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Assignment 4 - Optional part

(i) Modification

Compared to the basic case, I made several changes to the code part, which are illustrated below:

- 1) It seems that the performance of the network largely depends on its initialization. Thus, the random initialization of weights is replaced with Xavier initialization here: $U \sim N(0, \sqrt{\frac{2}{m+K}})$, $V \sim N(0, \sqrt{\frac{2}{m+K}})$, $W \sim N(0, \frac{1}{\sqrt{m}})$;
- 2) Add an end-of-tweet character to each piece of tweet. To avoid confusion, here I use '^' as the end character, which is not seen in the possible character set before;
- 3) For every 40000 update steps, anneal the learning rate with a decay rate of 0.97;
- 4) When the end-of-tweet character is detected in the mini-batch of training text, which means a new training tweet is fed into the network, the variable *hprev* will be re-initialized to its default value;
- 5) Change the length of synthesized text from 25 to 20 based on experimental performance.

(ii) Loss Function Plots

The basic code is correspondingly modified according to the bullets above, and the graph of the smooth loss function for a longish training run (2 epochs) is presented below, see Fig. 1. Here, the parameter settings are list, and the weights matrices are initialized using Xavier initialization: $m = 100$, $\eta = 0.1$, $\text{seq_length} = 20$, $n_epochs = 2$, $\text{decay} = 0.97$.

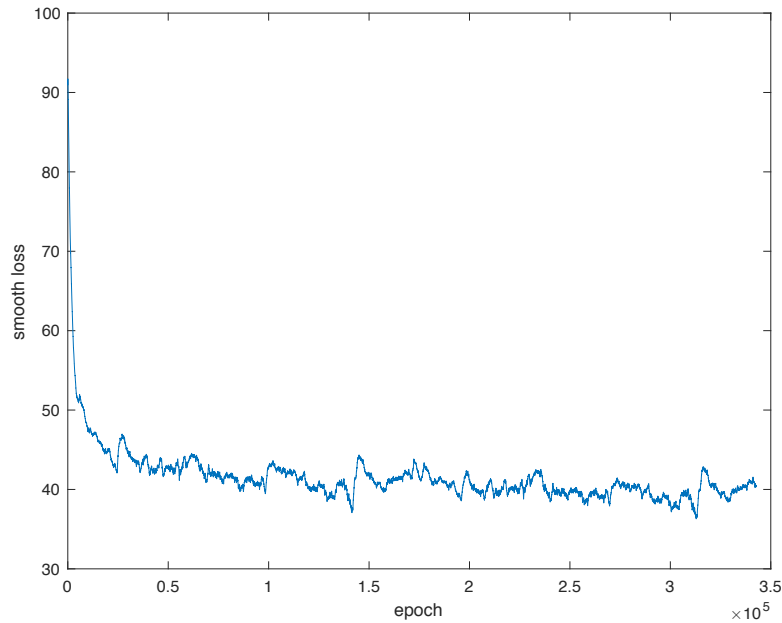


Fig. 1: Evolution of the smooth loss function as epoch increases

(iii) Synthesized Text

Here follows the synthesized texts generated by RNN during training. The length of each text is constraint to 140 characters long. And characters after the end-of-tweet character are abandoned. As we can see, some words like *Trump*, *Obama*, *lose*, *sack* and *@realDonaldTrump* seem to prove that this trained RNN could synthesize Trump's tweet with some efforts. Better results can be obtained if the parameters are more carefully selected.

epoch = 1, iter = 1, smooth_loss = 90.9179:

```
:W
O&HvTsuluvR+H7ul|
uKulugFm/mululuMu~ulu:T)umd4aldAe:'lu/ulXMblbmulC:_m5luapJA{}}ld
urululalcH_leJ'lululu:alu&ulumula:MnulalpUdloWM/uEukpWu
```

epoch = 1, iter = 10000, smooth_loss = 47.3192:

```
o't agrostalm heurs wevt hild the rile ges drly hht bot hace heop. Obaml Bo and th Deat..
```

epoch = 1, iter = 20000, smooth_loss = 45.0554:

```
lGfreTring http://t.co/L3chLXZjMS geation is eale dats as ba perectp, theppensopsref\oldm3
```

epoch = 1, iter = 30000, smooth_loss = 44.7004:

```
antece fircinvery ty.
```

epoch = 1, iter = 40000, smooth_loss = 43.1395:

```
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qultt thun hat nitt cast to cont lare thas goo ca
```

epoch = 1, iter = 50000, smooth_loss = 42.9086:

```
ne bepuspon a o http://t.co/BnKUgkJq
```

epoch = 1, iter = 60000, smooth_loss = 43.4377:

```
at of arel thowalo me she goll be in rear. #bemprignanifill- Breate Oxr in Fierising amace
for a great het for to Iur here my: @dealDonal
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```

epoch = 1, iter = 70000, smooth_loss = 42.7059:

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is tient @reeustanm is the Pecert. Gop
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epoch = 1, iter = 80000, smooth_loss = 41.5504:

iak che Dortersoratshowo affect at that Trump Dood nigutecite trump Iigh stally rurper
allenalivers of your to Obama Dole. @kicjzcaine Trum
=====
epoch = 1, iter = 90000, smooth_loss = 41.416:

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you pxorucnae, a lurelese pronerte homed tick,
=====
epoch = 1, iter = 100000, smooth_loss = 42.7181:

ortsh ping forg-to fact, stast!
=====
epoch = 1, iter = 110000, smooth_loss = 42.1852:

le ti my on thtinytademing is teand on @realDonaldTrump: Jolly! hoves are stopre butts. Se thin Sure,
I't Pwen!
=====
epoch = 1, iter = 120000, smooth_loss = 40.1524:

SSMRRIC SE Trump it very dewionald."
=====
epoch = 1, iter = 130000, smooth_loss = 39.0138:

OTRKe cosalling for treilly Me" Trump oungehts to stint"
=====
epoch = 1, iter = 140000, smooth_loss = 39.3189:

or: @AlerDonivextVB: Tromp: @lvtzeG2J11: \ud: I I vall achart!
=====
epoch = 1, iter = 150000, smooth_loss = 41.8419:

Hiag We dinaidingsting #VUMATAR NE Sshe plize @seatary8Hlit outh and ing the Rick to at defod,
prighe @Cli_ThcQin @LienaqCan20E
=====
epoch = 1, iter = 160000, smooth_loss = 41.1846:

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for the us nat! Frote httpsny, is a ot satlave s
=====
epoch = 1, iter = 170000, smooth_loss = 42.0474:

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The nith the I'temerigy cerming reburesiratio
=====
epoch = 2, iter = 180000, smooth_loss = 41.7631:

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is decternone trump @ttaikeApley @HajOback #Ar
=====
epoch = 2, iter = 190000, smooth_loss = 40.6035:

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=====
epoch = 2, iter = 200000, smooth_loss = 41.1582:

o countht polly Pregrens Budent." (vent! WO) Frechip: \u2019s 9 You!
=====
epoch = 2, iter = 210000, smooth_loss = 40.8823:

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SFryasdorterfies!
=====
epoch = 2, iter = 220000, smooth_loss = 39.8486:

." Will wow got puftry buchy thin ald is are yoom cast Making!!"
=====
epoch = 2, iter = 230000, smooth_loss = 40.9309:

rump puall @frigenfic: Chow toon's not rack Frick at a wing birts https://t.co/MVXRQqZERDW
=====
epoch = 2, iter = 240000, smooth_loss = 38.8277:

one very @Obaincorking: "#Chreaniaun: Trump you in you lote is teriluases prean the Feon Der
aby begote of the and an Cenentiffivirenes @fo
=====
epoch = 2, iter = 250000, smooth_loss = 38.7163:

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beate 20160 Deard 3 a, ood taxhing ht you are
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epoch = 2, iter = 260000, smooth_loss = 39.3829:

owandes ationally im got Making lluck toles prysis bribliamelt yout therrey A Kere pinn
nAmeccbialshet als --- @realDonaldTrump fertatie.QA
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epoch = 2, iter = 270000, smooth_loss = 38.4405:

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A no retheans jost by BEIp IGE!
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epoch = 2, iter = 280000, smooth_loss = 39.8256:

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=====
epoch = 2, iter = 290000, smooth_loss = 39.0402:

ung on we's @Make: @BBurilDozoAto IN"
=====
epoch = 2, iter = 300000, smooth_loss = 38.2214:

or the broodJ: Ly everts @realDonaldTrump Trump http://t.co/x2R020td " Stromper a gecouss in
the and's What is trudd."
=====
epoch = 2, iter = 310000, smooth_loss = 39.3182:

!. #Mikilly Mring a git herdon lose for will be @Gancaarnov: @reatAGlaTO
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epoch = 2, iter = 320000, smooth_loss = 40.5304:

lecAmn: #BC NIVE SI And Eldiadationallended shouls! he yom vating pome hame don\u202dYouth
=====
epoch = 2, iter = 330000, smooth_loss = 38.9396:

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notes the Presidet porects & CAdy. Vofe! Then
=====
epoch = 2, iter = 340000, smooth_loss = 40.8759:

a, What toment. Header of wele me & lomm Rees in turnert Obama & tecul Rastorgreate,
@rfaT Teat
#Voveskatoughth...hame tear outhe
=====

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(iv) Best Result

Now from the trained model, we pick out the best two results with the lowest smooth loss, and print out its synthesized text with a length of 140 characters. The results are shown below. It seems that more vocabularies are spelled correctly compared to the previous cases. But still, the sentences are kind of incomplete and in chaos.

```

----- Trial 1 -----
epoch = 2, iter = 312871, smooth_loss = 36.2972:

y\u201d http://t.co/CAFVRos5 @rijJarsts @ BGAG @realDonaldTrump Voom @realDonaldTrump
@realDonaldTrump @TrumpDonaldTAppanty hlderued polinio

----- Trial 2 -----
epoch = 2, iter = 312869, smooth_loss = 38.4268:

erfly #TrURNTVet: @realDonaldTrump Great don. @helledri: @realDonaldTrump #MyBuedmonty is beat
ontin\u201cn3 @Tricharumelliever feap to resp

```