batch 300, Loss 0.0021348586305975914
Epoch 48, Batch 400, Loss 0.015746187418699265
Epoch 48, Batch 500, Loss 0.0032548820599913597
Epoch 48, Batch 600, Loss 0.028263505548238754
Epoch 48, Batch 700, Loss 0.007368424441665411
Epoch 48, Batch 800, Loss 0.0027619535103440285
Epoch 48, Batch 900, Loss 0.005785462912172079
Epoch 48, Batch 1000, Loss 0.01696121133863926
Epoch 48, Batch 1100, Loss 0.0037246025167405605
Epoch 48, Batch 1200, Loss 0.006658997852355242
Epoch 48, Batch 1300, Loss 0.00108896114397794
Epoch 48, Batch 1400, Loss 0.03176086023449898
Epoch 48, Batch 1500, Loss 0.0015489544020965695
Epoch 48, Batch 1600, Loss 0.010621435940265656
Epoch 48, Batch 1700, Loss 0.024879368022084236
Epoch 48, Batch 1800, Loss 0.0026517354417592287
Epoch 49, Batch 0, Loss 0.008922647684812546
Epoch 49, Batch 0, Validation Loss 0.2216287234797767
Epoch 49, Batch 100, Loss 0.012714230455458164
Epoch 49, Batch 200, Loss 0.06724872440099716
Epoch 49, Batch 300, Loss 0.0019235273357480764
Epoch 49, Batch 400, Loss 0.00276759872213006
Epoch 49, Batch 500, Loss 0.011271637864410877
Epoch 49, Batch 600, Loss 0.008156250230967999
Epoch 49, Batch 700, Loss 0.011254837736487389
Epoch 49, Batch 800, Loss 0.022814592346549034
Epoch 49, Batch 900, Loss 0.012635491788387299
Epoch 49, Batch 1000, Loss 0.004061373881995678
Epoch 49, Batch 1100, Loss 0.0018113936530426145
Epoch 49, Batch 1200, Loss 0.0007626957958564162
Epoch 49, Batch 1300, Loss 0.01150959450751543
Epoch 49, Batch 1400, Loss 0.0006476319395005703
Epoch 49, Batch 1500, Loss 0.009181187488138676
Epoch 49, Batch 1600, Loss 0.004751368425786495
Epoch 49, Batch 1700, Loss 0.005318129435181618
Epoch 49, Batch 1800, Loss 0.026920044794678688
```

1 Model Saving and Loading

[61]:
```
torch.save(model.state_dict(), 'blstm1.pt')
```

[62]:
```
model2 = BLSTM(len(train_dataset.word2idx), EMBEDDING_DIM, HIDDEN_DIM,␣
↪OUTPUT_DIM, DROPOUT, OUTPUT_LABEL_DIM).to(device)
```

[63]:
```
model2.load_state_dict(torch.load('blstm1.pt'))
#model2.load_state_dict(torch.load('task_minloss.pt'))
```

[63]:
```
<All keys matched successfully>
```

2 Dev Prediction

[64]:
```
from sklearn.metrics import precision_recall_fscore_support

model2.eval()
predicted_labels = []
true_labels = []

with torch.no_grad():
    for x, lengths, y in dev_loader:
        x = x.to(device)
        y = y.to(device)
        target_packed_embedded = nn.utils.rnn.pack_padded_sequence(y, lengths,␣
↪batch_first=True, enforce_sorted=False)
        target, target_lengths = nn.utils.rnn.
↪pad_packed_sequence(target_packed_embedded, batch_first=True)

        output = model2(x, lengths)

        predicted = torch.argmax(output, dim=1)
        predicted_labels.extend(predicted.cpu().numpy().tolist())
        true_labels.extend(target.cpu().numpy().tolist())
```

[66]:
```
y_pred = [element for sub_list in predicted_labels for element in sub_list]
y_true=[element for sub_list in true_labels for element in sub_list]

list1 = y_true.copy()
list2 = y_pred.copy()
value_to_remove = train_loader.dataset.pad_idx
i = 0
while i < len(list1):
    if list1[i] == value_to_remove:
        # remove the element from list1
        list1.pop(i)
```

```python
        # remove the corresponding element from list2 by using its index
        list2.pop(i)
    else:
        # only increment the loop counter if an element wasn't removed
        i += 1

print(list1)
print(list2)
```

```
[1, 1, 0, 1, 1, 1, 1, 1, 1, 1, 1, 5, 1, 2, 7, 1, 3, 4, 1, 1, 1, 1, 1, 1, 1, 0,
1, 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,
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1, 1, 1, 1, 1, 0, 6, 1, 1]
```

[67]:
```python
precision, recall, f1_score, _ = precision_recall_fscore_support(list1, list2, average='weighted')
print(f'Precision: {precision:.4f}, Recall: {recall:.4f}, F1 score: {f1_score:.4f}')
```

```
Precision: 0.9598, Recall: 0.9607, F1 score: 0.9598
```

2.1 dev.out file for evaluating on PERL

[68]:
```
devOutput = open("dev.out", "w")
k=0
i=0
idx2label = {value: key for key, value in train_dataset.label2idx.items()}



with open('/content/dev', 'r') as f:
  for line in f:

    line = line.strip().split(' ')
    #print(line)
    if len(line)>1:
      idx,word,gold  = line[0], line[1],line[2]
      pred=predicted_labels[k][i]
      i=i+1
      key = idx2label[pred]
      devOutput.write(f"{idx} {word} {gold} {key}\n")
    else:
      devOutput.write(f"\n")
      k=k+1
      i=0
f.close()
devOutput.close()
```

[68]:
```
```

2.2 dev1.out file for submission (in same format as train)

[69]:
```
devOutput = open("dev1.out", "w")
k=0
i=0

with open('/content/dev', 'r') as f:
  for line in f:
    line = line.strip().split(' ')
    if len(line)>1:
      idx,word,gold  = line[0], line[1],line[2]
      pred=predicted_labels[k][i]
      i=i+1
      key = idx2label[pred]
      devOutput.write(f"{idx} {word} {key}\n")
    else:
      devOutput.write(f"\n")
      k=k+1
```

```
        i=0
f.close()
devOutput.close()
```

3 Test Predictions

[70]:
```
class TestNERDataset(Dataset):
    def __init__(self, filename,word2idx):
        self.data = []
        self.word2idx = word2idx
        self.max_sent_len = 0

        with open(filename, "r") as f:
            sentence = []
            for line in f:
                line = line.strip()
                if len(line) == 0:
                    if len(sentence) > self.max_sent_len:
                        self.max_sent_len = len(sentence)

                    self.data.append(sentence)
                    sentence = []
                else:
                    parts = line.split(" ")
                    word = parts[1]
                    if word not in self.word2idx:
                      if word[0].isupper():
                        word = '<unkcap>'
                      else:
                        word='<unk>'

                    sentence.append(self.word2idx[word])

        if len(sentence) > 0:
            if len(sentence) > self.max_sent_len:
                self.max_sent_len = len(sentence)

            self.data.append(sentence)


        self.pad_idx = self.word2idx['<PAD>']

        # Pad sentences
        self.x = [torch.tensor(s) for s in self.data]
        self.x = pad_sequence(self.x, batch_first=True,padding_value=self.
 ↪pad_idx)
```

```
        # Calculate lengths
        self.lengths = [len(s) for s in self.data]

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

    def __getitem__(self, index):
        return self.x[index], self.lengths[index]
```

[70]:

```

```

[71]:

```
test_dataset = TestNERDataset('test',train_dataset.word2idx)
test_loader = DataLoader(test_dataset)
```

[72]:

```
from sklearn.metrics import precision_recall_fscore_support

model2.eval()
predicted_labels = []
true_labels = []

with torch.no_grad():
    for x, lengths in test_loader:
        x = x.to(device)

        output = model2(x, lengths)

        predicted = torch.argmax(output, dim=1)
        predicted_labels.extend(predicted.cpu().numpy().tolist())
```

3.1 test1.out file for submission

[73]:

```
testOutput = open("test1.out", "w")
k=0
i=0

with open('/content/test', 'r') as f:
  for line in f:
    line = line.strip().split(' ')
    if len(line)>1:
      idx,word  = line[0], line[1]
      pred=predicted_labels[k][i]
      i=i+1
      key = idx2label[pred]
      testOutput.write(f"{idx} {word} {key}\n")
    else:
      testOutput.write(f"\n")
```

```
        k=k+1
        i=0
f.close()
testOutput.close()
```

[73]:

```
```