

```
In [ ]: #!pip install pytorch-ignite
```

```
In [ ]: #import torch
#torch.cuda.is_available()
```

```
In [1]: %load_ext autoreload
%autoreload 2
import sys
import pandas as pd
import numpy as np
from pathlib import Path

from torch import optim
import torch.nn as nn
import torch.nn.functional as F
import torch.utils.data
import torch.utils.data
from torch.utils.data.dataset import Dataset
from torch.utils.data.sampler import SubsetRandomSampler

from ignite.engine import Events, Engine
from ignite.metrics import Accuracy, Loss, RunningAverage
from ignite.contrib.handlers.tensorboard_logger import *
from ignite.handlers import Checkpoint, DiskSaver
from ignite.metrics.metric import reinit_is_reduced

output_dir = Path(f'CERT_OUTPUT')
answers_dir = Path(f"answers")
main_answers_file = answers_dir / "insiders.csv"
log_dir = output_dir / 'logs'
checkpoint_dir = output_dir / 'checkpoints'
processed_data = "./merged.pkl"
dataset_version='5.2'

assert(output_dir.is_dir())
assert(answers_dir.is_dir())
```

```
In [27]: 2**11
```

```
Out[27]: 2048
```

Model Architecture

```
In [51]: nn.Embedding?
```

In [66]:

```
class LSTM_Encoder(nn.Module):
    def __init__(self, padding_idx=None):
        super(LSTM_Encoder, self).__init__()

        self.input_size = 2048 #64 updated

        self.embedding = nn.Embedding(1127, 40, padding_idx = padding_idx)
        lstm_input_size = 40

        self.one_hot_encoder = F.one_hot

        self.lstm_encoder = nn.LSTM(
            lstm_input_size,
            40,
            num_layers=3,
            dropout=0.5,
            batch_first=True)
        self.dropout = nn.Dropout(0.5)
        self.decoder = nn.Linear(40,1127) # (40,60) to (40,1127)
        self.log_softmax = nn.LogSoftmax(dim=2)

    def forward(self, sequence):
        if self.embedding:
            x = self.embedding(sequence)
        else:
            x = self.one_hot_encoder(sequence,
                                      num_classes=self.input_size).float()
        x, _ = self.lstm_encoder(x)

        if self.training:
            x = self.dropout(x)
            x = self.decoder(x)
            x = self.log_softmax(x)
        return x
    else:
        return x

class CNN_Classifier(nn.Module):
    def __init__(self):
        super(CNN_Classifier, self).__init__()

        self.seq_length = 200
        self.lstm_hidden_size = 40

        self.conv1 = nn.Conv2d(1,32,kernel_size=5,padding=2) #####
        self.maxpool1 = nn.MaxPool2d(2, stride=2)
        self.conv2 = nn.Conv2d(32,64,kernel_size=5,padding=2)
        self.maxpool2 = nn.MaxPool2d(2, stride=2)

        self.flatten = lambda x: x.view(x.size(0),-1)
        self.linear = nn.Linear(64 * 200 * 40 // 16,2)
        self.softmax = nn.LogSoftmax(dim=1)

    def forward(self, x):
        assert(x.shape[2] == self.seq_length)
        assert(x.shape[3] == self.lstm_hidden_size)
        x = self.conv1(x)
```

```
class InsiderClassifier(nn.Module):
    def __init__(self, lstm_checkpoint):
        super(InsiderClassifier, self).__init__()
        self.lstm_encoder = LSTM_Encoder()
        self.lstm_encoder.requires_grad = False
        self.lstm_encoder.eval()
        self.load_encoder(lstm_checkpoint)

        self.sigmoid = nn.Sigmoid()
        self.cnn_classifier = CNN_Classifier()

    def train(self, mode=True):
        self.training = mode
        self.sigmoid.train(mode)
        self.cnn_classifier.train(mode)
        return self

    def load_encoder(self, checkpoint, device='cpu'): #cuda to cpu
        self.lstm_encoder.load_state_dict(
            torch.load(
                checkpoint,
                map_location=torch.device(device)),
            strict=True
        )
        return self

    def forward(self, x):
        with torch.no_grad():
            hidden_state = self.lstm_encoder(x)
            hidden_state = self.sigmoid(hidden_state)
        scores = self.cnn_classifier(hidden_state[:,None])

        return scores
```

In [68]: `#df = pd.read_pickle('merged.pkl')`

In [69]: `df.shape`

Out[69]: (692625, 4)

Dataset Preparation

```
In [71]: class CertDataset(Dataset):
    @staticmethod
    def prepare_dataset(pkl_file, answers_csv, min_length=50, max_length=1000):
        df = pd.read_pickle(pkl_file)
        df = df.reset_index().dropna()

        main_df = pd.read_csv(answers_csv)
        main_df = main_df[main_df['dataset'].astype(str) == str(dataset)]
        main_df = main_df.drop(['dataset', 'details'], axis=1)

        main_df['start'] = pd.to_datetime(main_df['start'], format='%m/%d/%Y %H:%M')
        main_df['end'] = pd.to_datetime(main_df['end'], format='%m/%d/%Y %H:%M')

        df = df.merge(main_df, left_on='user', right_on='user', how='left')
        df['malicious'] = (df.day >= df.start) & (df.day <= df.end)
        df = df.drop(['start', 'end', 'day', 'user'], axis=1)

        df['action_length'] = df.action_id.apply(len)

        df = df[df.action_length < min_length]

        df['action_id'] = df.action_id.apply(lambda x: x[:max_length])
        df['action_id'] = df.action_id.apply(lambda x: x + [0] * (max_length - len(x)))

        x = np.vstack(df.action_id.values)
        y = df.malicious.values

        return x, y

    def __init__(self, x, y, transform=None):
        self.x = x
        self.y = y.astype(int)
        self.transform = transform

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

    def __getitem__(self, idx):

        if torch.is_tensor(idx):
            idx = idx.tolist()

        sample = {'x': self.x[idx], 'y': self.y[idx]}

        if self.transform:
            sample = self.transform(sample)

        return sample

    def get_dataset(data, ans):
        x, y = CertDataset.prepare_dataset(data, ans)
        return CertDataset(x, y)

    def get_data_loaders(dataset, shuffle_dataset=True, validation_split=0.3, batch_size=32):
        dataset_size = len(dataset)
        indices = list(range(dataset_size))
        split = int(np.floor(validation_split * dataset_size))
```

```
train_loader = torch.utils.data.DataLoader(dataset, batch_size=batch_size)

validation_loader = torch.utils.data.DataLoader(dataset, batch_size=batch_size)

return train_loader, validation_loader
```

```
In [72]: class Gen_accuracy(Accuracy):
    def __init__(self, ignored_class, *args, **kwargs):
        self.ignored_class = ignored_class
        super(Accuracy, self).__init__(*args, **kwargs)

    @reinit_is_reduced
    def update(self, output):
        y_pred, y = output

        indices = torch.argmax(y_pred, dim=1)

        mask = (y != self.ignored_class)
        mask &= (indices != self.ignored_class)
        y = y[mask]
        indices = indices[mask]
        correct = torch.eq(indices, y).view(-1)

        self._num_correct += torch.sum(correct).item()
        self._num_examples += correct.shape[0]

    def prepare_batch(batch, device='cpu', train=True, non_blocking='non_blocking'):
        x = batch['x']
        x = x.to(device).to(torch.int64)
        if train:
            y = x[:, 1:]
            x = x[:, :-1]
            return x, y
        else:
            return x, batch['y']

    def get_lstm_train_engine(model, optimizer, criterion, prepare_batch,
                            device=None,
                            log_dir=log_dir,
                            checkpoint_dir=checkpoint_dir,
                            checkpoint=None,
                            tensorboard_every=10,
                            ) -> Engine:

        def _update(engine, batch):
            model.train()
            optimizer.zero_grad()
```

```
        return {'loss': loss.item(), 'y_pred': scores, 'y': y}

    model.to(device)
    engine= Engine(_update)
    if(engine):
        print('engine created!')
        RunningAverage(output_transform=lambda x: x['loss']).attach(engine, 'loss')
        Accuracy().attach(engine, 'accuracy')
        print(engine.state.metrics)
        Gen_accuracy(ignored_class=0).attach(engine, 'gen_accuracy')
        print(engine.state.metrics)

    tb_logger = TensorboardLogger(log_dir = log_dir+'/train')
    #tb_logger = TensorboardLogger(log_dir = log_dir + '/train')
    tb_logger.attach(
        engine,
        log_handler=OutputHandler(
            tag="train",
            output_transform=lambda x: {"batch_loss": x['loss']},
            metric_names=['average_loss']),
        event_name=Events.ITERATION_COMPLETED(every=1))
    tb_logger.attach(
        engine,
        log_handler=OutputHandler(
            tag="train",
            output_transform=lambda x: {"epoch_loss": x['loss']},
            metric_names=['gen_accuracy', 'accuracy'],
            global_step_transform=global_step_from_engine(engine)),
        event_name=Events.EPOCH_COMPLETED,
    )

    tb_logger.attach(
        engine,
        log_handler=GradsScalarHandler(model, reduction=torch.norm, tag="grads"),
        event_name=Events.ITERATION_COMPLETED(every=tensorboard_every))
    tb_logger.attach(
        engine,
        log_handler=GradsHistHandler(model, tag="grads"),
        event_name=Events.ITERATION_COMPLETED(every=tensorboard_every))

    to_save = {'model': model, 'optimizer': optimizer, 'engine': engine}
    checkpoint_handler = Checkpoint(to_save, DiskSaver(checkpoint_dir, create_dir=True),
    final_checkpoint_handler = Checkpoint(
        {'model': model},
        DiskSaver(checkpoint_dir, create_dir=True),
        n_saved=None,
        filename_prefix='final_'
    )

    if checkpoint:
```

```
def get_torch_validation_engine(\n    model: torch.nn.Module,\n    prepare_batch,\n    criterion,\n    device = None,\n    non_blocking: bool = False,\n    log_dir=log_dir,\n    checkpoint_dir=checkpoint_dir,\n) -> Engine:\n\n    if device:\n        model.to(device)\n\n    def _inference(engine, batch):\n        model.train()\n        with torch.no_grad():\n            x, y = prepare_batch(batch, device=device, non_blocking)\n            scores = model(x).transpose(1,2)\n            return (scores, y)\n\n    engine = Engine(_inference) #engine to engine_t new\n    Loss(criterion, output_transform=lambda x: x).attach(engine, 'epoch loss')\n    #metric1 = Accuracy() #new\n    #metric1.attach(engine, 'accuracy')\n    Accuracy().attach(engine, 'accuracy')\n    Gen_accuracy(ignored_class=0).attach(engine, 'gen_accuracy')\n    tb_logger = TensorboardLogger(log_dir = log_dir + '/validation')\n    #tb_logger = TensorboardLogger(log_dir = log_dir + '/validation')\n    tb_logger.attach(engine, log_handler=OutputHandler(\n        tag="validation",\n        metric_names="all",\n        global_step_transform=lambda x, y : engine.train_epoch)\n        event_name=Events.EPOCH_COMPLETED)\n    to_save = {'model': model}\n    best_checkpoint_handler = Checkpoint(\n        to_save,\n        DiskSaver(checkpoint_dir, create_dir=True),\n        n_saved=1, filename_prefix='best',\n        score_function=lambda x: engine.state.metrics['gen_accuracy'],\n        score_name="gen_accuracy",\n        global_step_transform=lambda x, y : engine.train_epoch)\n    engine.add_event_handler(Events.COMPLETED, best_checkpoint_handler)\n\n    @engine.on(Events.COMPLETED)\n    def log_validation_results(engine):\n        pass
```

In [73]:

```
train_loader, val_loader = get_data_loaders(get_dataset(processed_data, main_answers_file),\n                                            device = 'cpu')
```

In [74]:

```
#data=get_dataset(processed_data, main_answers_file)
```

```
In [75]: type(data)
```

```
Out[75]: __main__.CertDataset
```

```
In [76]: len(data)
```

```
Out[76]: 225247
```

```
In [77]: s= str(data[8])
```

```
In [78]: len(s)
```

```
Out[78]: 1127
```

```
In [79]: len(train_loader.dataset)
```

```
Out[79]: 225247
```

```
In [80]:  
lstm_encoder = LSTM_Encoder()  
criterion = nn.NLLLoss()  
optimizer = optim.Adam(lstm_encoder.parameters())  
  
train_engine = get_lstm_train_engine(lstm_encoder, optimizer, criterion, device=device,  
                                     prepare_batch=prepare_batch)  
  
val_engine = get_lstm_validation_engine(lstm_encoder, device=device,  
                                         prepare_batch=prepare_batch,  
                                         criterion=criterion)  
  
@train_engine.on(Events.STARTED)  
def log_training_results():  
    print('Initial validation run: ')  
    val_engine.train_epoch = 0  
    val_engine.run(val_loader)  
  
@train_engine.on(Events.EPOCH_COMPLETED)  
def log_training_results():  
    print('Validation run: ')  
    val_engine.train_epoch = train_engine.state.epoch  
    val_engine.run(val_loader)
```

```
engine created!  
{ }  
{ }
```

```
In [ ]: train_engine.run(train_loader, max_epochs=500)
```

```
Initial validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427
```

```
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.295344, Accuracy: 0.908784, Non-Pad-Accuracy: 0.67
8974
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.216102, Accuracy: 0.945516, Non-Pad-Accuracy: 0.67
8547
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.195067, Accuracy: 0.950141, Non-Pad-Accuracy: 0.67
8473
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.187008, Accuracy: 0.950992, Non-Pad-Accuracy: 0.67
8432
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.183403, Accuracy: 0.951166, Non-Pad-Accuracy: 0.67
8428
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.181106, Accuracy: 0.951265, Non-Pad-Accuracy: 0.67
8419
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.179392, Accuracy: 0.951341, Non-Pad-Accuracy: 0.67
8404
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.177966, Accuracy: 0.951389, Non-Pad-Accuracy: 0.67
8406
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.176570, Accuracy: 0.951424, Non-Pad-Accuracy: 0.67
8499
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.175576, Accuracy: 0.951412, Non-Pad-Accuracy: 0.67
```

```
8499
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.174878, Accuracy: 0.951485, Non-Pad-Accuracy: 0.67
8629
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.173831, Accuracy: 0.951527, Non-Pad-Accuracy: 0.67
8541
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.173234, Accuracy: 0.951653, Non-Pad-Accuracy: 0.67
8602
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.172506, Accuracy: 0.951800, Non-Pad-Accuracy: 0.67
8580
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.171775, Accuracy: 0.951930, Non-Pad-Accuracy: 0.67
8579
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.170698, Accuracy: 0.952075, Non-Pad-Accuracy: 0.67
8637
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.169781, Accuracy: 0.952218, Non-Pad-Accuracy: 0.67
8608
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.169268, Accuracy: 0.952331, Non-Pad-Accuracy: 0.67
8601
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.167112, Accuracy: 0.952367, Non-Pad-Accuracy: 0.67
8655
Validation run:
```

```
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.166147, Accuracy: 0.952390, Non-Pad-Accuracy: 0.67  
8684  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.165000, Accuracy: 0.952413, Non-Pad-Accuracy: 0.67  
8640  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.162732, Accuracy: 0.952402, Non-Pad-Accuracy: 0.67  
8577  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.160847, Accuracy: 0.952443, Non-Pad-Accuracy: 0.67  
8560  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.160458, Accuracy: 0.952483, Non-Pad-Accuracy: 0.67  
8505  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.159550, Accuracy: 0.952520, Non-Pad-Accuracy: 0.67  
8467  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.158180, Accuracy: 0.952546, Non-Pad-Accuracy: 0.67  
8497  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.157994, Accuracy: 0.952575, Non-Pad-Accuracy: 0.67  
8551  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.156814, Accuracy: 0.952594, Non-Pad-Accuracy: 0.67  
8489  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415
```

```
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.156499, Accuracy: 0.952600, Non-Pad-Accuracy: 0.67
8491
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.156329, Accuracy: 0.952596, Non-Pad-Accuracy: 0.67
8466
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.156052, Accuracy: 0.952595, Non-Pad-Accuracy: 0.67
8453
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.155629, Accuracy: 0.952610, Non-Pad-Accuracy: 0.67
8478
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.155402, Accuracy: 0.952616, Non-Pad-Accuracy: 0.67
8555
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.154758, Accuracy: 0.952621, Non-Pad-Accuracy: 0.67
8564
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.154290, Accuracy: 0.952634, Non-Pad-Accuracy: 0.67
8628
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.154460, Accuracy: 0.952641, Non-Pad-Accuracy: 0.67
8702
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.154920, Accuracy: 0.952658, Non-Pad-Accuracy: 0.67
8801
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
```

```
Epoch results - Avg loss: 0.154126, Accuracy: 0.952682, Non-Pad-Accuracy: 0.67  
8914  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.154145, Accuracy: 0.952661, Non-Pad-Accuracy: 0.67  
8814  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.154011, Accuracy: 0.952680, Non-Pad-Accuracy: 0.67  
8921  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.153522, Accuracy: 0.952695, Non-Pad-Accuracy: 0.67  
8969  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.153634, Accuracy: 0.952712, Non-Pad-Accuracy: 0.67  
9090  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.153285, Accuracy: 0.952708, Non-Pad-Accuracy: 0.67  
9051  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.153193, Accuracy: 0.952713, Non-Pad-Accuracy: 0.67  
9106  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.153089, Accuracy: 0.952739, Non-Pad-Accuracy: 0.67  
9232  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.153046, Accuracy: 0.952726, Non-Pad-Accuracy: 0.67  
9199  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.153182, Accuracy: 0.952748, Non-Pad-Accuracy: 0.67  
9287
```

```
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.152692, Accuracy: 0.952749, Non-Pad-Accuracy: 0.67  
9304  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.152840, Accuracy: 0.952761, Non-Pad-Accuracy: 0.67  
9360  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.152594, Accuracy: 0.952769, Non-Pad-Accuracy: 0.67  
9367  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.152634, Accuracy: 0.952777, Non-Pad-Accuracy: 0.67  
9429  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.152372, Accuracy: 0.952781, Non-Pad-Accuracy: 0.67  
9449  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.152605, Accuracy: 0.952790, Non-Pad-Accuracy: 0.67  
9540  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.152295, Accuracy: 0.952784, Non-Pad-Accuracy: 0.67  
9523  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.152192, Accuracy: 0.952792, Non-Pad-Accuracy: 0.67  
9541  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.152379, Accuracy: 0.952798, Non-Pad-Accuracy: 0.67  
9573  
Validation run:  
Validation Results -
```

```
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.152059, Accuracy: 0.952793, Non-Pad-Accuracy: 0.67
9579
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.152327, Accuracy: 0.952813, Non-Pad-Accuracy: 0.67
9668
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.152132, Accuracy: 0.952817, Non-Pad-Accuracy: 0.67
9673
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.152357, Accuracy: 0.952809, Non-Pad-Accuracy: 0.67
9598
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151505, Accuracy: 0.952819, Non-Pad-Accuracy: 0.67
9646
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151714, Accuracy: 0.952819, Non-Pad-Accuracy: 0.67
9637
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151836, Accuracy: 0.952828, Non-Pad-Accuracy: 0.67
9642
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151351, Accuracy: 0.952819, Non-Pad-Accuracy: 0.67
9624
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151925, Accuracy: 0.952828, Non-Pad-Accuracy: 0.67
9651
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
```

```
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151599, Accuracy: 0.952816, Non-Pad-Accuracy: 0.67
9601
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151649, Accuracy: 0.952806, Non-Pad-Accuracy: 0.67
9542
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151554, Accuracy: 0.952805, Non-Pad-Accuracy: 0.67
9607
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151498, Accuracy: 0.952811, Non-Pad-Accuracy: 0.67
9564
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151385, Accuracy: 0.952822, Non-Pad-Accuracy: 0.67
9669
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151255, Accuracy: 0.952811, Non-Pad-Accuracy: 0.67
9582
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151057, Accuracy: 0.952829, Non-Pad-Accuracy: 0.67
9694
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151017, Accuracy: 0.952822, Non-Pad-Accuracy: 0.67
9687
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150972, Accuracy: 0.952833, Non-Pad-Accuracy: 0.67
9690
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151086, Accuracy: 0.952838, Non-Pad-Accuracy: 0.67
```

```
9756
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150852, Accuracy: 0.952847, Non-Pad-Accuracy: 0.67
9793
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.151199, Accuracy: 0.952844, Non-Pad-Accuracy: 0.67
9742
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150662, Accuracy: 0.952845, Non-Pad-Accuracy: 0.67
9752
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150857, Accuracy: 0.952871, Non-Pad-Accuracy: 0.67
9881
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150446, Accuracy: 0.952869, Non-Pad-Accuracy: 0.67
9866
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150906, Accuracy: 0.952864, Non-Pad-Accuracy: 0.67
9842
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150581, Accuracy: 0.952870, Non-Pad-Accuracy: 0.67
9873
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150315, Accuracy: 0.952875, Non-Pad-Accuracy: 0.67
9900
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150648, Accuracy: 0.952869, Non-Pad-Accuracy: 0.67
9888
Validation run:
```

```
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.150675, Accuracy: 0.952865, Non-Pad-Accuracy: 0.67  
9839  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.150928, Accuracy: 0.952878, Non-Pad-Accuracy: 0.67  
9897  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.150637, Accuracy: 0.952879, Non-Pad-Accuracy: 0.67  
9927  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.150267, Accuracy: 0.952880, Non-Pad-Accuracy: 0.67  
9922  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.150552, Accuracy: 0.952878, Non-Pad-Accuracy: 0.67  
9922  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.150314, Accuracy: 0.952870, Non-Pad-Accuracy: 0.67  
9844  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.150330, Accuracy: 0.952880, Non-Pad-Accuracy: 0.67  
9967  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.150261, Accuracy: 0.952884, Non-Pad-Accuracy: 0.67  
9954  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.150330, Accuracy: 0.952874, Non-Pad-Accuracy: 0.67  
9935  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415
```

```
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150486, Accuracy: 0.952876, Non-Pad-Accuracy: 0.67
9886
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150178, Accuracy: 0.952891, Non-Pad-Accuracy: 0.67
9971
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150484, Accuracy: 0.952880, Non-Pad-Accuracy: 0.67
9947
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.149881, Accuracy: 0.952894, Non-Pad-Accuracy: 0.67
9981
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150282, Accuracy: 0.952882, Non-Pad-Accuracy: 0.67
9956
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.149697, Accuracy: 0.952890, Non-Pad-Accuracy: 0.68
0000
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.149489, Accuracy: 0.952888, Non-Pad-Accuracy: 0.67
9981
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.150557, Accuracy: 0.952904, Non-Pad-Accuracy: 0.68
0069
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.149902, Accuracy: 0.952889, Non-Pad-Accuracy: 0.68
0004
-- . . .
```

UPDATED RESULT

```
In [ ]: # EPOCHS DONE - 9:53 PM  
epoch=[1,2,3,4,5,6,7,8,9,  
loss=[]  
accuracy=[]
```

```
In [ ]:
```

```
In [ ]: %ls "{checkpoint_dir}"
```

```
In [ ]: # from google.colab import files  
# files.download(checkpoint_dir / "best_model_accuracy=0.6413.pt")
```

```
In [ ]: %load_ext tensorboard  
%tensorboard --logdir "{log_dir}"
```

BACKUP DATA

Initial validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.295344, Accuracy: 0.908784, Non-Pad-Accuracy: 0.678974 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.216102, Accuracy: 0.945516, Non-Pad-Accuracy: 0.678547 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.195067, Accuracy: 0.950141, Non-Pad-Accuracy: 0.678473 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.187008, Accuracy: 0.950992, Non-Pad-Accuracy: 0.678432 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.183403, Accuracy: 0.951166, Non-Pad-Accuracy: 0.678428 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.181106, Accuracy: 0.951265, Non-Pad-Accuracy: 0.678419 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.179392, Accuracy: 0.951341, Non-Pad-Accuracy: 0.678404 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.177966, Accuracy: 0.951389, Non-Pad-Accuracy: 0.678406 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.176570, Accuracy: 0.951424, Non-Pad-Accuracy: 0.678499 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.175576, Accuracy: 0.951412, Non-Pad-Accuracy: 0.678499 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.174878, Accuracy: 0.951485, Non-Pad-Accuracy: 0.678629 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.173831, Accuracy: 0.951527, Non-Pad-Accuracy: 0.678541 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.173234, Accuracy: 0.951653, Non-Pad-Accuracy: 0.678602 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.172506, Accuracy: 0.951800, Non-Pad-Accuracy: 0.678580 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.171775, Accuracy: 0.951930, Non-Pad-Accuracy:


```
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.150178, Accuracy: 0.952891, Non-Pad-Accuracy: 0.679971 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.150484, Accuracy: 0.952880, Non-Pad-Accuracy: 0.679947 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.149881, Accuracy: 0.952894, Non-Pad-Accuracy: 0.679981 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.150282, Accuracy: 0.952882, Non-Pad-Accuracy: 0.679956 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.149697, Accuracy: 0.952890, Non-Pad-Accuracy: 0.680000 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.150557, Accuracy: 0.952904, Non-Pad-Accuracy: 0.680069 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096 Epoch results - Avg loss: 0.149902, Accuracy: 0.952889, Non-Pad-Accuracy: 0.680004 Validation run: Validation Results - epoch_loss : 0.6348723945230415 accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096
```

```
In [ ]: train_engine.run(train_loader, max_epochs=500)
```

```
Initial validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.295344, Accuracy: 0.908784, Non-Pad-Accuracy: 0.678974  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.216102, Accuracy: 0.945516, Non-Pad-Accuracy: 0.678547  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.195067, Accuracy: 0.950141, Non-Pad-Accuracy: 0.678473  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.187008, Accuracy: 0.950992, Non-Pad-Accuracy: 0.678432  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.183403, Accuracy: 0.951166, Non-Pad-Accuracy: 0.678428  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096
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Epoch results - Avg loss: 0.181106, Accuracy: 0.951265, Non-Pad-Accuracy: 0.67  
8419  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.179392, Accuracy: 0.951341, Non-Pad-Accuracy: 0.67  
8404  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.177966, Accuracy: 0.951389, Non-Pad-Accuracy: 0.67  
8406  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.176570, Accuracy: 0.951424, Non-Pad-Accuracy: 0.67  
8499  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.175576, Accuracy: 0.951412, Non-Pad-Accuracy: 0.67  
8499  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.174878, Accuracy: 0.951485, Non-Pad-Accuracy: 0.67  
8629  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.173831, Accuracy: 0.951527, Non-Pad-Accuracy: 0.67  
8541  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.173234, Accuracy: 0.951653, Non-Pad-Accuracy: 0.67  
8602  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.172506, Accuracy: 0.951800, Non-Pad-Accuracy: 0.67  
8580  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.171775, Accuracy: 0.951930, Non-Pad-Accuracy: 0.67  
8579
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Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.170698, Accuracy: 0.952075, Non-Pad-Accuracy: 0.67  
8637  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.169781, Accuracy: 0.952218, Non-Pad-Accuracy: 0.67  
8608  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.169268, Accuracy: 0.952331, Non-Pad-Accuracy: 0.67  
8601  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.167112, Accuracy: 0.952367, Non-Pad-Accuracy: 0.67  
8655  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.166147, Accuracy: 0.952390, Non-Pad-Accuracy: 0.67  
8684  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.165000, Accuracy: 0.952413, Non-Pad-Accuracy: 0.67  
8640  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.162732, Accuracy: 0.952402, Non-Pad-Accuracy: 0.67  
8577  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.160847, Accuracy: 0.952443, Non-Pad-Accuracy: 0.67  
8560  
Validation run:  
Validation Results -  
epoch_loss : 0.6348723945230415  
accuracy : 0.868545081342427  
gen_accuracy : 0.6774193548387096  
Epoch results - Avg loss: 0.160458, Accuracy: 0.952483, Non-Pad-Accuracy: 0.67  
8505  
Validation run:  
Validation Results -
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epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.159550, Accuracy: 0.952520, Non-Pad-Accuracy: 0.67
8467
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.158180, Accuracy: 0.952546, Non-Pad-Accuracy: 0.67
8497
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.157994, Accuracy: 0.952575, Non-Pad-Accuracy: 0.67
8551
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.156814, Accuracy: 0.952594, Non-Pad-Accuracy: 0.67
8489
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.156499, Accuracy: 0.952600, Non-Pad-Accuracy: 0.67
8491
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.156329, Accuracy: 0.952596, Non-Pad-Accuracy: 0.67
8466
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.156052, Accuracy: 0.952595, Non-Pad-Accuracy: 0.67
8453
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.155629, Accuracy: 0.952610, Non-Pad-Accuracy: 0.67
8478
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.155402, Accuracy: 0.952616, Non-Pad-Accuracy: 0.67
8555
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
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gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.154758, Accuracy: 0.952621, Non-Pad-Accuracy: 0.67
8564
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.154290, Accuracy: 0.952634, Non-Pad-Accuracy: 0.67
8628
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.154460, Accuracy: 0.952641, Non-Pad-Accuracy: 0.67
8702
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.154920, Accuracy: 0.952658, Non-Pad-Accuracy: 0.67
8801
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.154126, Accuracy: 0.952682, Non-Pad-Accuracy: 0.67
8914
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.154145, Accuracy: 0.952661, Non-Pad-Accuracy: 0.67
8814
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.154011, Accuracy: 0.952680, Non-Pad-Accuracy: 0.67
8921
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.153522, Accuracy: 0.952695, Non-Pad-Accuracy: 0.67
8969
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.153634, Accuracy: 0.952712, Non-Pad-Accuracy: 0.67
9090
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.153285, Accuracy: 0.952708, Non-Pad-Accuracy: 0.67
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9051
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.153193, Accuracy: 0.952713, Non-Pad-Accuracy: 0.67
9106
Validation run:
Validation Results -
epoch_loss : 0.6348723945230415
accuracy : 0.868545081342427
gen_accuracy : 0.6774193548387096
Epoch results - Avg loss: 0.153089, Accuracy: 0.952739, Non-Pad-Accuracy: 0.67
9232
Validation run:
Validation Results -
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