DD2424 Assignment4 Optional Part

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May 2019

1   Introduction

In this assignment, we were asked to implement an RNN with AdaGrad to learn the representations of twitters of Donald Trump and try to generate some Trump-style tweets.

2   Changes

2.1   General Modifications

(a) Add an end-of-tweet character to my set of possible characters.

(b) Re-initialize hprev to its default value after each training tweet.

(c) Limit the length of synthesized text to 140 characters.

(d) Use json toolbox to read the data. (*https://github.com/fangq/jsonlab*)

2.2   Other non-trivial changes

(a) Search for good hyper-parameter values to achieve a better performance. After some searches, I found a set of good parameters for generating tweets.

The parameters are specified as follows:

$$m = 100, \ eta = .1, \ seq\_length = 20, \ sig = .01$$

(b) Use He initialization to initialize U, W, and V:

$$Parameters \sim \mathcal{N}(0; \sigma^2) \tag{1}$$

$$\sigma = \sqrt{\frac{2}{n_{in} + n_{out}}} \tag{2}$$

(c) Learning rate decay: learning rate * 0.96 after every 50000 iteration steps.

3 Results

3.1 Smooth Loss function

I trained my RNN for 2 epochs on Trump's tweets from 2009-2018(about 370000 iteration steps) and with the following parameters:

$$m = 100, \ eta = .1, \ seq\_length = 20, \ sig = .01$$

The plot of the smooth loss function is shown in Figure 1:
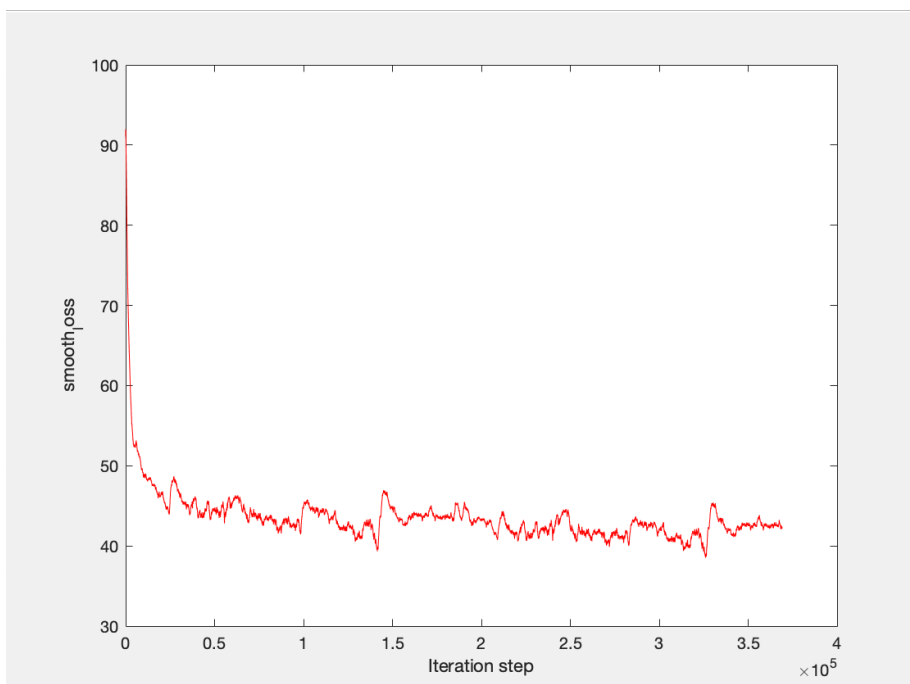

Figure 1: Smooth loss function

We can notice that the smooth loss drops quickly at first, the drop stops later on and the loss function shows great oscillation.

3.2   Text generated

I kept track of the text synthesized during the training process. The length of text generated is set to 140.

iter 1 - 70000:

iter = 1, smooth_loss = 91.0775

```
fmEToRw~s.p Y/79qCCPAMg-314WHRHI@H1WDLn3wv5d DliP]m~+DRP%cMc@U\TM}%M9b.?
%H+/1
IWB[MYILCz[nsBEom0ax5?8
OQne3l([]?x]eP0'oe[1kXThl-~W@)
RbbCpq}
```

iter = 10000, smooth_loss = 48.5645

```
obacheld. gh hsup: a wher wever chan hald makes. W.co/PBwich -she woned do hatksphtt Shesing
chat on the DuBL ht the we out eup of s h ry qu
```

iter = 20000, smooth_loss = 46.6045

```
 Yo wosling hoilly fhang donfQy wis on Cale @Ney d in reconvers pusurn, hit @RaS52^.I has
t.noveruth nscubavers a 2i20\uC019 a auges urd  @E
```

iter = 30000, smooth_loss = 46.6425

```
NR:/vontery. Hoamfry A bumpsiove!^Thand" @auplyq"R Trump "TrumpeP inendily 1non Smagyd.
VizaFoMSTrump reme coure sey Poillyt nea centiss oor
```

iter = 40000, smooth_loss = 44.8443

```
?@5: @GKalabefriau. Din Rrey l0% is to gouvasishot reliov The No thanon atton reaked yoo to http://
t.co/5DI: @reccritt psia wael live your t
```

iter = 50000, smooth_loss = 44.6053

```
oul #nob hilithy belshe, lot @CayAmeMtall &aming't no go'llassisgas son hore Surbiphingoidews bis
reakhtry ore be kishtelas.^@Jarecorid Jot
```

iter = 60000, smooth_loss = 43.4752

```
ens do the UM. Hutin  Crutulimating the The ste my fisten will bad http ofal a that at @natimie
biination and patides an is and bet in the b
```

iter = 70000, smooth_loss = 44.4397

```
anow Gsefing nillmared to the Prebliow Ftre is ne bresoding. ONTWI10Nghat cemows ix @Ml
Kstoruewi wonk(ty^"deace cagagessores."^"@Sqonstizhit
```

iter 80000-100000:

$iter = 80000,\ smooth\_loss = 43.2223$

thing InQ7^OA doife the supkelting forser preo ald ree sored twencrarts you Beoqu2L3VI5V: @realDonandTrump Ire you tuppoorer and 1 DqSaldoat

$iter = 90000,\ smooth\_loss = 43.2718$

@toremon: http://t.co/ckGOkI @jubaner_ju3: @realDonaldTrump CoOgrent he yea, doss yourtaid done etuen ethy Bed For coup on tr @jowM8AYG.^"@

$iter = 100000,\ smooth\_loss = 44.793$

onmensmovay: @realDonaldTremon! Ne bet the baird nake!! @Bcthulior--in Trump on #1roCon hors lobe onest makes ge @viffay! Res and s'mcttty!^

$iter = 110000,\ smooth\_loss = 44.1213$

y neix higinniect in @reallyLJ87NY POTRUThCR.#Vicedonade of @realDonaldTrump Fox the lebrove. Pyoum dore" pof @Trump20163pP.! In Ritquene vi

$iter = 120000,\ smooth\_loss = 42.2911$

C.^"@YJasion^I for manh @reakau225^Thoeded. Go lexsrvorthan's bud luche my't @Jardinbinimevow preale asd bald the we stors stope a reack who

$iter = 130000,\ smooth\_loss = 40.8298$

rietRomenckoulmanty a and fake wast of yin. Tounting mase stastithe make inhlyels, gead he I's mund and courgy you langhing dist thep los Mi

$iter = 140000,\ smooth\_loss = 41.2081$

7fRAIFVSO3 aders!^"@foVBeqxZ9C tolingoll os vees be tobonic Beisple of ONa kethe fleatwone will nge donure leade gorm he cou nighes theseb a

$iter = 150000,\ smooth\_loss = 44.2562$

LL2: My ring ferboned @DonabAHOCAGC! #TrumpREV5 to Menss laidg dow #Cele1519s @roundenton!^Cex SRonand forffict a vathors aghon.^I ma y and

$iter = 160000,\ smooth\_loss = 43.2894$

ens do the UM. Hutin Crutulimating the The ste my fisten will bad http ofal a that at @natimie biination and patides an is and bet in the b

iter 200000-350000:

$iter = 200000,\ smooth\_loss = 43.0219$

orslool seereterven Amadions upmetions in cistere and nith to it ray!s muloome priil tolle Amentrictime must. He shank Amdredom thing 2014 P

$iter = 250000,\ smooth\_loss = 41.845$

sratad: @realDonaldTrump geep to @NecrCrttinivy @realDonaldTrump undy to therte Thanks art @nerdiU: @rusclyonaly: Trump on : Thanks, My happ

$iter = 300000,\ smooth\_loss = 41.7479$

\u201: I way in plelsedar peace nils and And ariticas tinges will ows a conitees" Af you.-As seeding dow. It fut in Wh than'm ly bea bustali

$iter = 350000,\ smooth\_loss = 42.1736$

Was and atio rishid borssy. #Mass^Resting @TharITPS834NbLe the been cace notret. #Trump2016^See cory piess in waytrrent. https://t.co/56WPB

From the evolution of the text synthesized, we can see how the RNN was trained to learn the structure of Trump's Tweets.

At first, the text generated was totally meaningless. But it is exciting to see that in later iterations the text somehow became 'more like Trump's Tweets'. The RNN managed to generate some URL-style sequences like *http://t.co/5DI* in iteration 40000, *http://t.co/ckGOkI* in iteration 90000 and *http://t.co/56WPB* in iteration 350000. Also, it can generate Twitter topics like *#1roCon* in iteration 100000, *#Cele1519s* in iteration 150000 and *#Trump2016* in iteration 350000.

The RNN keeps generating some very familiar names including *@realDonaldTrump* (in iteration 80000,90000,110000....). It is surprising to see some of Trump's favourite words like 'bad'(in iteration 60000) and 'fake'(in iteration 130000) also appeared in the sequences.

3.3 Tweets of the best model

I achieved the lowest smooth loss of 37.7862 in iteration 326023. I stored this RNN and used it to generate a text with 140 characters.

The parameters are:

$$m = 100,\ eta = .1,\ seq\_length = 20,\ sig = .01$$

```
iter = 326023, smooth_loss = 37.7862
uremmooling is ond\ud8Rulcenniteosteute Apprentun @OPACalfiliBL Price Dovald roun fade want
love Arf @woryy he all show to @KerlateRraziB: Y
```

Across many trials there are some quite good instances. I also put them here.
It seems that a lower smooth loss does not necessarily mean a better result.

```
iter = 350000, smooth_loss = 42.5583
rerech rould UT I decte this "@TrumpBicasAzJN19td4attrin^Alloster oufing prow! Camess didsq juig
for in bush https://t.co/nq of will Trump r
```

```
iter = 326025, smooth_loss = 38.5346
, prenink to of why seid0 as @realDonaldTrump Best yats ansa borting capericl?"^"@Thisetarmp:!"
#TrumpSomiAg @realDonaldTrumpPromborr of Cel
```

```
iter = 320000, smooth_loss = 41.3046
aldTrump!!! #Leacciands zare me Yousel pants: @realDint: What say #Vaplennucerp-- of realy ho
backed makin Blation bale\u201_FrumpRAP hill s
```

```
iter = 240000, smooth_loss = 41.1503
 @toremon: http://t.co/ckGOkI @jubaner_ju3: @realDonaldTrump CoOgrent he yea, doss yourtaid
done etuen ethy Bed For coup on tr @jowM8AYG.^"@
```

```
iter = 250000, smooth_loss = 41.845
sratad: @realDonaldTrump geep to @NecrCrttinivy @realDonaldTrump undy to therte Thanks art
@nerdiU: @rusclyonaly: Trump on : Thanks, My happ
```

```
iter = 350000, smooth_loss = 42.1736
 Was and atio rishid borssy. #Mass^Resting @TharlTPS834NbLe the been cace notret.
#Trump2016^See cory piess in waytrrent. https://t.co/56WPB
```

```
iter = 250000, smooth_loss = 42.1155
dTrousRlNYlz^Vetring iny Grong! @realDaynejowertzurrep: @realDonaldTrump Thanks the a lound
long dief how thebry!^@dullasjReYkenc: @ryaud #C
```