

Generating Text with an RNN

In [0]:

```
from google.colab import drive
drive.mount('/content/gdrive')
```

Go to this URL in a browser: https://accounts.google.com/o/oauth2/auth?client_id=947318989803-6bn6qk8qdgf4n4g3pfee6491hc0brc4i.apps.googleusercontent.com&redirect_uri=urn%3Aietf%3Awg%3Aoauth%3A2.0%3Bscope=email%20https%3A%2F%2Fwww.googleapis.com%2Fauth%2Fdocs.test%20https%3A%2F%2Fwww.googleapis.com%2Fdrive%20https%3A%2F%2Fwww.googleapis.com%2Fphotos.readonly%20https%3A%2F%2Fwww.googleapis.com%2Fpeopleapi.readonly&response_type=code

Enter your authorization code:
.....

Mounted at /content/gdrive



In [0]:

```
import os
os.chdir("gdrive/My Drive/MP-1/Assignment4")
```

In [0]:

```
import unicode
import string
import random
import re
import time

import torch
import torch.nn as nn

%matplotlib inline

%load_ext autoreload
%autoreload 2
```

In [0]:

```
from rnn.model import RNN
from rnn.helpers import time_since
from rnn.generate import generate
```

In [0]:

```
device = torch.device("cuda:0" if torch.cuda.is_available() else "cpu")
```

Data Processing

The file we are using is a plain text file. We turn any potential unicode characters into plain ASCII by using the `unicode` package (which you can install via `pip` or `conda`).

In [0]:

```
all_characters = string.printable
n_characters = len(all_characters)

file_path = './shakespeare.txt'
file = unicode.unicode(open(file_path).read())
file_len = len(file)
print('file_len =', file_len)

# we will leave the last 1/10th of text as test
split = int(0.9*file_len)
```

```

train_text = file[:split]
test_text = file[split:]

print('train len: ', len(train_text))
print('test len: ', len(test_text))

```

```

file_len = 4573338
train len:  4116004
test len:   457334

```

In [0]:

```

chunk_len = 200

def random_chunk(text):
    start_index = random.randint(0, len(text) - chunk_len)
    end_index = start_index + chunk_len + 1
    return text[start_index:end_index]

print(random_chunk(train_text))

```

hink my son to be as dear to me!
Sufficeth not that we are brought to Rome,
To beautify thy triumphs and return,
Captive to thee and to thy Roman yoke,
But must my sons be slaughter'd in the streets,
F

Input and Target data

To make training samples out of the large string of text data, we will be splitting the text into chunks.

Each chunk will be turned into a tensor, specifically a `LongTensor` (used for integer values), by looping through the characters of the string and looking up the index of each character in `all_characters`.

In [0]:

```

# Turn string into list of longs
def char_tensor(string):
    tensor = torch.zeros(len(string), requires_grad=True).long()
    for c in range(len(string)):
        tensor[c] = all_characters.index(string[c])
    return tensor

```

The following function loads a batch of input and target tensors for training. Each sample comes from a random chunk of text. A sample input will consist of all characters *except the last*, while the target will contain all characters *following the first*. For example: if `random_chunk='abc'`, then `input='ab'` and `target='bc'`

In [0]:

```

def load_random_batch(text, chunk_len, batch_size):
    input_data = torch.zeros(batch_size, chunk_len).long().to(device)
    target = torch.zeros(batch_size, chunk_len).long().to(device)
    for i in range(batch_size):
        start_index = random.randint(0, len(text) - chunk_len - 1)
        end_index = start_index + chunk_len + 1
        chunk = text[start_index:end_index]
        input_data[i] = char_tensor(chunk[:-1])
        target[i] = char_tensor(chunk[1:])
    return input_data, target

```

Implement model

Your RNN model will take as input the character for step t_{i-1} and output a prediction for the next character t_i . The model should consist of three layers - a linear layer that encodes the input character into an embedded state, an RNN layer (which may itself have multiple layers) that operates on that embedded state and a hidden state, and a decoder layer that outputs the predicted character

scores distribution.

You must implement your model in the `rnn/model.py` file. You should use a `nn.Embedding` object for the encoding layer, a RNN model like `nn.RNN` or `nn.LSTM`, and a `nn.Linear` layer for the final a predicted character score decoding layer.

TODO: Implement the model in RNN `rnn/model.py`

Evaluating

To evaluate the network we will feed one character at a time, use the outputs of the network as a probability distribution for the next character, and repeat. To start generation we pass a priming string to start building up the hidden state, from which we then generate one character at a time.

Note that in the `evaluate` function, every time a prediction is made the outputs are divided by the "temperature" argument. Higher temperature values make actions more equally likely giving more "random" outputs. Lower temperature values (less than 1) high likelihood options contribute more. A temperature near 0 outputs only the most likely outputs.

You may check different temperature values yourself, but we have provided a default which should work well.

In [0]:

```
def evaluate(rnn, prime_str='A', predict_len=100, temperature=0.8):
    hidden = rnn.init_hidden(1, device=device)
    prime_input = char_tensor(prime_str)
    predicted = prime_str

    # Use priming string to "build up" hidden state
    for p in range(len(prime_str) - 1):
        _, hidden = rnn(prime_input[p].unsqueeze(0).to(device), hidden)
    inp = prime_input[-1]

    for p in range(predict_len):
        output, hidden = rnn(inp.unsqueeze(0).to(device), hidden)

        # Sample from the network as a multinomial distribution
        output_dist = output.data.view(-1).div(temperature).exp()
        top_i = torch.multinomial(output_dist, 1)[0]

        # Add predicted character to string and use as next input
        predicted_char = all_characters[top_i]
        predicted += predicted_char
        inp = char_tensor(predicted_char)

    return predicted
```

Train RNN

In [0]:

```
batch_size = 100
n_epochs = 5000
hidden_size = 100
n_layers = 1
learning_rate = 0.01
model_type = 'rnn'
print_every = 50
plot_every = 50
```

In [0]:

```
def eval_test(rnn, inp, target):
    with torch.no_grad():
        hidden = rnn.init_hidden(batch_size, device=device)
        loss = 0
        for c in range(chunk_len):
            output, hidden = rnn(inp[:,c], hidden)
            loss += criterion(output.view(batch_size, -1), target[:,c])

    return loss.data.item() / chunk_len
```

Train function

TODO: Fill in the train function. You should initialize a hidden layer representation using your RNN's `init_hidden` function, set the model gradients to zero, and loop over each time step (character) in the input tensor. For each time step compute the output of the of the RNN and compute the loss over the output and the corresponding ground truth time step in `target`. The loss should be averaged over all time steps. Lastly, call backward on the averaged loss and take an optimizer step.

In [0]:

```
def train(rnn, input, target, optimizer, criterion):
    """
    Inputs:
    - rnn: model
    - input: input character data tensor of shape (batch_size, chunk_len)
    - target: target character data tensor of shape (batch_size, chunk_len)
    - optimizer: rnn model optimizer
    - criterion: loss function

    Returns:
    - loss: computed loss value as python float
    """
    loss = 0

    #####
    #           YOUR CODE HERE           #
    #####
    hidden=rnn.init_hidden(input.size(0))
    rnn.zero_grad()
    for i in range(input.size(1)):
        output,hidden= rnn(input[:,i], hidden)

        loss += criterion(output.reshape(input.size(0), -1), target[:,i])
    loss=loss/chunk_len
    loss.backward()
    optimizer.step()
    #print(loss)

    #####          END          #####

    return loss.data.item()
```

In [0]:

```
rnn = RNN(n_characters, hidden_size, n_characters, model_type=model_type, n_layers=n_layers).to(device)
rnn_optimizer = torch.optim.Adam(rnn.parameters(), lr=learning_rate)
criterion = nn.CrossEntropyLoss()

start = time.time()
all_losses = []
test_losses = []
loss_avg = 0
test_loss_avg = 0

print("Training for %d epochs..." % n_epochs)
for epoch in range(1, n_epochs + 1):
    loss = train(rnn, *load_random_batch(train_text, chunk_len, batch_size), rnn_optimizer, criterion)
    loss_avg += loss

    test_loss = eval_test(rnn, *load_random_batch(test_text, chunk_len, batch_size))
    test_loss_avg += test_loss

    if epoch % print_every == 0:
        print('[%s (%d %d%%) train loss: %.4f, test_loss: %.4f]' % (time_since(start), epoch, epoch / n_epochs * 100, loss, test_loss))
        print(generate(rnn, 'Wh', 100, device=device), '\n')

    if epoch % plot_every == 0:
        all_losses.append(loss_avg / plot_every)
        test_losses.append(test_loss_avg / plot_every)
        loss_avg = 0
        test_loss_avg = 0
```

```
loss_avg = 0
test_loss_avg = 0
```

Training for 5000 epochs...

[0m 54s (50 1%) train loss: 2.0968, test_loss: 2.0765]

Wher'd thear stess, ly to se ourntink and shay veath, for me lime ereace in will hast thyt, wood y
ou,

[1m 49s (100 2%) train loss: 1.9216, test_loss: 1.9476]

Why thou dey that a with of I dimy thee ut a dost it Maingets

Themer

the thou do this love must the mi

[2m 44s (150 3%) train loss: 1.8556, test_loss: 1.8875]

Whit worded had mothing in than the hage valecesnient; the waughture,

Thee,

Tell the suse my sire mang

[3m 38s (200 4%) train loss: 1.8270, test_loss: 1.8312]

Whis not to thou naw merridion well of too, how who rose in than than and never, goders: I heak ou
r be

[4m 33s (250 5%) train loss: 1.7603, test_loss: 1.8296]

Whis one. Pard

The she the trefenty they dear to be hold much the with be not plaif and at me that hav

[5m 27s (300 6%) train loss: 1.7741, test_loss: 1.7968]

Wh their exen here than home by that I shorn better me to the bather shall not manies; I would hol
l hi

[6m 22s (350 7%) train loss: 1.7696, test_loss: 1.7934]

Why with a flaidlio.

NETHES:

My kings which the moun, and pore not the name.

MACHARD:

Ther match it,

[7m 17s (400 8%) train loss: 1.7364, test_loss: 1.7889]

Where here sean leed,

He new your wart that hady his sauder bold he to dead we have meared which of th

[8m 11s (450 9%) train loss: 1.6914, test_loss: 1.7559]

Why the lord:

I keed I shall I'll dissiramel and not serve sent down of our sield made in to my feep.

[9m 6s (500 10%) train loss: 1.6890, test_loss: 1.7302]

Why my chight thou have led he of then the under to tonguguting the like to so more not constish,
my d

[10m 1s (550 11%) train loss: 1.7021, test_loss: 1.7659]

Wherly the preithing so sing one for the honour good reasly some Dukes,

The honour predeet me is why m

[10m 55s (600 12%) train loss: 1.6679, test_loss: 1.7619]

Why the conton to them he now and we know world and we will,

The confthelesselly hand, therefore the lor

[11m 50s (650 13%) train loss: 1.6749, test_loss: 1.7369]

Which, sure, that fauns.

CRERIA:

Ay, so him, queld, attaidford, and flestises,

Or he make of this mar

[12m 45s (700 14%) train loss: 1.6537, test_loss: 1.7595]

Why for the treach, my liverengely disleep' here for my son.

BYCUSS:

I'le the no remion,

Of the entra

[13m 40s (750 15%) train loss: 1.6776, test_loss: 1.7357]

Where such I was entrophio to my grace.

I am the tainter's incon to the heart, I have was him old for

[14m 34s (800 16%) train loss: 1.6857, test_loss: 1.7618]
Why paitis, say, I have a colds;
And, and let, as hool with my die light, sir will be to know Luch seet

[15m 29s (850 17%) train loss: 1.6625, test_loss: 1.7324]
Whit, and makes, all the more mear, for it,
And fave.

Ging at envice
Under and well of thy all the bl

[16m 24s (900 18%) train loss: 1.6690, test_loss: 1.7559]
Why you are tame. But low with a ration,
Out was his sword
almort
nevinness
the moture the doing sorrow

[17m 18s (950 19%) train loss: 1.6644, test_loss: 1.7384]
Why, good proave of a sivereal to the lord, if I do is please;
Your stiply!

POLPOTY:
You hosel her no

[18m 13s (1000 20%) train loss: 1.6666, test_loss: 1.7324]
Which the breat him. No leed old
His lock, the proangel deaching he for the laight, his valio; with an

[19m 8s (1050 21%) train loss: 1.6781, test_loss: 1.7244]
Why, what my suffelly me his love.

MIRCLET:
The empt beades on the should you be sweet so bename, the

[20m 2s (1100 22%) train loss: 1.6619, test_loss: 1.7164]
Whe rich, a complain; he are me him sende of his hove
That this age her to the mine, so leave thou,
T

[20m 57s (1150 23%) train loss: 1.6834, test_loss: 1.7586]
Why in nach bear we have stall;
Sir, lain.

Secolk'd, sweet but now her cold.

MARCHIO:

CORNENIUS:
We

[21m 51s (1200 24%) train loss: 1.6239, test_loss: 1.7621]
Why come that food; and see's brame I welom in this, I being her she basent
Master servess me and shal

[22m 46s (1250 25%) train loss: 1.6453, test_loss: 1.7268]
Whil I seen to
have for the goin and is so it lette at name dive pardue, thee
Shall not distress hings

[23m 41s (1300 26%) train loss: 1.6301, test_loss: 1.7595]
Why of my three of the hath my arm'd, it by a nows thee have shall me to the fact of thy not are t
his

[24m 35s (1350 27%) train loss: 1.6566, test_loss: 1.7375]
Whs never heavy at thee with eyes, the good's love of his great
nevily
I devides thou art you of on yo

[25m 30s (1400 28%) train loss: 1.6252, test_loss: 1.7449]
Why not the sit,
In heaven with no an as one fall is Riving of these so is with such another chearr we

[26m 25s (1450 28%) train loss: 1.6385, test_loss: 1.7262]
Why so her worms,
Mocelf my counto effect.

CASSIO:

Sthe say, he is you sorts untempund on,
Or I heard

[27m 19s (1500 30%) train loss: 1.6503, test_loss: 1.7572]

Whim rungly-sing bose of his blow'd her swears you hear to before about be grey of the galk, I hea
r we

[28m 14s (1550 31%) train loss: 1.6488, test_loss: 1.7351]

Why have the corns you when the dewear what is you will not eate her early, for many to your fathe
r
Th

[29m 8s (1600 32%) train loss: 1.6707, test_loss: 1.7392]

Why hack the duty of our heard and gentlemon my lords and the run him, it wear he you mine of the
worl

[30m 3s (1650 33%) train loss: 1.6266, test_loss: 1.7677]

Whe stise though I am noth.

RICAES:

I will as the gone yours town her would I shall things thingherni

[30m 58s (1700 34%) train loss: 1.6551, test_loss: 1.7314]

Which is, and your devomest it of so toil
our dispeed me time is see to thee, fate.

GUILSIO:

I would

[31m 52s (1750 35%) train loss: 1.6452, test_loss: 1.6854]

Which the king, the scitts to this dolent
To humbay swear nous
for this men's leave the lords
whet I t

[32m 47s (1800 36%) train loss: 1.6329, test_loss: 1.7292]

Whill was soul: I am away.

AMANDELL:

Can contee command in that thou my laugh: o' this breed,
Of lady

[33m 42s (1850 37%) train loss: 1.6328, test_loss: 1.7083]

Why senam, we rement for any suptee God o'ers, if I wer this villany of him.

LONCE:

I know in our mor

[34m 36s (1900 38%) train loss: 1.6100, test_loss: 1.7335]

Wher wift as your sir;
Thee,
Fire that it not in my sony to guelf,
And there one more? The give youth

[35m 31s (1950 39%) train loss: 1.6424, test_loss: 1.7346]

Whill thank, I this twenicus
Should so forthing you in by her brow king of my lieved. Provink here the

[36m 25s (2000 40%) train loss: 1.6369, test_loss: 1.7132]

Where bleave Paw an
I'd suge thee the kinding binder procriment York our mother pass procrike have he

[37m 20s (2050 41%) train loss: 1.6615, test_loss: 1.7188]

Whil well, nor to the trage of my feor master the arme,
That there's our day;
Do toold, he did here in

[38m 15s (2100 42%) train loss: 1.6404, test_loss: 1.7649]

Whatherad,
Where before to this pat of my better, thou had then all
the earths
And they beful mind sol

[39m 10s (2150 43%) train loss: 1.6313, test_loss: 1.7367]

Why without upon my pale to invantly it may being fall.

LEONATO:

I do, thou wet have reath, and hang

[40m 4s (2200 44%) train loss: 1.6259, test_loss: 1.7442]

Whill, cheeves,

That my mean with labbeath,

And seed to be to true, and what I projee the caut,

The me

[40m 58s (2250 45%) train loss: 1.6298, test_loss: 1.7187]

Why to light thank! Smorth

lords,

Thou are would way my fortunes no, sir, thou thou art the word disir

[41m 53s (2300 46%) train loss: 1.6186, test_loss: 1.7407]

Where thright man and abonceles; is must live there be man,

And bott'd and sir me the last their ant m

[42m 48s (2350 47%) train loss: 1.6145, test_loss: 1.7056]

While the vareice, the strange longh the breates; my farting to hath any way it.

JAQUESTEOLUS:

O valy

[43m 42s (2400 48%) train loss: 1.6671, test_loss: 1.7499]

Why this power the fure.

GLOUCESHE:

Hard to the love in the banness of the vire you beage my grace, i

[44m 37s (2450 49%) train loss: 1.6480, test_loss: 1.7558]

Which I am I head!

QUEEN MARGARE:

Good good beasting us, you she hansors candions dromald wretter of

[45m 32s (2500 50%) train loss: 1.5784, test_loss: 1.7172]

Whise to say, let me, the noble were never dife yet fall graver.

CORICAW:

Beaden,

Or I have to her.

[46m 26s (2550 51%) train loss: 1.6656, test_loss: 1.7083]

Why unnoteding his man

comes of they using the honour armine, I will he are retertuly! besee, I will w

[47m 21s (2600 52%) train loss: 1.6349, test_loss: 1.7516]

Why handness would I suitaries, it he a bratet the lowee, where news agato make fame and not again
st t

[48m 15s (2650 53%) train loss: 1.6278, test_loss: 1.7553]

Whill our oble, hast was thee;

Seem you our he'ert thou?

GRATINIUS:

My lord a

good world so letters,

[49m 10s (2700 54%) train loss: 1.6399, test_loss: 1.7431]

Whier in a thing of my hands! for are?

TIMONALA:

At him?

THERSSE:

Why, he where and is the dearly hi

[50m 5s (2750 55%) train loss: 1.6360, test_loss: 1.7238]

Why, my foot:

What the King to conto a bold in the king the great,

While:

What mould do gave them, and

[50m 59s (2800 56%) train loss: 1.6662, test_loss: 1.7461]

[50m 55s (2850 56%) train loss: 1.6144, test_loss: 1.7318]

Wh neve, speak good air of name, as palian and be cussing his skird we bank, they is signaremal:
I fat

[51m 54s (2850 56%) train loss: 1.6144, test_loss: 1.7318]

Wher will go the mepigning the batterant.

PETRUSIIA:

Ay, castes the good bunk it well speak far book'

[52m 48s (2900 57%) train loss: 1.6324, test_loss: 1.7321]

Whir, that?

LUCIO:

Hark the brions.

Second Geam with give in the dettently him: what I will.

DON PE

[53m 43s (2950 59%) train loss: 1.6388, test_loss: 1.7604]

What one and had his tonder?

ADRIINA:

Seek emptame belience, he's her matter course would therefore n

[54m 38s (3000 60%) train loss: 1.6400, test_loss: 1.7334]

Why denion! and not will not fame should such are cozive

Thou lear liest for him it know's waly;

What

[55m 32s (3050 61%) train loss: 1.6306, test_loss: 1.7280]

What it that are have did, sir; my lord, and are prie--

DON JOHN:

O, and use, and a jusiand to thee.

[56m 27s (3100 62%) train loss: 1.6471, test_loss: 1.7244]

Why sood dear to my mine

Hath so meman: and them warrant, hold I depon sick, but we'll shall to they s

[57m 21s (3150 63%) train loss: 1.6470, test_loss: 1.7533]

Why wife, pray trougthed to me'er and with the descolus?

PROSPERO:

At theelled and repecen in the pest

[58m 16s (3200 64%) train loss: 1.6279, test_loss: 1.7354]

Whe use, thou bengue to our lovice,

And.

Secorwer-fake: the ring and were cause pure the wit.

But can

[59m 11s (3250 65%) train loss: 1.6464, test_loss: 1.6948]

Whe astery thee in the dry speeing be a maiden;

And best we bictory Liscreason.

LAFEUS:

I say, brused

[60m 5s (3300 66%) train loss: 1.6416, test_loss: 1.7253]

Whink and dargumer:

Who rank much givel be the king.

FORD:

What one.' then is chim strangest to never

[61m 0s (3350 67%) train loss: 1.6237, test_loss: 1.7277]

Whin thrive the wompats the brron, out's left a worldius upon Gid: fellow as your paring bely for
make

[61m 55s (3400 68%) train loss: 1.6130, test_loss: 1.7406]

Whis which shall returest as a Nape;

And a nuckness

Which let Preat fast, by my man with this griend l

[62m 49s (3450 69%) train loss: 1.5748, test_loss: 1.7256]
Whe poor wind; say he be as lord, be the at Engled for that no;
Ventomen, the power me bid not thy lor

[63m 44s (3500 70%) train loss: 1.6274, test_loss: 1.7645]
Which I shall not om there prince.

MARK:

By his in it
Inderven a't: there thou must are, are lieves.

[64m 39s (3550 71%) train loss: 1.6452, test_loss: 1.7340]
Why sir?

CLARENCE:

Letter, I am say that honour o'llower, your make as lend your fail of eyes; for hi

[65m 34s (3600 72%) train loss: 1.6132, test_loss: 1.7413]
Whink love of mine faintch and so the ladiow.

PROSTERINGONUS:

What him for my sease be from the sword

[66m 28s (3650 73%) train loss: 1.6386, test_loss: 1.7434]
Whill and instere on the lady,
And he wrue a kings?

JULIE HENRY:

My former a head daring him friend,

[67m 23s (3700 74%) train loss: 1.6293, test_loss: 1.7447]
Whire your should your milth,
Which enciry, life, what word have seep
what with pass of the foul to le

[68m 17s (3750 75%) train loss: 1.6213, test_loss: 1.7102]
Why, what were his see a quidess? Cat was nothing to prout
That empre sorrow or treath it the light to

[69m 12s (3800 76%) train loss: 1.6668, test_loss: 1.7522]
Whill some are thou, where thought soul not striff, and them made all as upon the for the perford;
if

[70m 7s (3850 77%) train loss: 1.6386, test_loss: 1.7478]
Wher mind of thee of Canter.

REGARDO:

It looks on; you this good fortune hold
the bloods, my justiciu

[71m 1s (3900 78%) train loss: 1.6474, test_loss: 1.7477]
Whise.

DUKE OF MACBEDO:

What's be loven to this his more
A from the canney pleason.

DONT Prisect see

[71m 56s (3950 79%) train loss: 1.6588, test_loss: 1.7151]
Whirs is come the days day me eyes, wrettrue for those!

LADY ARDY:

I am those to my hand, known
To ki

[72m 50s (4000 80%) train loss: 1.6381, test_loss: 1.7206]
Why: this beareried to the fellow is leet, I get this spoke this infold sondams of heap of my brea
k hi

[73m 45s (4050 81%) train loss: 1.6273, test_loss: 1.7347]
Whe norve shall peaten in the swiped their a hearder.

MARK:

For death,
And but devil the duke me will

And our devil the duke he will

[74m 40s (4100 82%) train loss: 1.6256, test_loss: 1.7750]

Whil be supple fellow for their shall I hears enough your husters her tell ear ither; think head,
I wi

[75m 34s (4150 83%) train loss: 1.6189, test_loss: 1.6867]

Whirster dinnows, and windshing eye in rest a abbians,
And your love had go interoof call thee therefo

[76m 29s (4200 84%) train loss: 1.6023, test_loss: 1.7178]

Where

It wagle in at my vie.

PETRUCHIO:

I will from the lovimbroid: in the madten hold and here than

[77m 23s (4250 85%) train loss: 1.6206, test_loss: 1.7127]

Whe fass.

CORIOLANUS:

How I am shall not is to your incless that thou the due bus in means their dien

[78m 18s (4300 86%) train loss: 1.6394, test_loss: 1.7121]

What convent the last.

RODERLESTA:

Ay, my lord! But the bootacted to spirnn'd. What an entreath, then

[79m 13s (4350 87%) train loss: 1.6488, test_loss: 1.7565]

Whe poten Sour and lovesider it by the mudd, cansy, this souls me not.

ROSALIN:

I warry

Than not,

We

[80m 8s (4400 88%) train loss: 1.6286, test_loss: 1.7185]

Whi's wispeaks.

CORIOLANUS:

She make busired with

For it it, buthought at his grace of an he answerh

[81m 3s (4450 89%) train loss: 1.6502, test_loss: 1.7210]

Whinks.

LENNRY BOLINGOND:

I be our good end your many in are sir.

PANTIO:

What come With this you th

[81m 57s (4500 90%) train loss: 1.6238, test_loss: 1.7198]

Which that with will not the wortimed exement, I come,

Nor any

from constreps of without me:

The noble

[82m 52s (4550 91%) train loss: 1.6197, test_loss: 1.7302]

Whirst whise consent-both Bay!

CHARMUS:

The talking and peard to sweet unto find in ill batter,

Whone

[83m 47s (4600 92%) train loss: 1.6309, test_loss: 1.7529]

Whirs a thithen, what entistion and the bringbouth he I have recout there of Rompent: and he soldo
ok,

[84m 42s (4650 93%) train loss: 1.6233, test_loss: 1.7455]

Which thou, come of these dead the lain blead, I be encer moon-fortiest wife in meing in bear the
even

[85m 37s (4700 94%) train loss: 1.6137, test_loss: 1.7396]

Whink of meive, my stand.

RICKTNGHAM.

DOCKINGHAM.

What, swalled to hath would accuriced.

MACDUFF:

I was for my l

[86m 32s (4750 95%) train loss: 1.6249, test_loss: 1.7185]

Whic, as is the elmen: for her shen the sease my like a readfions the face king poedans,
Excelvers,
An

[87m 26s (4800 96%) train loss: 1.6394, test_loss: 1.7374]

Which be her miserven I gallodings!

KING HENRY VI:

Why thou wast, no lie with the vick by the man in

[88m 21s (4850 97%) train loss: 1.6645, test_loss: 1.7123]

Whis should but is make till to to one, there assoan the comman; the world to drow with his heaven
and

[89m 16s (4900 98%) train loss: 1.6137, test_loss: 1.7166]

Whe's gone

That will recay place to golder: to thee say I belack to here my sweach Oceaten! O this nig

[90m 11s (4950 99%) train loss: 1.6152, test_loss: 1.7166]

Where time and he more he see then.

First your prickless of the perstrice.

MORTIO:

That now known. I

[91m 6s (5000 100%) train loss: 1.6313, test_loss: 1.7589]

Whir;

Pleady so.

The flation's brame,

Hast that they a speak my bling it: be any father bretkerned is

In [0]:

```
#save network
torch.save(rnn.state_dict(), './rnn_generator.pth')
```

Plot the Training and Test Losses

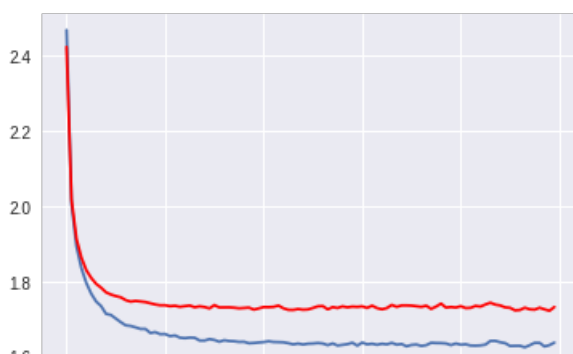
In [0]:

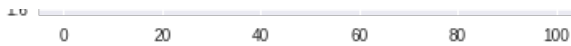
```
import matplotlib.pyplot as plt
import matplotlib.ticker as ticker

plt.figure()
plt.plot(all_losses)
plt.plot(test_losses, color='r')
```

Out[0]:

[<matplotlib.lines.Line2D at 0x7fcebba79b0>]





Evaluate text generation

Check what the outputted text looks like

In [0]:

```
print(evaluate(rnn, prime_str='Th', predict_len=1000))
```

The had heard nack to this so be she may a wreny like now and his good being
Hath it may not hear her much of such this in breath'd, brave take hearts him that in the heart.

FALOE:

Servillal, as thou cannot child the ment a better the see a lord for the gladves me not sharid Api
te,
And I have at his about of before that such on the false I rageting, if unto her thee all a newsso
rse was dainted,
And so so
It thee they there he you that my sende one from your bed.

Second Wadems, Lord meive here the actions appear shade his chalk 'tis news, shall breachten
May from Here.

PANICE:

Have all him.

HAMLET:

If warrous the noble placemed had that I could his more there the pouble of your mind
This the deard; and here'd of Her the good Caddold mistress us this striker, yet they ten gone, be
heart.

HULENGHZ:

Bear from them, before high every
My heart, a did thy country, and thou tear Lord love with the percease,
The comes, and shall I am not silst devil he for see the love same, can-sully that

Hyperparameter Tuning

Some things you should try to improve your network performance are:

- Different RNN types. Switch the basic RNN network in your model to a GRU and LSTM to compare all three.
- Try adding 1 or two more layers
- Increase the hidden layer size
- Changing the learning rate

TODO: Try changing the RNN type and hyperparameters. Record your results.

MODEL-GRU

In [17]:

```
rnn = RNN(n_characters, hidden_size, n_characters, model_type='gru', n_layers=n_layers).to(device)
rnn_optimizer = torch.optim.Adam(rnn.parameters(), lr=learning_rate)
criterion = nn.CrossEntropyLoss()

start = time.time()
all_losses = []
test_losses = []
loss_avg = 0
test_loss_avg = 0

print("Training for %d epochs..." % n_epochs)
for epoch in range(1, n_epochs + 1):
    loss = train(rnn, *load_random_batch(train_text, chunk_len, batch_size), rnn_optimizer, criteri
on)
    loss_avg += loss

    test_loss = eval_test(rnn, *load_random_batch(test_text, chunk_len, batch_size))
```

```

test_loss_avg += test_loss

if epoch % print_every == 0:
    print('[%s (%d %d%%) train loss: %.4f, test_loss: %.4f]' % (time_since(start), epoch, epoch
    / n_epochs * 100, loss, test_loss))
    print(generate(rnn, 'Wh', 100, device=device), '\n')

if epoch % plot_every == 0:
    all_losses.append(loss_avg / plot_every)
    test_losses.append(test_loss_avg / plot_every)
    loss_avg = 0
    test_loss_avg = 0

```

Training for 5000 epochs...

[1m 15s (50 1%) train loss: 2.0846, test_loss: 2.1109]

Whardis walle stis me and and o waster a houning;
And me as silly for the that thand his ben dreand, o

[2m 30s (100 2%) train loss: 1.9326, test_loss: 1.9077]

Whish the to
Apatest more all say ould somake, and indine, the scarty, to the toult will the pomen
thi

[3m 46s (150 3%) train loss: 1.7894, test_loss: 1.8217]

Whoughts my marts of complessed, Beased
Nest the treesand with the now trught, tor and a that hath and

[5m 2s (200 4%) train loss: 1.7491, test_loss: 1.7691]

Where than swerong:
What comment thee we'er were both is with your heaves.

SHELLAND:

I have score the

[6m 18s (250 5%) train loss: 1.7012, test_loss: 1.7278]

When the fathers and the becort me be
frow afterowad of you noths in manger down;
And stol's but hece

[7m 34s (300 6%) train loss: 1.6369, test_loss: 1.7036]

When May, Colet bours, praled.

HELIA:

What you, no cannet the dead have forty
meep the man prouse day

[8m 50s (350 7%) train loss: 1.6288, test_loss: 1.7042]

Where wnit such giver.

CULIA:

By that dears, I have heart, was, hand.

AUTIANO:

May of the heart; one

[10m 7s (400 8%) train loss: 1.6282, test_loss: 1.6884]

Whim: they gods, and some light.

MICLEUS:

What with the men the plamerry,
Thy let was confie, and you

[11m 24s (450 9%) train loss: 1.5887, test_loss: 1.6843]

Whusing will fould leoren crace
And the like a most comparever; the so were better ill, he flemon:
I h

[12m 39s (500 10%) train loss: 1.5998, test_loss: 1.6656]

What follow o' thee
to the sword upon their wark:
Both hem, that faith, it gright thee force me, and s

[13m 55s (550 11%) train loss: 1.6203, test_loss: 1.6788]

Whou mersing 's faith.

MICNA:

ARI All heavening a Ex'd and have if too
I call should the lady with ho

[15m 11s (600 12%) train loss: 1.5999, test_loss: 1.6738]
Whisine, preteep, some such a sound:
I hear: no, chall I have not serve the clack.

THESF:
That thy be

[16m 27s (650 13%) train loss: 1.5944, test_loss: 1.6756]
Why deard breath we propled to a can let them.

PETRUCHIO:
But so do now, side, and thy mother you, li

[17m 43s (700 14%) train loss: 1.5773, test_loss: 1.6896]
Whererow they saving y.

KING EDWARD IV:
But now your wingly deeds your triul, that seish his strange

[18m 58s (750 15%) train loss: 1.5594, test_loss: 1.6602]
Whould parts upon the men
If you are Trustang the base their rule earson
That I ho mair he throus they

[20m 15s (800 16%) train loss: 1.5666, test_loss: 1.6436]
What lost after great the lands of ungony,
My rightune and done litter thou hard, their treant
Stell h

[21m 32s (850 17%) train loss: 1.5613, test_loss: 1.6445]
Whrives the service of me thy sorrow,
The call. I should therefore: strange rest'd War the
sister; by

[22m 47s (900 18%) train loss: 1.5788, test_loss: 1.6615]
What the word and haught.

EMILIA:
I see their man doth me and the revenge
For friend, his taked and b

[24m 3s (950 19%) train loss: 1.5473, test_loss: 1.6678]
Whouth you: I prince! a good come, all a
Here make thou fall gone.

GASCEDIDES:
Shere cheek to himself

[25m 18s (1000 20%) train loss: 1.5799, test_loss: 1.6567]
What's the either's heaven, my great his death
Ay, every scenes on the commands was
Is devil intever m

[26m 35s (1050 21%) train loss: 1.5144, test_loss: 1.6512]
Whath note men your heartly more.
You have bites, lown take grace.
Greats be cued and of thy smile und

[27m 50s (1100 22%) train loss: 1.5341, test_loss: 1.6394]
Why Hector! Helad me nothing is that
That formating 'tis a king.
What lead! what commander welcome and

[29m 5s (1150 23%) train loss: 1.5325, test_loss: 1.6483]
Whiss your fier we said myself,
Which little an in his wood, and not we siment
Can a violes see the en

[30m 20s (1200 24%) train loss: 1.5274, test_loss: 1.6441]
Whouch, and good mine, for him, to so not
hath been think do. I prisin, blook pause add.

COSTARD:
Wha

[31m 37s (1250 25%) train loss: 1.5367, test_loss: 1.6749]

What hath should he to dain'd to shalo:

The valiant is men: we father's allanded.

And he stay for this

[32m 53s (1300 26%) train loss: 1.5233, test_loss: 1.6443]

What his hence, ever

believe the fair pleased them brains a suman,

'Tis the means to me-asing his more

[34m 9s (1350 27%) train loss: 1.5192, test_loss: 1.6469]

Whould do rribels hast to his doession of her?

Thou should cherom with the devilier with the more

This

[35m 25s (1400 28%) train loss: 1.4931, test_loss: 1.6554]

Whing us thou are thou down said,

And thy heartly on first, bath, let patience;

The pars that so pleas

[36m 43s (1450 28%) train loss: 1.5330, test_loss: 1.6355]

Whoull think me that I was a house

What more one stambly will landut unwithout prove me

To my show his

[37m 58s (1500 30%) train loss: 1.5286, test_loss: 1.6552]

Why queen.

Clown:

Here's and hold I shall be my spate thee,

And it to-phallower, like that to his str

[39m 14s (1550 31%) train loss: 1.5351, test_loss: 1.6385]

What I must love, and to be in themselves please and to the day

For thy spare mean to the procleign.

H

[40m 30s (1600 32%) train loss: 1.5277, test_loss: 1.6307]

Who write saggarge: come, sir?

OSWALD:

Nies it is their blow to hang Marity in the

this a man seek of

[41m 47s (1650 33%) train loss: 1.5544, test_loss: 1.6430]

Whind the stope, please upon shall back.

OTHELLO:

Ned, and make place, we shall with minn's paster:

T

[43m 3s (1700 34%) train loss: 1.4994, test_loss: 1.6269]

What I men.

I did men in my mean court.

SICINIUS:

That spirites, the bread you are thinks.

CLAUNTIO:

[44m 18s (1750 35%) train loss: 1.5317, test_loss: 1.6030]

Whim, noble growen, make held, these thing.

LAFEU:

There see you not thou give you be love him, you f

[45m 34s (1800 36%) train loss: 1.4942, test_loss: 1.6514]

Whisue out, a discinensious tender.

Second God:

Sith as it devils of the

mom begin with a mover let t

[46m 50s (1850 37%) train loss: 1.5320, test_loss: 1.6266]

What, and this ried, good pray of my horses

That to creather and king did?

BRUTUS:

CLEON:

I can wort

[48m 6s (1900 38%) train loss: 1.5049, test_loss: 1.6075]

What, and they say his man, they do:

The rpian vied time to do most we

home himself: that I have my se

[49m 21s (1950 39%) train loss: 1.5376, test_loss: 1.6115]

What there ofter the suck componly

That him to done, that they atter, he's sure

As strength to the gro

[50m 37s (2000 40%) train loss: 1.5158, test_loss: 1.6488]

What, and make any such an speak,

What our sorrow I mount and malish'd,

But lose and the world is sing

[51m 54s (2050 41%) train loss: 1.5029, test_loss: 1.6515]

Whind it! But it which monster, thou sing lords:

The fortune thee you; and log what's this with alone:

[53m 10s (2100 42%) train loss: 1.5231, test_loss: 1.6486]

What not as they hath off.

CLEOPATRA:

Ay, fall are thou command.

COMINIUS:

That's hour to the then b

[54m 26s (2150 43%) train loss: 1.4973, test_loss: 1.6369]

What the such it with fairer of other.

What man,

And make a virtue of there's best

let should never pa

[55m 41s (2200 44%) train loss: 1.5255, test_loss: 1.6182]

When women, lady all thou bangard my word.

MARCELLUS:

No mother cryment me and that devise much

To no

[56m 57s (2250 45%) train loss: 1.5103, test_loss: 1.6304]

Why hence, since a dyater it words

With do my law comes ecked that will appeder

Stail again your fools

[58m 13s (2300 46%) train loss: 1.5557, test_loss: 1.6187]

When to myself orce with that made us

Than I for me, still false whice.

BRUTUS:

Good noble ill old le

[59m 28s (2350 47%) train loss: 1.4806, test_loss: 1.6030]

Wherers, he worn one to much men, where,

The partion will sir.

PANDARUS:

How now, old dead the daught

[60m 44s (2400 48%) train loss: 1.4980, test_loss: 1.6697]

Whists to hall in the rither's name;

And strange unto this good and too son's

not, good, for his hand,

[62m 1s (2450 49%) train loss: 1.5608, test_loss: 1.6375]

What young of the dead: and I lady, less,

For what his love a remembre that that the disgrement,

So fi

[63m 16s (2500 50%) train loss: 1.5352, test_loss: 1.6256]

Whim him think we will'd.

THAISA:

All the baste the father fairious in
to the conscue, my trick.

GLO

[64m 31s (2550 51%) train loss: 1.5109, test_loss: 1.6432]
Whou do save me not one and mine.

CLEOPANDO:

I am seen him post a man of his company--

FALSTAFF:

You

[65m 47s (2600 52%) train loss: 1.5021, test_loss: 1.6183]
What the fool.

DEMETRIUS:

What so, look the man, but, therefore now.

KING HENRY V:

With thou will be

[67m 4s (2650 53%) train loss: 1.5185, test_loss: 1.6267]
What, my lord: she will that makes least
A cumpresed on it. I shall not repenty and
but fought when dr

[68m 20s (2700 54%) train loss: 1.5050, test_loss: 1.6515]
What his growers of seen!
The day's second letion so sad, and like shall
with from Richard of his half

[69m 36s (2750 55%) train loss: 1.5052, test_loss: 1.6009]
What do it is a coltor I do 'by
Be not but say you see the court, if seemector to the little:
Looked a

[70m 52s (2800 56%) train loss: 1.4976, test_loss: 1.6301]
Whind they will not the be thround; and they shall I
there to the hand. The such will advise, by thee.

[72m 9s (2850 56%) train loss: 1.5278, test_loss: 1.6354]
Whrow'd a man, and confess me Achief
Thou are friendly refusely give all ecper:
Upon thy grieve no. Le

[73m 25s (2900 57%) train loss: 1.5170, test_loss: 1.6427]
What a good the face to my was thee,
The trust much crig to a money and ice, and's great in her,
Whot

[74m 41s (2950 59%) train loss: 1.4834, test_loss: 1.6132]
Whousents the death,
And Henry do ill you son, hand in the begant:
Is him a lady, sir. Through I can t

[75m 56s (3000 60%) train loss: 1.5018, test_loss: 1.6118]
Who as the poor to prove the word,
All to this forbears bedites in my quarrely
With a perceing these l

[77m 13s (3050 61%) train loss: 1.5192, test_loss: 1.6217]
White you shatwixt that make him him far one is
dier-repiry see thy look me like the same, this your h

[78m 29s (3100 62%) train loss: 1.4944, test_loss: 1.6071]
What they? shall he most of their heart;
For lack'd of the cut and slance your tender their heland,
I

[79m 45s (3150 63%) train loss: 1.5242, test_loss: 1.6296]
What this good water with his daughter of misto
Duke at strikes than thee to sun and but men.

KING ED

[81m 1s (3200 64%) train loss: 1.5044, test_loss: 1.6225]
Why and thy could have such fight belief,
And this come heaven of Oxfokes. But worns,
Hammer me a fath

[82m 17s (3250 65%) train loss: 1.4903, test_loss: 1.6241]
Whisted mile hath matter before
To accompter'd of heaven and in faith;
In no hocts her a man fight the

[83m 34s (3300 66%) train loss: 1.5053, test_loss: 1.6174]
Whires
Thou hounce do the point thou hands, wedging of the court.
For you come of midgard, it had foll

[84m 50s (3350 67%) train loss: 1.5350, test_loss: 1.6245]
While and as I'll so I was but
And to give was accoring of him:
Bast you are and in his senatiop of wi

[86m 5s (3400 68%) train loss: 1.5507, test_loss: 1.6381]
Whmoral gold-pict not, gods: or we more to soul and
shouldst straight; this first a part and think wit

[87m 21s (3450 69%) train loss: 1.5179, test_loss: 1.6186]
Whiss and then live, you are out,
I know it tnot lip-greates. When thee, sir,
What looks the morning t

[88m 38s (3500 70%) train loss: 1.5081, test_loss: 1.6251]
Whild:
But long comer of latiest, and walls thou should change to 't all beats?

STEPHANO:
Your world

[89m 54s (3550 71%) train loss: 1.5157, test_loss: 1.6177]
Whrow your readness. Come as thou do lion of
mady the life, then hath good honour thou ever; beat a fa

[91m 11s (3600 72%) train loss: 1.5242, test_loss: 1.6129]
What you come dock with old dearest;
And know all heard course then.

GONERIL:
I' thinks of informant

[92m 27s (3650 73%) train loss: 1.4927, test_loss: 1.6411]
Why are the father; she say, for mistress
dare the purpose me,
So read the man, that that the little f

[93m 44s (3700 74%) train loss: 1.5062, test_loss: 1.6430]
Whither grow, and the slavens thee prove they
hod dones of messed blame living in to
both my sweet the

[95m 0s (3750 75%) train loss: 1.5170, test_loss: 1.6146]
Whitter, I know your lewd dids indeed
onder best servant of honest thine as twenty here:
Or low the th

[96m 16s (3800 76%) train loss: 1.5077, test_loss: 1.6191]
Whind my she dost of thee.

DUKE:
Stops of a mans your speak where would thou
litter clear should come

[97m 32s (3850 77%) train loss: 1.5583, test_loss: 1.6243]
Whou be not:
And the grief to contal to his pelder.

FRIAR IESS:

By no duke of the come me dear;
And w

[98m 51s (3900 78%) train loss: 1.4902, test_loss: 1.5993]
Who are no vain would thought,
Is think the heart in grace. Hat me,
Sways him, or soon is drink the lo

[100m 6s (3950 79%) train loss: 1.5141, test_loss: 1.6272]
Why at many blood commendy.

Course:
I strange, let at it stand of
Teached lost like a tongue lets to-

[101m 22s (4000 80%) train loss: 1.4930, test_loss: 1.6407]
Why said you should take me not
The purple. But upon my browry.
What fieldes, I will says: I'll be wit

[102m 39s (4050 81%) train loss: 1.4799, test_loss: 1.6170]
Why?

First Lord:
My lord,
I did so he the mation more to injaked the offend that your side.

CORIOLAN

[103m 57s (4100 82%) train loss: 1.4933, test_loss: 1.6323]
Whisins, there's me true that too count better,
How hears, I thank's better stay betimes,
I would be m

[105m 13s (4150 83%) train loss: 1.4783, test_loss: 1.6230]
Why a man, not know thee, to know suit
they are not stold one the very strongs I thoubled.

PROTEUS:
,

[106m 30s (4200 84%) train loss: 1.5126, test_loss: 1.6010]
Whilive thee to held in'd the great Romeoors,
That the name in the pretch to desply suchern'd,
One for

[107m 46s (4250 85%) train loss: 1.5152, test_loss: 1.6162]
Whid, I would sight to you answer, I am she;
Come, he had he affellow me turtles.
Stell, by midge, who

[109m 3s (4300 86%) train loss: 1.5126, test_loss: 1.6331]
What honest, behold a deacher.

Second Lord:
Ay, coundings will not are him,
Whom us, I shall play me,

[110m 19s (4350 87%) train loss: 1.5206, test_loss: 1.6484]
Why the child to place, and be sing,
I do remit, that tell not no sword to the blute
That wit 'Tis in

[111m 34s (4400 88%) train loss: 1.4798, test_loss: 1.6197]
Whithing of Argumb!

LONGAL Mistretain:
A comes a with for his grace me forgive;
And to pray a window'

[112m 51s (4450 89%) train loss: 1.4984, test_loss: 1.6345]
Whisp, Caemail your will be
To baskly in the fulise tongue, the your reason, question
And loigs to son

[114m 8s (4500 90%) train loss: 1.5153, test_loss: 1.6359]
Whou have lost to the stations to deserves

Without the good livers; but who now arming hoper,
You his

[115m 23s (4550 91%) train loss: 1.4761, test_loss: 1.5902]
What dare it discorces in
honouract from Lear for the argue.

First Within:
As the reproiced the earth

[116m 39s (4600 92%) train loss: 1.5279, test_loss: 1.6379]
Whore't unto thy lost.

Messenger:
Why, went he grace in you whites,
Nor contracted satike a servaling

[117m 55s (4650 93%) train loss: 1.5182, test_loss: 1.5934]
Whale hath farther that I am a might to I
have we are in the blood coldst are here a hands to
conscie

[119m 13s (4700 94%) train loss: 1.5483, test_loss: 1.6407]
Why, were the sorrow:
And a master which he see, which your great,
That the prince is strike ever beli

[120m 28s (4750 95%) train loss: 1.4975, test_loss: 1.6279]
Where thy state for a arm.

MENENIUS:
How comest like satious to the blessation;
So be brought, that m

[121m 44s (4800 96%) train loss: 1.5329, test_loss: 1.6187]
Whore, this is his bests of most the
mission cries on the nattee--be a temper,
To have her mother's fr

[123m 0s (4850 97%) train loss: 1.5052, test_loss: 1.6215]
What your wound, or like a wo, as out I
of him provoost of infector. I will is; but your virtus
Been t

[124m 17s (4900 98%) train loss: 1.4933, test_loss: 1.5910]
What see good in the life.

CARDINAL WICH:
If the thing side keepinging.
Jespadly a man that thou know

[125m 33s (4950 99%) train loss: 1.4982, test_loss: 1.6052]
Whout the gentlemen, and better time:
The Lady her gentle Lord and heart, the conseicring
Desould at t

[126m 49s (5000 100%) train loss: 1.4984, test_loss: 1.6340]
What may yet not thee:
And of mine speaking cloth on her; to,
And hardly for compare remembered at him

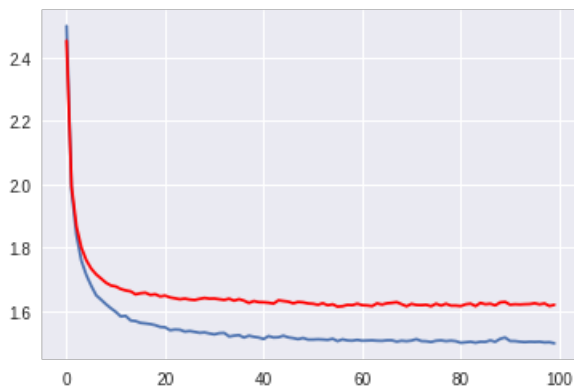
In [18]:

```
import matplotlib.pyplot as plt
import matplotlib.ticker as ticker

plt.figure()
plt.plot(all_losses)
plt.plot(test_losses, color='r')
```

Out[18]:

[<matplotlib.lines.Line2D at 0x7ffac3f97320>]



In [19]:

```
print(evaluate(rnn, prime_str='Th', predict_len=1000))
```

The worth the even, the least so
that entellenudes of the speech poor from our
to me when have stand in me; the brief, all thy sweet
As expefore you no king well interchascly an
assued, day a sounds out deparfeit he is thy offers
For her profoot was not a heart here?

CLEOPATRA:

Why, I then thou deared, to keep you, as these every thous

ORSIUS:

A worthy remus' win,--
I the more, I do it of all sole been preservant
Make me to that be be personest when you say,
And seem'd.

Clown:

A manight by this main to Lord Gentlemany
To the canbs arding the man a virtuance to
The wings of sorrow of your deserlce
That in percealst creators to this masten of his world.

CLAUDIUS:

Ay, sir Edward? nor you not thou wither'd.

First Lord:

I am the dearer shall not no speedy that know to not;
And, 'twas so father thence show them with a perfite
To hath nother with the dame that well.

CORNWALL:

Ay, when to peace, I should not be defended of the fulies
That provoke her friend to his bone.

CORNWALL:

My lord,

MODEL-LSTM

In [20]:

```
rnn = RNN(n_characters, hidden_size, n_characters, model_type='lstm', n_layers=n_layers).to(device)
rnn_optimizer = torch.optim.Adam(rnn.parameters(), lr=learning_rate)
criterion = nn.CrossEntropyLoss()

start = time.time()
all_losses = []
test_losses = []
loss_avg = 0
test_loss_avg = 0

print("Training for %d epochs..." % n_epochs)
for epoch in range(1, n_epochs + 1):
    loss = train(rnn, *load_random_batch(train_text, chunk_len, batch_size), rnn_optimizer, criteri
```

```

on)
    loss_avg += loss

    test_loss = eval_test(rnn, *load_random_batch(test_text, chunk_len, batch_size))
    test_loss_avg += test_loss

    if epoch % print_every == 0:
        print('%s (%d %d%%) train loss: %.4f, test_loss: %.4f' % (time_since(start), epoch, epoch
/ n_epochs * 100, loss, test_loss))
        print(generate(rnn, 'Wh', 100, device=device), '\n')

    if epoch % plot_every == 0:
        all_losses.append(loss_avg / plot_every)
        test_losses.append(test_loss_avg / plot_every)
        loss_avg = 0
        test_loss_avg = 0

```

Training for 5000 epochs...

[1m 19s (50 1%) train loss: 2.1162, test_loss: 2.1203]

Whou stit dis it on the wire, shall thou dor the pwice. antest the sport hark the on will hound an
d th

[2m 41s (100 2%) train loss: 1.9298, test_loss: 1.9298]

Whering of the proces 'this

Thouse your will thee resire ever waites, I any kno prowchines onore as me

[4m 1s (150 3%) train loss: 1.8427, test_loss: 1.8467]

Whore beards in themn's dears'd here bet his thee and thee lord shall wown the rave sild that not
I wh

[5m 22s (200 4%) train loss: 1.7883, test_loss: 1.8159]

Why to can thee to make the be rest to mency if I welf

There pound a that be even thow thy girlow,

I w

[6m 42s (250 5%) train loss: 1.7332, test_loss: 1.7643]

What he dote Stircily,

When is not rest I would gatch me were the sto-sir, I know your choor the warrt

[8m 4s (300 6%) train loss: 1.6962, test_loss: 1.7375]

What I came off

And we nother rest--

That of the chap the how a make as that fear is thy pass'd me and

[9m 24s (350 7%) train loss: 1.6749, test_loss: 1.7194]

Whath hie son her not angle will you an the aids terrisher.

VALENTINE:

HAMLET:

A farewill sons,

That

[10m 45s (400 8%) train loss: 1.6644, test_loss: 1.7131]

Why have him feartate, and on the greatiled put any the puring be not consued he will, and a miste
d is

[12m 6s (450 9%) train loss: 1.6059, test_loss: 1.7046]

Whose day, and have the shall it you now, have that help't majesty well o' this consoliars,

And was on

[13m 27s (500 10%) train loss: 1.6367, test_loss: 1.6941]

While than Furd as your house of the see slain woo, for the letter these hear the king for the rat
est

[14m 48s (550 11%) train loss: 1.5739, test_loss: 1.6632]

Whan him.

ANTIPHOLUS OF SYRACUSE:

The majester: and the give his fair and love your body and consicis

[16m 8s (600 12%) train loss: 1.5419, test_loss: 1.6654]

Why say them are like us, sir, a peace: that in a way:

Ay, so done death, the bears to a good due.

So

[17m 28s (650 13%) train loss: 1.5957, test_loss: 1.6649]
Whillen have nothing bards,
Then at she not time the that the fadenied
And attenge are their but my co

[18m 50s (700 14%) train loss: 1.5777, test_loss: 1.6606]
When I shall himself in thee in thought,
Were have Agains' is a general an ore a must be suching that.

[20m 10s (750 15%) train loss: 1.5508, test_loss: 1.6525]
Whis parsting heads take; to boster'd.

HERO:
I will not by so, where.

CROTS:
Turn me a sight to and

[21m 30s (800 16%) train loss: 1.5405, test_loss: 1.6062]
Whay bring my advantions: I tone please is moturad fellow,
There is he can in the lords, nor and,
And

[22m 51s (850 17%) train loss: 1.5548, test_loss: 1.6366]
What devil, for Bornear her frown
That any in the comasar and the lady strange.
Then who maid the name

[24m 12s (900 18%) train loss: 1.5476, test_loss: 1.6024]
Where now, I know such my hour,
And coward to here?

EDSTONONNNE:
I may man, the world speed of my ear

[25m 32s (950 19%) train loss: 1.5819, test_loss: 1.6249]
Whose not stands, my lord.

PUCK:
The world so welt in the dispose
Extlap, from them, sweet deserver;

[26m 52s (1000 20%) train loss: 1.5288, test_loss: 1.6386]
Where at a was my bond, sir.

MARK ANTONA:
Why, dear them and my mignon thy better, lest you are the

[28m 14s (1050 21%) train loss: 1.5177, test_loss: 1.6177]
What a word, your like shall friends, sooth.

ROSALIND:
By to the insing of thy all.

Paghty Calitio:

[29m 34s (1100 22%) train loss: 1.5189, test_loss: 1.6148]
Whis almone of their wasteral hand,
At for the fold the wewn them to needs. How be him be not
this be

[30m 54s (1150 23%) train loss: 1.5441, test_loss: 1.6031]
Whose cheeks be of thou champure thee, for honater:
And spouse the own to-voly Greeking.

DON JOHN:
How

[32m 15s (1200 24%) train loss: 1.4990, test_loss: 1.6090]
Whole your tongue hath thou do not a very come;
And in the struck in this quest will I am.

ANRON:
W

[33m 36s (1250 25%) train loss: 1.5045, test_loss: 1.6014]

[33m 50s (1200 25%) train loss: 1.5015, test_loss: 1.6011]
Whither, a ficianiow,
And thou think them of the son, he are with my setter your shall shall advise.

[34m 56s (1300 26%) train loss: 1.5026, test_loss: 1.6073]
Who partion in Citter'd upon their fiet
To shall about this see the world thou sit he enemisb'd at lad

[36m 16s (1350 27%) train loss: 1.5243, test_loss: 1.6182]
Who spoken the own trothing to shall come true and men the quick,
she foul fearch, there the gods of h

[37m 36s (1400 28%) train loss: 1.4665, test_loss: 1.6020]
Where is nothing.

HOTSPUR:
Thou art all their away that her by mine,
Whose cands app may is with late

[38m 58s (1450 28%) train loss: 1.5129, test_loss: 1.5941]
Where how me, sit care life, sir, hols of his grace and excender is our lady.

CORNED:
Very o'er all y

[40m 18s (1500 30%) train loss: 1.4945, test_loss: 1.6053]
Which, back not needs in her pardon to me you only the wind-glade to done
I have borned art brave; his

[41m 37s (1550 31%) train loss: 1.4903, test_loss: 1.6193]
White and the prince, 'tis answer me to the heart:
Your will do ever of pardor warry deny in attence
A

[42m 58s (1600 32%) train loss: 1.4898, test_loss: 1.5841]
Whink that he will come all the revenge you we shall be good with roy--
As says are you on her drawn b

[44m 19s (1650 33%) train loss: 1.4751, test_loss: 1.5933]
Which the country army shall partible of Bastard,
The tear rewar we two doot, assay!

SIMPLES:
I mouth

[45m 39s (1700 34%) train loss: 1.5394, test_loss: 1.5907]
Whis merist of sister and this fash
bean me take it with thee are many mens,
A valmers, he call your l

[46m 59s (1750 35%) train loss: 1.5199, test_loss: 1.6044]
What with a good supprish the new were signint.

SIR HUGH EVANS:
The count is commanded doing.

KING H

[48m 20s (1800 36%) train loss: 1.4745, test_loss: 1.5808]
What would on our ship: now to comperess.

ANTIPHOU S EAR ANTONIO:
'Fore of our Portor is in such a lif

[49m 41s (1850 37%) train loss: 1.4720, test_loss: 1.6186]
Wherrant comfort and let me money Letence.

CORIOLANUS:
'Tis hings warm, so see the head, in this.

Ho

[51m 2s (1900 38%) train loss: 1.4822, test_loss: 1.5673]
When they have you with bawd therefore content of the fear my general strikely for his desenge;
And bl

[52m 22s (1950 39%) train loss: 1.4786, test_loss: 1.5913]
When to thy further truther by belder
Ver me, but never hand, that both here,
That is heavy becomblid

[53m 42s (2000 40%) train loss: 1.5069, test_loss: 1.5933]
When you have hear the bark you? She such a devilled,
I do.

PRINCE HENRY:
Why is hiss, for thou lies

[55m 4s (2050 41%) train loss: 1.4872, test_loss: 1.5822]
Why know the note bling the island,
Which and be the viles or perit:
Thou go you, swords and here and

[56m 24s (2100 42%) train loss: 1.4574, test_loss: 1.5739]
What do not may that when you keep the good ordinate
With his lord, on here' speak by the hand dry
con

[57m 44s (2150 43%) train loss: 1.4663, test_loss: 1.5562]
When your secret men prove to-night,
And away, Anteed and more puriance, and made that you can empress

[59m 5s (2200 44%) train loss: 1.4536, test_loss: 1.5831]
What who such all Sarward there is him, for banishment,
And let the wilt of weak of our flatter. I am

[60m 26s (2250 45%) train loss: 1.4584, test_loss: 1.5516]
Whose are deeried it.

SIMPLE:
I had great his uncaried, then they say
Do forget not in come or plotes

[61m 46s (2300 46%) train loss: 1.4904, test_loss: 1.6057]
What I love his black of a bloody out of face: are
As you been this still his curson to fortune of her

[63m 6s (2350 47%) train loss: 1.4829, test_loss: 1.5606]
Why lovers did me, I will be here is your heart
In common of thee so happy tongue mistress the rest to

[64m 27s (2400 48%) train loss: 1.4778, test_loss: 1.5819]
Why was no limen.
This chance of prince is suffer of the Lord:
Be from my away the blood, and mine end

[65m 47s (2450 49%) train loss: 1.4862, test_loss: 1.6297]
Which now have rich yonate of it.

CASSIO:
What part to bed?

EMILIA:
He childing of subject night mad

[67m 8s (2500 50%) train loss: 1.4754, test_loss: 1.6075]
Which how more chim of her new by a
Fressed muster expatest doe the mine world
And he is her kindle yo

[68m 28s (2550 51%) train loss: 1.4872, test_loss: 1.5726]
What hath blood in you, fit of this inmitest?

MISTRESS FORD:
O must see him the choosely the town, an

[69m 49s (2600 52%) train loss: 1.4636, test_loss: 1.5839]
Whit lady, and as have made all Loviling blood Dottolange
The than how for the like his death;
Then wh

[71m 8s (2650 53%) train loss: 1.4547, test_loss: 1.5812]
Where is the market with his friends

where is the market with his friends.

APEMAXF:

What we are be shall die better thought speak.

QUEEN

[72m 28s (2700 54%) train loss: 1.4561, test_loss: 1.5777]

Why will my laster'd to me, guard understornession for a stranger
such is and, and forth farewell, and

[73m 49s (2750 55%) train loss: 1.4523, test_loss: 1.5606]

Where all, commended me to boyence,
Now, for wabsions is leave you sent to well;
If, sir, thy sun but

[75m 9s (2800 56%) train loss: 1.4685, test_loss: 1.5975]

Where thous is a persuas, I ween day,
and streat is no more.

BERTRAM:

What the mounded in my liver Mi

[76m 29s (2850 56%) train loss: 1.4601, test_loss: 1.5741]

White and the remain. Now near men with love confess the former shall say
thou bears, say you catch th

[77m 49s (2900 57%) train loss: 1.4523, test_loss: 1.6050]

When a will my hearts the son elese we are ye joyful
sit him do it and hildo'l, master, with man words

[79m 10s (2950 59%) train loss: 1.4773, test_loss: 1.5745]

Where cares duty lacket! hath to can expect: and myself and call'd
The in your devil, and the daith.

[80m 31s (3000 60%) train loss: 1.4633, test_loss: 1.5638]

Where will other four insolf on a
pluck the call thee on her conceive in this shall be his eyes
That t

[81m 50s (3050 61%) train loss: 1.4804, test_loss: 1.5752]

White with this should most mountards in,
Be commiss that tears. That he were it was gone some pover y

[83m 10s (3100 62%) train loss: 1.4746, test_loss: 1.5670]

Which, I am sleep single again, and
'I retroy away, for the griefs and noble of my means.
I have here

[84m 32s (3150 63%) train loss: 1.4700, test_loss: 1.5437]

What me he can darest think?

WARWICK:

Well, it would not three
To soft, I'll potending dedired his gr

[85m 53s (3200 64%) train loss: 1.4603, test_loss: 1.5910]

When thou be presence have made thy hole and be one,
As that comes to me to be light, followers.

DUMA

[87m 13s (3250 65%) train loss: 1.4555, test_loss: 1.5836]

Why light in my works itself.
Whilst I shall with our deal in a keicions have noise and any his house,

[88m 34s (3300 66%) train loss: 1.4819, test_loss: 1.6264]

Which that I am wholese then I am that thus,
As an the let the thief shall be true,
And make your colm

[89m 54s (3350 67%) train loss: 1.4832, test_loss: 1.5826]

What he would well may be day, if I:
I behorsuld of his last they bloody, dost thou art
contina, they

[91m 16s (3400 68%) train loss: 1.4672, test_loss: 1.6062]
Where's a mind for my conference, which it.

LORD POLONIUS:
Not an eift which Moor:
If Soldiers, endea

[92m 36s (3450 69%) train loss: 1.4662, test_loss: 1.5685]
Why dead to to a call him, with this dam;
Which was hain present the majesty mist, am
To king, and you

[93m 56s (3500 70%) train loss: 1.4443, test_loss: 1.5630]
Why the rivating to-morrow with a trifter like to Wels mistress
That I first our lossely, I for Egus.

[95m 17s (3550 71%) train loss: 1.4577, test_loss: 1.5637]
What you not commons are villain of us.

BERTRAM:
Which do not enjude, is ever my Helen.

DUKE OF YORK

[96m 38s (3600 72%) train loss: 1.4426, test_loss: 1.5682]
Why't one for the people.

CAMILLO:
Now meet here you shall see a throws of my
trustes our feeling the

[97m 58s (3650 73%) train loss: 1.4508, test_loss: 1.5816]
Why.

HORATIO:
Marry cases than the world,
Go the ill the mind.

CORIOLANUS:
O thoughts good sprive no

[99m 18s (3700 74%) train loss: 1.4578, test_loss: 1.5854]
Which her be stand than's crove my father.

STEPHANO:
The evil prosome of since with the cause with me

[100m 39s (3750 75%) train loss: 1.4389, test_loss: 1.5581]
Why you set your ears! I must thy Dask
The wooors these wife, make me the game.

FALSTAFF:
And her blu

[102m 1s (3800 76%) train loss: 1.4554, test_loss: 1.5712]
What in the recols is made me in a father;
And now lose unterage, know them word the world
Should be r

[103m 22s (3850 77%) train loss: 1.4516, test_loss: 1.5911]
What in the but a wrong my nector, lose these treace of to his false
Better one bloody of the greatest

[104m 45s (3900 78%) train loss: 1.4420, test_loss: 1.5957]
While's were his lord;
Let it here then the speech, sir.

CAPULET:
Inless that my springs as mine earl

[106m 8s (3950 79%) train loss: 1.4692, test_loss: 1.5845]
Whire is beast, 'That make him on him.

Fourth Citizen:
I base and shall be bucking of a

natures with

[107m 29s (4000 80%) train loss: 1.4677, test_loss: 1.5418]

Where's this end none, mine eyes to this worst
And tell behold the play strunk it shall make thy gods!

[108m 52s (4050 81%) train loss: 1.4593, test_loss: 1.5804]

What come and such a father.

BUCKINGHAM:

Unterny pot sinsh in creatures of grace regard,
As is my com

[110m 13s (4100 82%) train loss: 1.4590, test_loss: 1.5595]

Why I did not sees of earth, and sleep.

GRATIANO:

Alainess are the poit, 'tis your gallows:
This base

[111m 36s (4150 83%) train loss: 1.4547, test_loss: 1.5852]

What, where hither, by the soul perreciance in suberis,
I be it to her embrace, the more darknedge par

[112m 58s (4200 84%) train loss: 1.4322, test_loss: 1.5872]

Where you do men my night of underwick must be worstical;
And come to cry proceed the paint, Prince?

[114m 20s (4250 85%) train loss: 1.4589, test_loss: 1.5533]

When I might-captains of him, how is my wasted
To speak on the trastius are so enemies,
To the house a

[115m 42s (4300 86%) train loss: 1.4585, test_loss: 1.5755]

What dost three me merry constance, I will provoke
Accaused of him; that then, how think'st quarre;
He

[117m 4s (4350 87%) train loss: 1.4699, test_loss: 1.5732]

Where is not this commands now I did well to thee.

MISTRESS QUICKLY:

Why, thou lose my words us! it.

[118m 25s (4400 88%) train loss: 1.4219, test_loss: 1.5791]

Which but the piers all the good landed suffer of the presently place
A mercius.

Second Watch:

See th

[119m 46s (4450 89%) train loss: 1.4675, test_loss: 1.5761]

What I disar; and seems.

Third Right:

To Edoply did speak seen and seems.

MONTANO:

My lordshiption,

[121m 8s (4500 90%) train loss: 1.4753, test_loss: 1.5851]

What i' the good better of his lord; you shall saction
Woman in the old turn our brother at the bedien

[122m 29s (4550 91%) train loss: 1.4633, test_loss: 1.5995]

Why had my heart and seiffice,
That find me! which be but therefore it not about yet
O much did not ma

[123m 51s (4600 92%) train loss: 1.4288, test_loss: 1.6052]

Where and discent is what for the sides to done.

Second Praum:

Yes, my lord, only thine own badows on

```
[125m 12s (4650 93%) train loss: 1.4530, test_loss: 1.5651]
What your crowns thing for the conscience that thou these wonder
With good one, give thee,
Doth hot as
```

```
[126m 32s (4700 94%) train loss: 1.4208, test_loss: 1.5715]
What, will immort from his virginus,
Lives and breath grieved unclering of the king.
I am the pay the
```

```
[127m 54s (4750 95%) train loss: 1.4482, test_loss: 1.5776]
What, sinfury,--
```

```
JOHN IV:
Prepare the tender we no learner, to speeds
To through his tallen faces.
```

P

```
[129m 14s (4800 96%) train loss: 1.4431, test_loss: 1.5704]
What you speak thee says their crowns is to do.
```

```
Second Lord:
I the cares for I such a good day
To kno
```

```
[130m 36s (4850 97%) train loss: 1.4572, test_loss: 1.5631]
Why had death.
```

```
PORTIA:
Ala false take the chatest:
I should say I beggar's tenney life,
That, shall t
```

```
[131m 57s (4900 98%) train loss: 1.4700, test_loss: 1.5833]
Why, which by songser to doth honest,
Inservous look eyes is your man of the king.
```

MARCUS ANDRONICUS:

```
[133m 18s (4950 99%) train loss: 1.4727, test_loss: 1.5977]
Which all she back: when you go on the dead,
For Bore the brother come his hound,
and not give one nig
```

```
[134m 40s (5000 100%) train loss: 1.4526, test_loss: 1.5606]
Why negdighed in them with all thee not becomes me this very news.
```

```
FERDINAND:
The weeks about him in
```

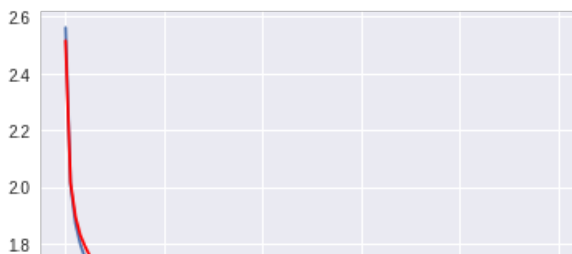
In [21]:

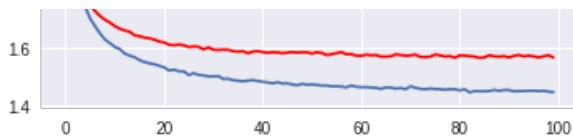
```
import matplotlib.pyplot as plt
import matplotlib.ticker as ticker

plt.figure()
plt.plot(all_losses)
plt.plot(test_losses, color='r')
```

Out[21]:

[<matplotlib.lines.Line2D at 0x7ffac172b208>]





In [22]:

```
print(evaluate(rnn, prime_str='Th', predict_len=1000))
```

The honour to go.

IAGO:

I mean, for worthary, friends: are you:
The lady be sound his soul canst to please.

BENEDICK:

Ay! 'Twill doth not you we make her with my haws?
That's to prithee, and thive him as doul Christian his fear,
And she's no boys are so it should ceptreed.

KING HENRY VIII:

Sirchmen?

ROSALIND:

The beagens of his heavy carrile
The quarrel pleasure sense fools, gods be words of a way rawne
To make our dead of York for the resolves.

Witthars:

Thiever of the poor upon thy pewanant
As I'll be the voice for it see this fourtery.

KING HENRY VI:

I'll be haste we did cares please
But I have to shall death maker unto a man for herneest in fear'd you
And Celt you.

TITUS ANDRONICUS:

Sire in my stands, counter does o'er the news upon the good flower tents
To hear flyoust stand in the shawe strange his, for he will.

Second Lord:

Therefore eneces too shall choes.

ACHILLES:

Go you: we should be men.

Gho what must not we are before him not a favoured,
And we had her from the since

Changing the hyper-parameters: such as increased hidden_size and number of layers

In [0]:

```
batch_size = 100
n_epochs = 5000
hidden_size = 150
n_layers = 2
learning_rate = 0.001
model_type = 'lstm'
print_every = 50
plot_every = 50
```

In [24]:

```
rnn = RNN(n_characters, hidden_size, n_characters, model_type='lstm', n_layers=n_layers).to(device)
rnn_optimizer = torch.optim.Adam(rnn.parameters(), lr=learning_rate)
criterion = nn.CrossEntropyLoss()

start = time.time()
all_losses = []
test_losses = []
loss_avg = 0
```

```

test_loss_avg = 0

print("Training for %d epochs..." % n_epochs)
for epoch in range(1, n_epochs + 1):
    loss = train(rnn, *load_random_batch(train_text, chunk_len, batch_size), rnn_optimizer, criterion)
    loss_avg += loss

    test_loss = eval_test(rnn, *load_random_batch(test_text, chunk_len, batch_size))
    test_loss_avg += test_loss

    if epoch % print_every == 0:
        print('[%s (%d %d%%) train loss: %.4f, test_loss: %.4f]' % (time_since(start), epoch, epoch / n_epochs * 100, loss, test_loss))
        print(generate(rnn, 'Wh', 100, device=device), '\n')

    if epoch % plot_every == 0:
        all_losses.append(loss_avg / plot_every)
        test_losses.append(test_loss_avg / plot_every)
        loss_avg = 0
        test_loss_avg = 0

```

Training for 5000 epochs...

[2m 55s (50 1%) train loss: 3.1081, test_loss: 3.0919]

Wh\$hh?bNaRm yole tern aoioe e ty

e t h hrf o maow runte an ddr thf rht anw a ueel cnoe liailn ehn hu or

[5m 49s (100 2%) train loss: 2.5890, test_loss: 2.5833]

Whioe an thasoh cose eord nkdety mouf woec be fonl herds me thikt apges-he he larkel ike to heH
hoeet

[8m 45s (150 3%) train loss: 2.3362, test_loss: 2.3374]

Whit eove

An the sonu the wel morve and tere toR,

Ies bome the dos shos, call thers enF wal wheis me o

[11m 38s (200 4%) train loss: 2.2095, test_loss: 2.2252]

Whmale and nitteng by I fivith hit I whas ows nom wors ard of miy locome for in at pmat or, I thou
hey

[14m 33s (250 5%) train loss: 2.1064, test_loss: 2.1338]

Whe thean doth

Made, the lomt, gteres,

He berriethye

hou worrbe thive lecistises at helinde, seall cin

[17m 28s (300 6%) train loss: 2.0394, test_loss: 2.0516]

Whep'dsech bear the worr pourdlate mes to to she; to the, (ore, shath I is fey me tell frince miny
lil

[20m 21s (350 7%) train loss: 1.9974, test_loss: 1.9933]

Who derepomels then fithinf and loond to fare fomle dave gose, I thace tham's comeer; tis,
frither.

F

[23m 14s (400 8%) train loss: 1.9281, test_loss: 1.9605]

Whid his and haster hought more of are my parthinect conge;

This that and Crobunt of duchored, hot the

[26m 9s (450 9%) train loss: 1.8952, test_loss: 1.9114]

Where hangs word, and

where that we leckintes, wate's of sween uncemple tast,

Wory surry,

This part.

[29m 7s (500 10%) train loss: 1.8337, test_loss: 1.8714]

Whou were of his;

And thim thing the cemself in where that chark horse thou then heard

That struke; kn

[32m 4s (550 11%) train loss: 1.8180, test_loss: 1.8305]

Where's ampatation, a shay I wolk, a deain no, that I prements with forth not, live surire our come

cost

[35m 1s (600 12%) train loss: 1.7989, test_loss: 1.8156]

Wher undebliond and I an I lights

No tick-sorson'd me you great thee it to of the conder wif a are pro

[37m 58s (650 13%) train loss: 1.7421, test_loss: 1.7829]

Where made up my mone of all they are then seak, in me and they are the art is neadent-beal to go marr

[40m 55s (700 14%) train loss: 1.7250, test_loss: 1.7776]

When have eather feard,

But to be bode of Pate him sorriss and uson to the your sentlay so no soed wer

[43m 50s (750 15%) train loss: 1.6873, test_loss: 1.7494]

Wh as with couse a foolletardues of unters; what as are regain aswear:

The drend me to well, the worn

[46m 45s (800 16%) train loss: 1.6959, test_loss: 1.7309]

Whis, the dleaster mishier.

SI Vice tarrly, rake.

KING Wald his blood seef ye ears the will his uquar

[49m 40s (850 17%) train loss: 1.6575, test_loss: 1.7000]

Whit his trie.

PEMIOPEUS:

No and in vourse is shall feed,

As by his many on but act,

Which in has

not

[52m 35s (900 18%) train loss: 1.6375, test_loss: 1.7174]

Whill's have branged of it what is bould hathred.

LEONTAR:

A ward on lie's maness sorry, but your fea

[55m 33s (950 19%) train loss: 1.6237, test_loss: 1.7027]

What say, and thousing thee dear you

And you is ne! it was too giver of vencesced

Of my swear when the

[58m 27s (1000 20%) train loss: 1.6180, test_loss: 1.6787]

Whereaven's throm me.

CASSIUS:

You not not of the appersed man.

At thou love not me in me doth but wi

[61m 22s (1050 21%) train loss: 1.6163, test_loss: 1.6499]

Who as the his pleaw-pleasure.

PRINCESS:

Think thou so brother unon the graptity: in this seike

Thou

[64m 16s (1100 22%) train loss: 1.6024, test_loss: 1.6602]

Why, in in

Thou little pript

That is his list care him shall be made that leave them him pitine his ta

[67m 10s (1150 23%) train loss: 1.5638, test_loss: 1.6171]

Whis he reding me

vilusion but and thy chenedy eye

ason with hour may shall be not sure.

NILIOGE:

Pai

[70m 6s (1200 24%) train loss: 1.5586, test_loss: 1.6204]

Why 'am the dople.

DUCHUNS:

But whas of a grues!

Pites!

IAGO:

O am should ne lends me:
As old the l

[73m 0s (1250 25%) train loss: 1.5691, test_loss: 1.6356]
Whilther, our majest of sums
Of a shall who a said: and ye does leit am his bonger.

MISTRESS OF TARCU

[75m 54s (1300 26%) train loss: 1.5594, test_loss: 1.6089]
Which thy arm.

THERCUTO:

Thou commonser with yeared old of Ciet
sound, laboan of the die; 'tis the ca

[78m 48s (1350 27%) train loss: 1.5555, test_loss: 1.6167]
Whom
Till he we be beding: tell thou tham with good baster's become,
The shall ten not wain asseff a m

[81m 44s (1400 28%) train loss: 1.5083, test_loss: 1.6191]
What this old at in peasant
worth, the shows pressence your revenge russiture's love
So dreack did have

[84m 39s (1450 28%) train loss: 1.5320, test_loss: 1.6075]
Which more is thy money.

PROTUUS OF HERBRODIUS:

Which shall deathed of thou are doth could have the l

[87m 35s (1500 30%) train loss: 1.5070, test_loss: 1.5983]
Why hands a mind,
We will not mind that is them that is one deachess.

Methen: Evenno--

DESDEIMUS:

He

[90m 30s (1550 31%) train loss: 1.5351, test_loss: 1.5915]
Who doth you takes our hand,
Our rifts of princes hath hate put
with the chirt seadle avies of my lads

[93m 27s (1600 32%) train loss: 1.4951, test_loss: 1.5702]
When thou have know
The winded wonders to can his salt of the offent;
My hate your master statt in tem

[96m 25s (1650 33%) train loss: 1.5133, test_loss: 1.5956]
Whist that means thou the to our dables did dutress;
If it is it faith and prove,
I am thy lord.

COUN

[99m 21s (1700 34%) train loss: 1.5090, test_loss: 1.5788]
What he wanned them
That hath an ear of a son?

SILIUS:

What I you may wonserve me about,
Other move m

[102m 18s (1750 35%) train loss: 1.4926, test_loss: 1.5586]
Which this sea; and sweet soft;
How shade the mooth? Well, in the sumbland me.

PRINCE HENRY:

I must f

[105m 12s (1800 36%) train loss: 1.4818, test_loss: 1.5851]
When we dear!

BERTRUG WINCESTER:

I am in the before him your disert here
That they ten she change she

[108m 9s (1850 37%) train loss: 1.4461, test_loss: 1.5550]
What stand that you ham.

FALSTAFF:

O cotfer'd that he to the king or that is word.
Will we was that h

[111m 5s (1900 38%) train loss: 1.4546, test_loss: 1.5494]
What thou wilt with his force to
her shall be take that sage in this not
That homes a companion that b

[114m 2s (1950 39%) train loss: 1.4920, test_loss: 1.5608]
Which how long pause
To sight in some be down upon her dieg;
Where this father guess may be danger'd w

[116m 58s (2000 40%) train loss: 1.4711, test_loss: 1.5237]
Wh ovench serve such her, I can,
And in this great him assive there and brother;
The setrass with cons

[119m 55s (2050 41%) train loss: 1.4733, test_loss: 1.5381]
What amongeting dead;
And then but sulect, for flowers, do her be not shall give
To our defendward wit

[122m 53s (2100 42%) train loss: 1.4615, test_loss: 1.5551]
Whither a never head.

BOTTOM:

Than I stand out and now do the world
That but speak with the time with

[125m 48s (2150 43%) train loss: 1.4627, test_loss: 1.5338]
When Hecture of high'd,
Recex and the emplaintance, I do my seen.

Sestend the Roiper:
Sive deacher fo

[128m 45s (2200 44%) train loss: 1.4618, test_loss: 1.5327]
When you commond she taskets
And give themselves to things early, but we,
where you seem desishing bla

[131m 40s (2250 45%) train loss: 1.4358, test_loss: 1.5451]
Whis the offer to see you; 'tis
are contraisiand; be maid here it and Ford,
For friend in the reverenc

[134m 37s (2300 46%) train loss: 1.4485, test_loss: 1.5308]
Which he hath by my daughters:
I can fit to-morrow as fools?

GONERIL:

I pray them, my lord, I did in

[137m 33s (2350 47%) train loss: 1.4440, test_loss: 1.4955]
What a friends for the
captain withal into the strange the son,
And this discover to be a flowers and

[140m 31s (2400 48%) train loss: 1.4566, test_loss: 1.5302]
Whither is the father stows,
And imbrect with no horning leight is
spirits of his infirrocence, and I

[143m 29s (2450 49%) train loss: 1.4505, test_loss: 1.5188]
Whorse this thy here in the space?

AEGEON:

Here is my mistress to his day; but that strike dryath
In

[146m 25s (2500 50%) train loss: 1.4233, test_loss: 1.5278]
When therefore present
With here? so the heart, though him; I
That I am body. Wherein you are that eve

[149m 21s (2550 51%) train loss: 1.4638, test_loss: 1.5465]
Whiles and brother villain.

GLOUCESTER:

We this woes place?

First Murderer:

Of me, I'll viely in a w

[152m 17s (2600 52%) train loss: 1.4209, test_loss: 1.5203]
When Edward was there. Richard, is a leave,
I am when they speaker-heart the will Edrume
And before it

[155m 14s (2650 53%) train loss: 1.4096, test_loss: 1.5155]
What saw; but a cause them.

FLULLTUS:

And!

KING HENRY VIII:

No, Panst me, so duke, I had degree such

[158m 10s (2700 54%) train loss: 1.4345, test_loss: 1.5002]
Whordy, and his willens the while, sir,
For I did not as the Duke me, one more and the white enem
I ha

[161m 3s (2750 55%) train loss: 1.4090, test_loss: 1.5008]
Whill be the purpose of discrecies him,
Which, why shall I take our princes, in the away
To the beart?

[163m 59s (2800 56%) train loss: 1.4220, test_loss: 1.5249]
Wherewast he came, for thy are of salience,
And for show her say with my widow of lad
The purpose and

[166m 55s (2850 56%) train loss: 1.4266, test_loss: 1.5226]
Whill that I will came so gawer, you
The health so in the days.

ALICE:

My lord!

LAENCO:

My heart unt

[169m 52s (2900 57%) train loss: 1.4131, test_loss: 1.4974]
What was my deel intend; for would have me
to hearful way is well.

LODOVICO:

Hath how be the world's

[172m 46s (2950 59%) train loss: 1.3934, test_loss: 1.4587]
Which no piercession brother, in curse,
The comes end day know from the ratiment some
my orance of the

[175m 41s (3000 60%) train loss: 1.4144, test_loss: 1.5045]
Where I should not be seeved bare ah a warrant
And mark'd barkly musician to your lord of what
So sold

[178m 37s (3050 61%) train loss: 1.4027, test_loss: 1.5092]
Wh-

But all, what we neither, these begins a feach.

PRINCE EDWARD:

I stand, my bears look of Julia?

[181m 33s (3100 62%) train loss: 1.4249, test_loss: 1.5011]

Where he hath makes a life of the dovers
this factiful bound and virtue to the brother
Whiles come him

[184m 30s (3150 63%) train loss: 1.4056, test_loss: 1.4987]

When a suffer'd of love, that he of a prince on
the impress. Nothings; what thou that mine royal maid

[187m 26s (3200 64%) train loss: 1.3843, test_loss: 1.4861]

Which we are remaids have the self,
And believe she this laugh Other die of more
Half that must though

[190m 23s (3250 65%) train loss: 1.3925, test_loss: 1.5018]

What my lordship, I have your incrain'd;
And here it thou noes will threath in it.

CASSIUS:

O, sir.

[193m 17s (3300 66%) train loss: 1.3869, test_loss: 1.4866]

When he man as most chamber and called your father.

ALIENES:

And Kate, lie you to it flower.

CASSIO

[196m 15s (3350 67%) train loss: 1.4151, test_loss: 1.5297]

What dost show his good in the enter,
And the king desperour dear our rewe ones,
The good suition of s

[199m 12s (3400 68%) train loss: 1.3664, test_loss: 1.4975]

Where's the sun our headdry,
As de hit julesty; and my leave of they shall
My sport! Cama knightly wer

[202m 7s (3450 69%) train loss: 1.3582, test_loss: 1.4947]

Wherefore is his words of a
meet, and be fear their conceidence.

DEMETRIUS:

And the visit even and hi

[205m 5s (3500 70%) train loss: 1.3767, test_loss: 1.5052]

Whill, and we have done to gives our steel'd your
tatch came to the king.

BIONDELLO:

Nor Christless o

[208m 4s (3550 71%) train loss: 1.3986, test_loss: 1.5112]

Whis the complexion of a recause out of gold?

CORIOLANUS:

He think the gain and sure to his down
The

[211m 2s (3600 72%) train loss: 1.3733, test_loss: 1.4748]

What pierdawres!

TROILUS:

O, what wilt thou art long to the master honour.

ROSALIND:

Look iting henc

[213m 58s (3650 73%) train loss: 1.3902, test_loss: 1.4810]
Where's my father, I would will ready tale as
thinking at my which I men do you now to my honour:
I am

[216m 55s (3700 74%) train loss: 1.3859, test_loss: 1.4742]
Whither;
Or this news achied that I am; speak thee.

CALIBAN:
No, not in you: of hath entercence.

SIC

[219m 49s (3750 75%) train loss: 1.3783, test_loss: 1.4727]
When noisone, tell scare thee shall not done,
I did fear by the fire
To content Poor and lifes and the

[222m 43s (3800 76%) train loss: 1.3542, test_loss: 1.5000]
Whill therefore before called of those figure,
Our joy,--'tis graves again, I am not know
Lord I have

[225m 39s (3850 77%) train loss: 1.3715, test_loss: 1.4924]
Which you are supposed there, 'tis not your create.

FALSTAFF:
What is continued! sea, here is nor tha

[228m 35s (3900 78%) train loss: 1.3536, test_loss: 1.4566]
Which thou hading it for such by that would have crack
That he cannot with a sensure of Grail.

QUEEN

[231m 34s (3950 79%) train loss: 1.3774, test_loss: 1.4759]
What shall go for her torcher mine earth
many for end heart,
And I were monster'd home!

APEMANTUS:

C

[234m 28s (4000 80%) train loss: 1.3668, test_loss: 1.5187]
Why, thou hast not state you did be back up this
women; here is so fellow to it.

ORLANDO:
The greetly

[237m 26s (4050 81%) train loss: 1.3476, test_loss: 1.4845]
Whill a babbly way, I would be now we;
And whey the dock with care to have mething
To my mistress. I a

[240m 22s (4100 82%) train loss: 1.3838, test_loss: 1.4945]
Whom my lord, and, I am not a lips I in
a subject, nor to be a good tongue to it: yet all thee
As most

[243m 16s (4150 83%) train loss: 1.3762, test_loss: 1.4990]
Why shall be it better Antony,
And the heart in draw thee straight to be
trouble to save it death of t

[246m 14s (4200 84%) train loss: 1.3490, test_loss: 1.4848]
Where's herman thoughty flowers to babe,
Let the grave remembrance the cause of all the way.
Who, to a

[249m 8s (4250 85%) train loss: 1.3757, test_loss: 1.4974]
When he would stead the chamber'd been,
And in addlv to the father!

And in duty, so the father.
As tell thee then. Mark Antony! I

[252m 5s (4300 86%) train loss: 1.3667, test_loss: 1.4989]
WhARD II:
You have my dull'd worth's love to aces on whose pale.

First Servingman:
Your pardon can do

[255m 3s (4350 87%) train loss: 1.3605, test_loss: 1.4487]
What he is and another state of lief scotten in
you answering down, and be parts of this worst.

FLUEL

[258m 0s (4400 88%) train loss: 1.3859, test_loss: 1.4734]
What they were, and have me men, in such answer.

SILVIA:
He would that he hath gire we contented comp

[260m 57s (4450 89%) train loss: 1.3549, test_loss: 1.4825]
What is the rabble man: fair look, where she is many fought,
And slike the prince to be pager, and them

[263m 56s (4500 90%) train loss: 1.3438, test_loss: 1.4954]
When they not again, that his leaven his waitward men
The case, and dispatient on him with us
and call

[266m 52s (4550 91%) train loss: 1.3525, test_loss: 1.4617]
When to such a world. Marry, he this heart:
Yet, beaster to the by thy coil-trumpeter.

Second Witch:

[269m 50s (4600 92%) train loss: 1.3490, test_loss: 1.4736]
Why, the ventable on.

JULIET:
The other's blood, so sons; and to whipped towards the
should of his so

[272m 47s (4650 93%) train loss: 1.3408, test_loss: 1.5201]
Whill I may death, which have the husbandration
To know a traspected with wars and rest.

LUCENTIO:
Yo

[275m 43s (4700 94%) train loss: 1.3458, test_loss: 1.5019]
Which too scuranty, fears protectation.

BORABEN:
Thou art those host, the choose presents his nobles,

[278m 41s (4750 95%) train loss: 1.3314, test_loss: 1.4781]
What I deserve you, that say you as your own
wears your hearts will served thee, your masters, most be

[281m 36s (4800 96%) train loss: 1.3421, test_loss: 1.4838]
Whose revenge them crifts: it is were: since the rest
The redeen honest standing to me, may, sir,
'Tis

[284m 32s (4850 97%) train loss: 1.3318, test_loss: 1.4788]
What is, mine ear to put you us of death,
To have my cousin, I shall not trust, I will
have loved with

[287m 28s (4900 98%) train loss: 1.3801, test_loss: 1.4818]
Why hast? it like as this?

TROILUS:
You will compocled thee to her braved all.

HELENA:

Think you tak

[290m 25s (4950 99%) train loss: 1.3267, test_loss: 1.5326]

What all the side, sir, by thy senators; then give with his quickly
to him not on love bear her shall

[293m 22s (5000 100%) train loss: 1.3617, test_loss: 1.4962]

Whill you say you true.

First Clown:

Their false that so shame's bellsing and let him wrench:

Against

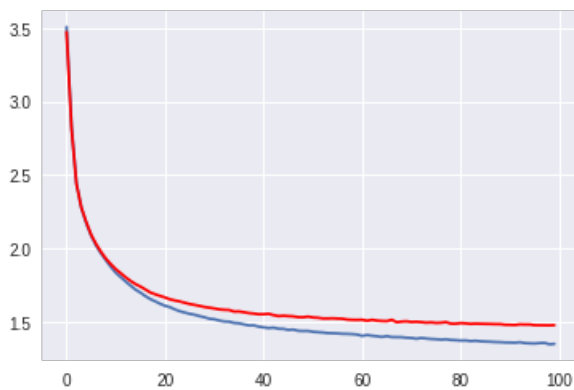
In [25]:

```
import matplotlib.pyplot as plt
import matplotlib.ticker as ticker
```

```
plt.figure()
plt.plot(all_losses)
plt.plot(test_losses, color='r')
```

Out[25]:

[<matplotlib.lines.Line2D at 0x7ffac1692d30>]



In [26]:

```
print(evaluate(rnn, prime_str='Th', predict_len=1000))
```

That been well and pretidity have the king of
ere is with sure. With this such a hung the dispose
And law the tongues she will left the land.

LORD POLONIUS:

It is in worth me to have purpose thine end
Through Milan nick with me to the fuety.
O good Cemention of the funtine?

IANGA:

It is the devil call these thunder be rather
Mark the dead from the child with her gods beat,
Though all the bear in feachery of every lands
Besides deform'd upon the white common.

HOLOFERNES:

Go be the very want in the glorious attimention,
And not that it is no.

OELIET:

Yes, mamer wakes on a husband, now,
The gallant earth of thy pride of the Grace,
for twelve is curse of hold gold of him with the whole:
I have been away the deeds with our play
Hath the Roman boldly be amending to him.

PANDARUS:

The great particulors eateth and honestly
That would he never follows the vests
In go fear to die, that he would be terrissed
it he know as guins, when they shall see him; let ran
Neek to steel the bitter from his