In [13]:
```
from google.colab import drive
drive.mount('/content/gdrive')
```

```
Drive already mounted at /content/gdrive; to attempt to forcibly remount, call drive.mount("/content/gdrive", force_remo
unt=True).
```

In [14]:
```
%cd /content/gdrive/My\ Drive/Colab\ Notebooks/Notebooks/Luodingo

import torch
import torch.optim as optim

import seq2seq_multilayer_gru
from sequence_model_trainer import TrainModel

from torchtext.data import Field, LabelField
from torchtext.data import TabularDataset
from torchtext.data import Iterator, BucketIterator

%load_ext autoreload
%autoreload 2
```

```
/content/gdrive/My Drive/Colab Notebooks/Notebooks/Luodingo
The autoreload extension is already loaded. To reload it, use:
  %reload_ext autoreload
```

In [0]:
```
MASKED_TEXT = Field(
                sequential=True,
                tokenize=lambda x: x.split(),
            )

TARGET_TEXT = Field(
                sequential=True,
                tokenize=lambda x: x.split(),
            )

# LABEL = LabelField(dtype=torch.long)

fields = [('id', None), ('keywords', MASKED_TEXT), ('target', TARGET_TEXT)]
```

In [16]:
```
%cd /content/gdrive/My\ Drive/Colab\ Notebooks/Datasets
train, val, test = TabularDataset.splits(
                            path='Masked Corpus',
                            train='train.csv',
                            validation='val.csv',
                            test='test.csv',
                            format='csv',
                            skip_header=True,
                            fields=fields
                    )
```

```
/content/gdrive/My Drive/Colab Notebooks/Datasets
```

In [0]:
```
MASKED_TEXT.build_vocab(train)
TARGET_TEXT.build_vocab(train)
# LABEL.build_vocab(train)
```

In [0]:
```
BATCH_SIZE = 32

device = torch.device('cuda' if torch.cuda.is_available() else 'cpu')

train_iter, val_iter, test_iter = BucketIterator.splits(
                            (train, val, test),
                            batch_size=BATCH_SIZE,
                            device=device,
                            sort_key=lambda x: len(x.keywords))
```

In [0]:
```
# EMB_DIM=bert.config.to_dict()['hidden_size']
EMB_DIM=256
ENC_INPUT_DIM=len(MASKED_TEXT.vocab)
DEC_INPUT_DIM=len(TARGET_TEXT.vocab)
OUTPUT_DIM=DEC_INPUT_DIM
N_LAYER=4
HID_DIM=1024
DROPOUT=0.3

model = seq2seq_multilayer_gru.Seq2Seq(
              enc_input_dim=ENC_INPUT_DIM,
              dec_input_dim=DEC_INPUT_DIM,
              emb_dim=EMB_DIM,
              enc_hid_dim=HID_DIM,
              dec_hid_dim=HID_DIM,
              n_layers=N_LAYER,
              output_dim=OUTPUT_DIM,
              device=device,
              dropout=DROPOUT
         ).to(device)
```

In [0]:
```
LEARNING_RATE = 0.0001

adam = torch.optim.Adam(model.parameters(), lr=LEARNING_RATE)
cross_e = torch.nn.CrossEntropyLoss()
```

In [0]:
```
trainer = TrainModel(
            model=model,
            train_iterator=train_iter,
            val_iterator=val_iter,
            optimizer=adam,
            criterion=cross_e,
            output_dim=OUTPUT_DIM
          )
```

In [0]:
```
N_EPOCHS = 200
CLIP = 1
trainer.epoch(n_epochs=N_EPOCHS, clip=CLIP, model_name='seq2seq-multilayer-gru.pt')
```

```
Epoch: 01 | Time: 0m 51s
        Train Loss: 3.570 | Train PPL:  35.501
         Val. Loss: 5.155 |  Val. PPL: 173.218
Epoch: 02 | Time: 0m 51s
        Train Loss: 3.024 | Train PPL:  20.564
         Val. Loss: 5.115 |  Val. PPL: 166.445
Epoch: 03 | Time: 0m 51s
        Train Loss: 2.951 | Train PPL:  19.126
         Val. Loss: 5.139 |  Val. PPL: 170.565
Epoch: 04 | Time: 0m 51s
        Train Loss: 2.892 | Train PPL:  18.024
         Val. Loss: 5.233 |  Val. PPL: 187.324
Epoch: 05 | Time: 0m 51s
        Train Loss: 2.821 | Train PPL:  16.801
         Val. Loss: 5.093 |  Val. PPL: 162.935
Epoch: 06 | Time: 0m 51s
        Train Loss: 2.740 | Train PPL:  15.490
         Val. Loss: 4.900 |  Val. PPL: 134.298
Epoch: 07 | Time: 0m 51s
        Train Loss: 2.694 | Train PPL:  14.797
         Val. Loss: 4.945 |  Val. PPL: 140.430
Epoch: 08 | Time: 0m 51s
        Train Loss: 2.714 | Train PPL:  15.091
         Val. Loss: 4.972 |  Val. PPL: 144.382
Epoch: 09 | Time: 0m 51s
        Train Loss: 2.646 | Train PPL:  14.092
         Val. Loss: 4.867 |  Val. PPL: 129.919
Epoch: 10 | Time: 0m 51s
        Train Loss: 2.534 | Train PPL:  12.601
         Val. Loss: 4.685 |  Val. PPL: 108.356
Epoch: 11 | Time: 0m 51s
        Train Loss: 2.411 | Train PPL:  11.142
         Val. Loss: 4.754 |  Val. PPL: 116.044
Epoch: 12 | Time: 0m 51s
        Train Loss: 2.337 | Train PPL:  10.352
         Val. Loss: 4.677 |  Val. PPL: 107.442
Epoch: 13 | Time: 0m 51s
        Train Loss: 2.292 | Train PPL:   9.896
         Val. Loss: 4.454 |  Val. PPL:  85.932
Epoch: 14 | Time: 0m 51s
        Train Loss: 2.219 | Train PPL:   9.197
         Val. Loss: 4.563 |  Val. PPL:  95.904
Epoch: 15 | Time: 0m 51s
        Train Loss: 2.149 | Train PPL:   8.572
         Val. Loss: 4.210 |  Val. PPL:  67.335
Epoch: 16 | Time: 0m 51s
        Train Loss: 2.084 | Train PPL:   8.036
         Val. Loss: 4.283 |  Val. PPL:  72.488
Epoch: 17 | Time: 0m 51s
        Train Loss: 2.009 | Train PPL:   7.457
         Val. Loss: 4.084 |  Val. PPL:  59.386
Epoch: 18 | Time: 0m 51s
        Train Loss: 1.939 | Train PPL:   6.949
         Val. Loss: 3.955 |  Val. PPL:  52.179
Epoch: 19 | Time: 0m 51s
        Train Loss: 1.852 | Train PPL:   6.376
         Val. Loss: 3.932 |  Val. PPL:  51.030
Epoch: 20 | Time: 0m 51s
        Train Loss: 1.810 | Train PPL:   6.108
         Val. Loss: 3.806 |  Val. PPL:  44.981
Epoch: 21 | Time: 0m 51s
        Train Loss: 1.746 | Train PPL:   5.732
         Val. Loss: 3.685 |  Val. PPL:  39.843
Epoch: 22 | Time: 0m 51s
        Train Loss: 1.675 | Train PPL:   5.338
         Val. Loss: 3.451 |  Val. PPL:  31.532
Epoch: 23 | Time: 0m 51s
        Train Loss: 1.609 | Train PPL:   5.000
         Val. Loss: 3.392 |  Val. PPL:  29.721
Epoch: 24 | Time: 0m 51s
        Train Loss: 1.574 | Train PPL:   4.824
         Val. Loss: 3.287 |  Val. PPL:  26.774
Epoch: 25 | Time: 0m 51s
        Train Loss: 1.515 | Train PPL:   4.549
         Val. Loss: 3.236 |  Val. PPL:  25.425
Epoch: 26 | Time: 0m 51s
        Train Loss: 1.465 | Train PPL:   4.328
```

```
         Val. Loss: 3.191 |  Val. PPL:  24.320
Epoch: 27 | Time: 0m 51s
        Train Loss: 1.427 | Train PPL:   4.166
         Val. Loss: 3.188 |  Val. PPL:  24.247
Epoch: 28 | Time: 0m 51s
        Train Loss: 1.394 | Train PPL:   4.032
         Val. Loss: 3.037 |  Val. PPL:  20.853
Epoch: 29 | Time: 0m 52s
        Train Loss: 1.354 | Train PPL:   3.874
         Val. Loss: 2.909 |  Val. PPL:  18.337
Epoch: 30 | Time: 0m 51s
        Train Loss: 1.310 | Train PPL:   3.705
         Val. Loss: 3.124 |  Val. PPL:  22.730
Epoch: 31 | Time: 0m 50s
        Train Loss: 1.294 | Train PPL:   3.647
         Val. Loss: 2.930 |  Val. PPL:  18.725
Epoch: 32 | Time: 0m 50s
        Train Loss: 1.249 | Train PPL:   3.488
         Val. Loss: 2.871 |  Val. PPL:  17.653
Epoch: 33 | Time: 0m 50s
        Train Loss: 1.215 | Train PPL:   3.372
         Val. Loss: 2.718 |  Val. PPL:  15.157
Epoch: 34 | Time: 0m 51s
        Train Loss: 1.176 | Train PPL:   3.241
         Val. Loss: 2.758 |  Val. PPL:  15.765
Epoch: 35 | Time: 0m 51s
        Train Loss: 1.148 | Train PPL:   3.151
         Val. Loss: 2.918 |  Val. PPL:  18.510
Epoch: 36 | Time: 0m 51s
        Train Loss: 1.116 | Train PPL:   3.053
         Val. Loss: 2.692 |  Val. PPL:  14.763
Epoch: 37 | Time: 0m 51s
        Train Loss: 1.083 | Train PPL:   2.954
         Val. Loss: 2.778 |  Val. PPL:  16.081
Epoch: 38 | Time: 0m 51s
        Train Loss: 1.046 | Train PPL:   2.848
         Val. Loss: 2.640 |  Val. PPL:  14.015
Epoch: 39 | Time: 0m 51s
        Train Loss: 1.027 | Train PPL:   2.793
         Val. Loss: 2.574 |  Val. PPL:  13.124
Epoch: 40 | Time: 0m 51s
        Train Loss: 1.006 | Train PPL:   2.735
         Val. Loss: 2.615 |  Val. PPL:  13.669
Epoch: 41 | Time: 0m 50s
        Train Loss: 0.974 | Train PPL:   2.648
         Val. Loss: 2.715 |  Val. PPL:  15.099
Epoch: 42 | Time: 0m 50s
        Train Loss: 0.949 | Train PPL:   2.583
         Val. Loss: 2.490 |  Val. PPL:  12.058
Epoch: 43 | Time: 0m 51s
        Train Loss: 0.914 | Train PPL:   2.494
         Val. Loss: 2.478 |  Val. PPL:  11.918
Epoch: 44 | Time: 0m 51s
        Train Loss: 0.891 | Train PPL:   2.436
         Val. Loss: 2.383 |  Val. PPL:  10.836
Epoch: 45 | Time: 0m 51s
        Train Loss: 0.857 | Train PPL:   2.356
         Val. Loss: 2.496 |  Val. PPL:  12.130
Epoch: 46 | Time: 0m 51s
        Train Loss: 0.853 | Train PPL:   2.347
         Val. Loss: 2.511 |  Val. PPL:  12.312
Epoch: 47 | Time: 0m 50s
        Train Loss: 0.839 | Train PPL:   2.314
         Val. Loss: 2.646 |  Val. PPL:  14.094
Epoch: 48 | Time: 0m 51s
        Train Loss: 0.796 | Train PPL:   2.218
         Val. Loss: 2.451 |  Val. PPL:  11.601
Epoch: 49 | Time: 0m 51s
        Train Loss: 0.786 | Train PPL:   2.195
         Val. Loss: 2.407 |  Val. PPL:  11.100
Epoch: 50 | Time: 0m 51s
        Train Loss: 0.750 | Train PPL:   2.116
         Val. Loss: 2.439 |  Val. PPL:  11.466
Epoch: 51 | Time: 0m 51s
        Train Loss: 0.735 | Train PPL:   2.085
         Val. Loss: 2.443 |  Val. PPL:  11.502
Epoch: 52 | Time: 0m 51s
        Train Loss: 0.703 | Train PPL:   2.019
         Val. Loss: 2.514 |  Val. PPL:  12.352
Epoch: 53 | Time: 0m 50s
        Train Loss: 0.682 | Train PPL:   1.978
         Val. Loss: 2.308 |  Val. PPL:  10.058
```

```
Epoch: 54 | Time: 0m 51s
        Train Loss: 0.661 | Train PPL:   1.937
         Val. Loss: 2.243 |  Val. PPL:   9.421
Epoch: 55 | Time: 0m 50s
        Train Loss: 0.637 | Train PPL:   1.891
         Val. Loss: 2.267 |  Val. PPL:   9.655
Epoch: 56 | Time: 0m 51s
        Train Loss: 0.618 | Train PPL:   1.856
         Val. Loss: 2.298 |  Val. PPL:   9.952
Epoch: 57 | Time: 0m 51s
        Train Loss: 0.592 | Train PPL:   1.807
         Val. Loss: 2.264 |  Val. PPL:   9.621
Epoch: 58 | Time: 0m 51s
        Train Loss: 0.571 | Train PPL:   1.769
         Val. Loss: 2.258 |  Val. PPL:   9.564
Epoch: 59 | Time: 0m 51s
        Train Loss: 0.559 | Train PPL:   1.750
         Val. Loss: 2.243 |  Val. PPL:   9.426
Epoch: 60 | Time: 0m 51s
        Train Loss: 0.545 | Train PPL:   1.725
         Val. Loss: 2.116 |  Val. PPL:   8.295
Epoch: 61 | Time: 0m 51s
        Train Loss: 0.522 | Train PPL:   1.685
         Val. Loss: 2.161 |  Val. PPL:   8.681
Epoch: 62 | Time: 0m 51s
        Train Loss: 0.495 | Train PPL:   1.640
         Val. Loss: 2.145 |  Val. PPL:   8.541
Epoch: 63 | Time: 0m 51s
        Train Loss: 0.480 | Train PPL:   1.616
         Val. Loss: 2.094 |  Val. PPL:   8.115
Epoch: 64 | Time: 0m 51s
        Train Loss: 0.455 | Train PPL:   1.577
         Val. Loss: 2.115 |  Val. PPL:   8.286
Epoch: 65 | Time: 0m 51s
        Train Loss: 0.441 | Train PPL:   1.555
         Val. Loss: 2.120 |  Val. PPL:   8.331
Epoch: 66 | Time: 0m 51s
        Train Loss: 0.421 | Train PPL:   1.523
         Val. Loss: 2.104 |  Val. PPL:   8.201
Epoch: 67 | Time: 0m 51s
        Train Loss: 0.403 | Train PPL:   1.497
         Val. Loss: 2.040 |  Val. PPL:   7.691
```

In [0]: