

Assignment 4 - Deep Learning DD2424

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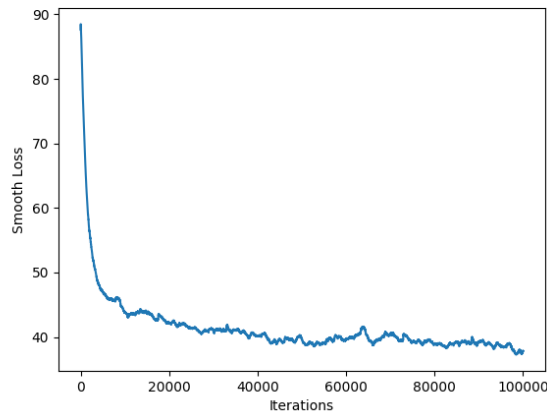
1 Exercise 1

For the fourth assignment we had to implement a vanilla RNN to synthesize English text character by character and train it. As always after the computation of the gradients we had to check if our implementation was bug free. For this purpose we used the function `check_grad()`, which computes the gradients numerically and we compared the analytical and numerical values of the gradients. The calculation of the gradients was correct, since the error we got after the comparison was of the order of $e-10$. This error is adequately small and we can consider the implementation of the analytical function, `backward_pass()`, correct.

After that, we implemented the mini batch according to the instructions given in the description of the assignment and we computed the Smooth Loss for every update step, when training for 100000 steps.

Below in Figure 1, we present the graphs of the Smooth Loss for a network where the dimensionality of the hidden vectors is $m = 100$. For eta we chose the initial value of 0.1, since we are using Adagrad update, that adapts the learning rate to the parameters of the network.

Figure 1: Mini-batch training of vanilla RNN with 100000 update steps. $\eta = 0.1$, $seqlength = 20$



Following we present text synthesized by our network. We include a text of 200 characters before the training and after every 10000 update steps.

Figure 2: 200-character text printed every 10000 steps, when training for 100000 steps.

```
Synth text iteration 0
HmaDk;UM6/s      /jCz:TX!pX9,lBlXeU/

qd-yaS_OVVTMXNCFg2?UjjCt/*gd_PcpfC)Ai^h0r6pc;D(cqsSq^0i jxuKEu.OJ;SP_B}rV^g.BomzC!({}D?"
ip!-4VEKpLBfkXZG G6gpqxivQN7?DnHmbiewBiTU/üXn/hQhyU}      ,,D3BzvT3EY ürv-ü'PxZqpHhE^4
```

```
Synth text iteration 10000
m. Wasp a deatint sas was Harit hoapped Ml was anganny magryo erloted?"
Hor foyseis he ons the kHounk"" heim Midle,, buged et arry. An. Whe Mept theis" free do
isherad.
"Yoverry dins. . Waok, staaronk
```

```
Synth text iteration 20000
Hadroowond wizarle his meds be hit hif be bein, He rloken in quar terno sond watesaply
so ture wordy aid ook.
"An't was newbione ax pout'd . swrokilk Harghige thatringotsuipict and s of saleun - se
n t
```

```
Synth text iteration 30000
vE's Ron hou they them, so Iry Rondoneryen up," they ree! Cnald agont to to Elingled i
n sup then hadp ssal oversamed and he sakove and, in his andiks bathod he on, de you hr
Harl Rot woy Hermoof a wh
```

```
Synth text iteration 40000
6
"
"rand. The shand and heaved chenupon sod hearn hoafint. "I looks ofe to hingintwar.
. HarryLsso see off mirl. The misting dould at anked betas monk. Andsto tlofering unc
hed you fekeap her ted
```

```
Synth text iteration 50000
domd; and in and when as had hard, - whly hlly and thangp, whe kudof loong monter thenk
said as his stimer. He wat through, revered by, morting Harry mand that the wis encer
t of Voldes wormerlling ve
```

```
Synth text iteration 60000
kApen's as be 'im and the was of for collion crink from Warry hadn't here the feathoug
h theney aw-Eny, Pearter of hid and shat scusail very just enower shout Ceys Voldey, b
us for that geplay Mrted a
```

Synth text iteration 70000

.
"Thit his jain stissered arn. -"Efo for was, su
rsed and Eadon menie? and. That thop ta pollousl, shevening themerne now, mang in't yo
uzg as twos oun a jemestid strop heas was thifre slowped.

Synth text iteration 80000

hD Prom Hagridn't - Kiggilf afoust and donet, blyaret. Agh thes exiced seit Baglieven
in it.
"I klopoarong fremgaplioned it mid yheir aless, an his sein aid bellus."
"Ifo stoppes thasks when of happ

Synth text iteration 90000

s and looder that the gob ith the soinden of Filed as seif as, for beampide the whas, y
nem Ghuth have acd suppoencuttarer to hat yeu sas stapped to Courd thith gown was grit
es op. farce badging him

From Figure 2 we observe that as the training goes the network can actually synthesize words existing in English vocabulary and mainly words that are really common in English like 'and', 'the', 'it', 'I' etc.

Finally in Figure 3 we present a text of 1000 characters synthesized by our best model.

Figure 4: 1000-character text synthesized by our best model!!

Synth text best model

Nr."E supeap starplerstruice. Harry, in a from said, getteriom.
Iir go was. Harrviride ifthing he gramboll were awatchedding was sionpnottedparts, of
had aired having into was beghtin sfishing incigh an-ook."
Harry look to whown of Buck of bearmarary; searly. "The fagged was hears, sid. bestri
ng.
"You evere, and badgan anssas in of digh wofo in thrum heverly!"
"You's thatcy his hart and has Quipess," said Hermilling antonny," said Ring that, got
the haw hainis, were of to a gomunzeds rimed.
"Whoawping he's lood to now sloted who witare's vould. Colder peech" mave himan former
onging. "He nove!"d behindosed, air now mere sooridles lollizedlanisablyswinted in?" H
ermion I was back of Kremping, theins with them chand was (sear the hismed. Beation so
slogking crocke in shady a staristed slewgins was nee turnted troon wask in breave beni
oned for yooring thluth his lake to minn't aw. . of the liklerorbe heave pitted of muro
rs in thintant ha winaint to rearn. PThem. "Herwiell of the Pant

As we can see, most of the words exist in English language and even though the text does not make sense, we can see that the network was also able to learn the form of the book given as input (e.g. quotation marks are followed by the verb 'said'). With a more sophisticated model than the vanilla RNN we might be able to synthesize text of a better quality.