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**Report for Assignment 3**Due date: 28 November 2019, 23:59

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**Answer 1****Answer 1.1**

For this Assignment i have chosen the book The Count of Monte Cristo

**Answer 1.2** The text was converted to lower case, after identifying the number of unique characters the frequency of character was computed and all the characters whose frequency was below 1000 were removed. After the cleaning of data I recomputed the unique characters which turned out to be 42.

**Answer 1.5** The code for Answer 1(excluding the bonus questions) is implemented in **main.py** For the model our hyper parameters are:

Batch size = 16

Length of Subsequence = 256

Total Number of Unique Characters = 42

Learning Rate = .01

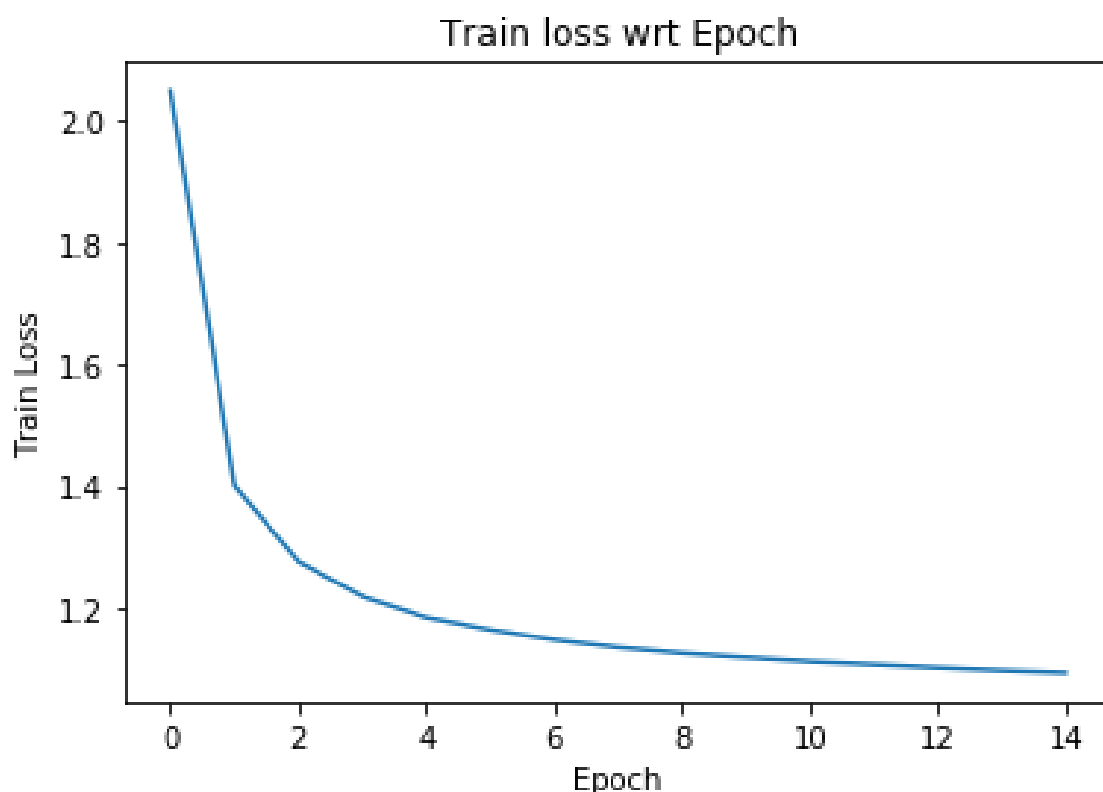
Hidden Units = 256

Epochs = 15 (trained on a lot of different epochs but for generation of better plot used 15 epochs)

Input Tensor Dimension = (16,256,42)

with the last shape being a one hot encoding of our characters.

**Answer 1.6** Below is the plot of training loss function with respect to Epochs. I have trained the model till 15 epochs(Although would have worked till 10 epochs too).



**Answer 1.7** Below are the 20 subsequence generated of 256 characters. I have initialised the model with the word "the". Although it will work for any other word or even a single character too. As we can see the model has learned a lot of interesting features with very small dataset and not a lot of parameters.

**Sequence 1** *the goed and solvent. if he had the clothes was anxious to death was all the salutation, and the false arrival to me, the contraite of the police in his words. tell them in accordances, then, he is so showed them a shreld, in accordance to the corner of the sto*

**Sequence 2** *the source which he had set the less things which he is not the contemplate the count of my mother of the same thing in the colosseum,—hopes arranged to the palais de vine of that silver, when i am to the secles which was interve there is the stones in their co*

**Sequence 3**

*the shoulder of me when he shall have surpassed in the last procureur and so solemn as a prison, with their carriage which should be a man of a prisons and motives out as he was still the signature, and any three dose of the shores. and i was chance informed th*

**Sequence 4** *the shoulder of me when he shall have surpassed in the last procureur and so solemn as a prison, with their carriage which should be a man of a prisons and motives out as he was still the signature, and any three dose of the shores. and i was chance informed th*

**Sequence 5** *the who had been ill solicit, in the sailor in her face i am now. and."*

*the strange conversation the little time his fortune, and the count was strewed, and seemed to himself to the count of monte cristo astonished her wilmore.*

"you make at my place," cried m

**Sequence 6** the count the doop to the letter on the procureur, who he had spoken at a few selection and a man who was sitting and assumed, and said the signal of his father with his health, the crair asked to her.

Om "to ask you in my sorrow and as you should be inst

**Sequence 7**

the see you spear at the same time with a most importancy when he will do the power in my husband on the count, which seems the sail."

all they called baching him to the project gutenber with some stand so shaking her corners of madame danglars. "you are said

**Sequence 8** the shoulders will so anxious to suffer that they are so promised to cloth and states,—and the least. any other, the champters in the sentinel with a more spread, and they appeared to hall, whence the first ten years, and the steward simple her father, still co

**Sequence 9** the sails, we have some possible cause of sheer than he sold it?"

"they are, then, what are you not speak as i to speak to yourself, my dear father?" inquired mademoin debray, when the secret which had not been different to monte cristo when they had left the

**Sequence 10** the carriage, a man thought the countess stars at least the steward, who shall say with the legions of m. dancers in the solemn and decided champs-éllysées."

albert and still addressed before the sacred the count and the comte she had straight his finger over h

**Sequence 11** the world and a sees and steps, and i am sure. so that i will be a sign in a straight florenting me that i hung over my master was the same. in the same morning i asserted over, then? i am no longer to permer my langer?"

"to accompany you, maximilian?" said al

**Sequence 12** the waves of the location of mademoiselle."

"well, we were collected aside, my good and talent a marriage."

"ah, sir?" asked the caproist. debray.

"you are," he murmured and rose as the door opened.

"yes, you were sitting over the person they are a messer,

**Sequence 13** the countess famous contenting all things over the prisoner. whence you most seen in your height will be sure if you shall not have been the passport in yanina, since you perceive, to you." morrel. then the same contrary, and wine, and his chair terrible as he

**Sequence 14** the girens whatever answer. it were if you speak than the same mute and any sea with an almost constant specks, i should ask me in the window of the secret to the sailors' color. then then, will you anow to make you, if you stopes.

"ah, madame."

"well, i had

**Sequence 15** the coups for the shoulders, i am so much the clock in which you have been all of them."

"truly, yok where well is if you have to be confessly? the desperate silence would entertenail is imagines to me? i am a letter than that ship. i saw it, and you have here

*Sequence 16* the count as the deadly child will attract that they were they were indifferent. they are all a senses of their service of selecting me in the lock at your sincere and two six different and more, and the left have all these two self.”

“you will, then, i am the

*Sequence 17* the gidenbole. he was called a frightful catron of the project gutenbergm electronic world in permatical and extent was not the seconds. the count will not destroy my life of the champs. at length of the shore, and as i do not see her appresensiel in my fathe

*Sequence 18* the care, i saw a most asemoron of the salon in the propect that they had sat danglars and his stewm of the steward, then; as he had told him to the servants with him and distress the steward seemed to be the conversation, and the salutation and sailor, then a

*Sequence 19* the count, with him to the gross and the steward should have said,—the first carriage stopped and beginning with an old, and whether he deserted behind, and the sailors of the same and strive who had been the charming alba in mademoisen has said then with hithe

*Sequence 20* the carriage, a shrate words with which i have no disclaimly in the prevalser of speaking of that morning he will not leave these words two were seated in, and was somewhere, but i will see you, the fair door?”

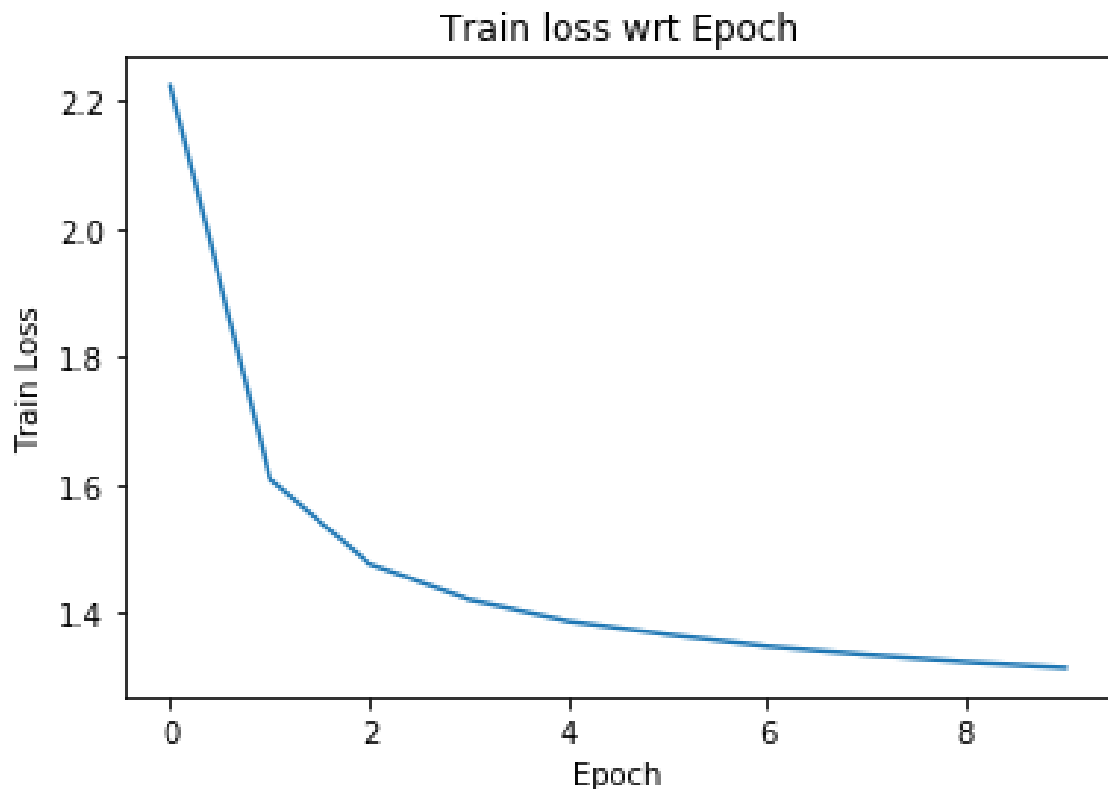
“well, yet, the distinction on the mountain of my

## Bonus Part

**Answer 1.8** For this problem i have added gradient clipping to make sure we don't face problem with gradient explosion added dropout layer and have generated characters by randomly choosing from top 5 high probability characters to minimise randomness. I have increased my batch size to 32 because gradient clipping with low batch size causes problems in tensorflow with loss values. I have trained model to 10 epochs. The code is implemented in **bonus1\_8.py** .

Apart from this i could have also changed hidden unit size, learning rate, optimizer or as was mentioned in Andre Karpathy's blog added the variable temperature to generate characters. Using Temperature is another variable which give us our model more freedom to either be more risky or conservative. Apart from this GRU model could also have been implemented.

Below is the plot of training loss and Epochs.



Below are two subsequences generated using the above model:

**Sequence 1** *the hands in the salon to a franz, beauchamp to sprung any providence of any of a matter of the compasse of marriage of to the same of my cold meaning; and here is its first start of my daughter, and the count of monte cristo any apparate is told me with his ha*

**Sequence 2** *the appearance with this state. this i would say, i trive it. how well that is that he has continued that your excellency to say to a change of such a comply as a good thing in the same tame."*

*"alas you have some person i said in my daughter, as i clear to you.*

**Answer 1.9** I have implemented the code in the **bonus1\_9.py** doing as was asked in assignment by initialising the weights of all the gates and doing the matrix computation of LSTM equation to return the final state and hidden state. The LSTM class code is also present in the main.py file.

**Please Note:** *As these were bonus questions somewhat different to the implementation of main question 1 i have made separate python files for easy access and understanding of the code*