
COGS 260: Assignment 4

Saurabh Gupta
A53091070
sag043@ucsd.edu

Abstract

In this assignment, we use Recurrent Neural Networks to generate text documents by predicting one character at a time and then use this technique to generate music.

1 Char RNN

The “torch-rnn” code written by Justin Johnson was used to train the models.

1.1 Data preprocessing

A vocabulary of characters was built from the given text file. Out of this dictionary, 2 mappings were constructed as each character in the vocabulary can be mapped to its corresponding index. So, the 2 mappings constructed are token_to_index and index_to_token. Length of each mapping is same as the length of vocabulary.

Total vocabulary size: 65
Total tokens in file: 1115390

1.2 Network architecture and Input and output representation of data

The network consists of 3 layers of LSTM cells with 256 hidden units in each cell.
Batch size and sequence length were chosen to be 50.
A 64 dimensional character vector embedding is learned at the input to LSTM units.
A dropout of 0.3 is applied after each LSTM layer for regularization.

While training, the input to LSTM is given as a sequence of indices, where each index corresponds to a character as in index_to_token mapping. Explicit one hot encoding of characters is not required because “nn.LookupTable” in Torch, which defines the character vector embedding, interprets the input vector as sequence of indices.

The output is taken from the softmax layer, which is a vector of probabilities with a dimension equal to that of the vocabulary. The index with the highest probability is selected and the corresponding character is obtained using index_to_token mapping.

1.3 Other hyper-parameters

Learning rate: 0.002
Epochs: 80
Optimization strategy: Adam
Gradient clipping: 5

lr_decay_every: 5 epochs
lr_decay_factor: 0.5 times

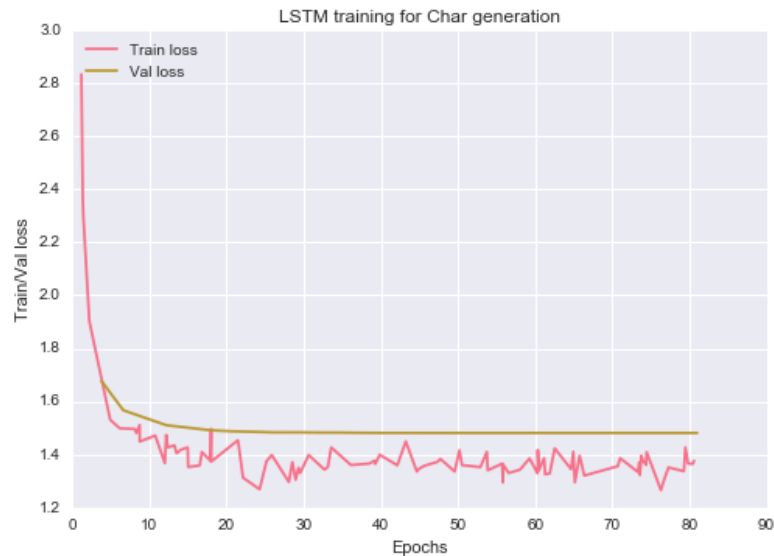


Figure 1: Train/validation loss for Char-RNN training

1.4 Some output texts

Output 1

Te thee, like at bisfex't for the sentence,
In a parter were hours in Melfstives.

KING EDWARD IV:

Spake but my son, shall self you?

ROMEO:

Gwant of the arms what hath saswer, bid it
Will wo left as one surposess pardon, a burthening with his malk.

CORIOLANUS:

Say when my tonguely down.

Corizen:

May the fire to our fortune: why, sweet Perward stones,
And bring thy tool, where is at you to to my peace.

AUTOLYCUS:

We'll neck it bear the inken prove soft-present in the mouth;
The soul; favour of us, Bamillow-'measugius,'
For now romaly done the glory by his srace,
Wither will dull no hat plint well.

Second Keeper:

And lay is need-blood?

CORIOLANUS:

All where you will not dangers. Here is it

But giving their fortune's poison, he is
Is strike them mert my thusses from those times.

HENRY

Output 2

They were recourse that I will have find ihself
It of a veins and done's fall's. Fy about young Countinae,
In the cluckens the fearful heart: afford,
A cares and gants did Cains hold me: and
Against you, 'fore like blaughter'd Henry
As myself I am one again's with the voices!

SOMERSET:

Stay you not let him fortune.

Nurse:

Why, since he say, tell me,
That that send. You have indeed not to discrop
A more things, my lord, speak'st will be no heavy
Your mother of his himbers be clume of rebate
First king to peace of pervicious his mowe.
Thou franghed their brother and Frence I want thee.

QUEEN ELIZABETH:

The like age to me to thee done the came
Be praise at oath and may be not death
to villain, by our asper, and honour?

Servant:

Nay, against him, valiant I was take with
Jeasous Crief can

Output 3

you had much.
Think an ere and never have not nor pamers!
Women, for what God in the odds that Cecond
And weep the most lands but men stand, by the king's
In Richard hear: where shall but to do the grape.

MENENIUS:

No mean, in every royal atchants,--

OXFORD:

What soiling soon to his boivate
Ert thou hear one further.

PAULINA:

He laid it hath be a man?

CORIOLANUS:

The death from sut and go?

FRIAR LAURENCE:

Thou art good high shall have conplacked.

ROMEO:
Gentle Respect life imen, if you the tates,
Like this he hath less shouts, my lord: think,
You are guess'd
Your queen nots, thus shame it is doover.
Now in mins of Histume on the Thithard's death
Are say. This arm'd to be issue. My night-is kinsmar of flower
The bids the boying impariron of the pame of right,
Thy aubate commilant race

2 Music composition

2.1 Data-preprocessing

Data.txt file was used to train the LSTM model. Each <start> token was replaced by a single character - € symbol. Each <end> token was replaced by \$ symbol. These characters were chosen because they were not present in the original dataset. Once this preprocessing was done, the same steps as in question 1 were followed to train the model.

2.2 Data representation and Network architecture

Data representation is also same as question 1.

The network consisted of 2 layers of LSTM cells with 256 hidden units in each cell.

Batch size and sequence length were chosen to be 50.

A 64 dimensional embedding was learned at the input to LSTM units.

2.3 Other hyperparameters

Learning rate: 0.002

Epochs: 50

Optimization strategy: Adam

Gradient clipping: 5

lr_decay_every: 5

lr_decay_factor: 0.5

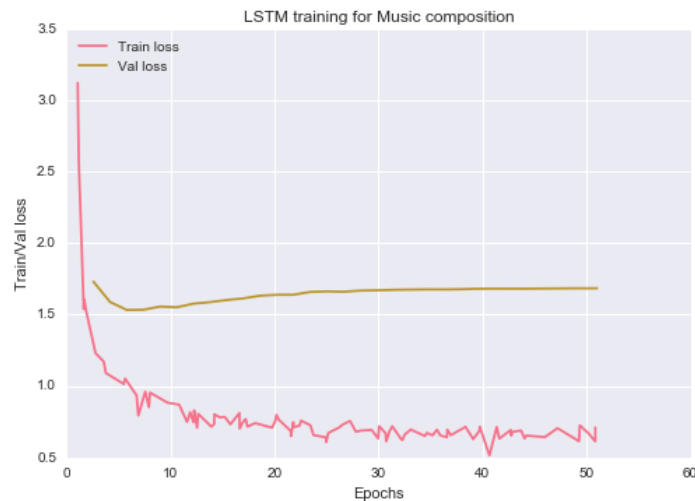


Figure 2: Train/validation loss vs Epochs

2.4 Output

The model was used to generate around 5000 characters starting with a randomly chosen character. Following songs have characters which are extracted from the output produced between €(start token) and \$(end token).

Song 1

https://drive.google.com/open?id=0B_eq8FNIEtxuNVRycGpDa0hjUIE

X: 132

T: Creed of the Get

% Nottingham Music Database

S: via PR

M: 4/4

L: 1/4

K: D

A/2G/2|"D"F/2G/2A/2B/2 AA|"G"Bg "D"aA|"Em"B/2A/2G/2F/2 "a"Bd\
|3"A7"c/2d/2e/2f/2 g/2f/2e/2g/2|
"D"fa/2f/2 d/2f/2a/2f/2|"G"g/2f/2e/2d/2 e2|"D"f/2e/2d/2e/2 fe|"Em"GE F3/2E/2|"D"DD ::
A/2F/2|"Em"EA e/2f/2e/2g/2|"A7"ae "Bm"a2|\
"Em"ee "A7"e3/2e/2|
"D"ff/2g/2 ff/2g/2|"D/f+"fe/2f/2 e/2c/2A/2B/2|"G"BB "F#/a"e2|\
"B7"f/2e/2d/2e/2 fe/2f/2|"E7"e/2d/2c/2B/2 "A7"Ac/2d/2|
"A7"ea/2g/2 a/2g/2f/2e/2|"D"df "A7"^fg|"D"fa/2g/2 aa/2f/2|\
"Em"gf/2e/2 "D"df|
"A"ee e/2d/2e|"Bm"fb Bf/2d/2|"E7"e/2f/2e/2d/2 cB|"A"Ac/2c/2 B/2A/2A|
"B7"(3B/2^cd ef|"A"e/2c/2e/2f/2 g/2f/2e/2c/2|"Bm"d3[2|

Song 2

https://drive.google.com/open?id=0B_eq8FNIEtxua2dYNDJnTGlySk0

X: 42

T: Part of Town

% Nottingham Music Database

P: AABA

S: Aneyan McCollentives, via Phil Rowe

M: 6/8

K: A

E|"A"A2E AcB|"A"ABA "E7"B2A|"A"Ace "D"f3|"A"e2e "E7"cde|"A"a3 "D"f2d|\
"A"ecA "D"d2f|
"G"g3 "A"c3|"A"c3 A2c|"E"B3 "A"GFE|"Bm"ABc "E7"BdB|
"A"c3 "D"d2A|"A"c2A "E7"B2e|"A"A3 A3::
"A"EAe ec2|"A"cea a2e|"D"fga bgf|"E7"ece gfe|
"A"a2e c2e|"D/f+"agf "E7/g+"ede|"A"a4 "A#"f2e/2g/2|\
"D"a2f "E7"gab|"D"A2A d2f|
"D"b2a "A"bgf|"Bm"d2e "E7"f2e|"A"A2c "E7"B2=c|"A"A3 -A2:|

Song 3

https://drive.google.com/open?id=0B_eq8FNIEtxucFYwTGIHR3ZEVms

X: 11

T:Oaloled Free 3

% Nottingham Music Database

S:Kevin Briggs, via EF

M:4/4

L:1/4

K:D

P:A

d/2e/2|"D"f3d/2e/2|"D"fA/2A/2 A/2B/2A/2G/2|"D"F"A7"E/2D/2 Ed|"D"AF Ad|"D"FA dc|"G"d3/2c/2 BA|
"Em"GG B|"D"A2 "A7"AA|"D"de f2|"A7"e3/2f/2 ed/2c/2|"D"BA FA|
"G"G3/2B/2 Bd|"G"Be d3/2e/2|"D"fe df|"D"a2 ag|"B7"f6|"Em"e2 -"A7"ce|
"D"d2 "Bm"A3/2c/2|"A"cd"A7"e|"D"fd "A7/e"c/2d/2e|"D"d3:|

References

Torch-RNN (<https://github.com/jcjohnson/torch-rnn>)

Appendix

All the codes used for this assignment are available at this GitHub repository – <https://github.com/saurabh3949/UCSD-COGS-260>