

# COURSE: DD2424 - ASSIGNMENT 4

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## Q1: GRADIENT COMPUTATIONS

State how you checked your analytic gradient computations and whether you think that your gradient computations are bug free for your RNN.

A1:

I calculated the gradients numerically as it was suggested in the assignment and compared these values with the ones I derived analytically. To check if the computations are bug free, I used the relative error formula given on the [Stanford](#) page:

$$\frac{|f'_a - f'_n|}{\max(|f'_a|, |f'_n|)}$$

Where  $f'_a$  represents the analytical gradients and  $f'_n$  represents the numerical gradients. Max relative error was for grad\_W ( $4.5395022299828325e-06$ ).

Parameter	Value
K	80
m	5
eta	0.1
seq_length	25
sig	0.01

Table-1: Parameters used for Gradient Computations

	grad_W	grad_U	grad_V
MEAN	5.721857655398036e-07	2.0073072354229825e-09	7.648515785404735e-08
MAX	4.5395022299828325e-06	1.1291280754341362e-07	5.403300733099425e-07
MIN	5.40208728428326e-09	0.0	8.06930618392259e-11

Table-2: Relative errors between numerical and analytic Gradients of Weights

	grad_b	grad_c
MEAN	4.217786027707498e-09	1.3895726298730234e-09
MAX	8.756013561045187e-09	1.8782966366826153e-09
MIN	1.5056811658156454e-09	1.6559669038602898e-10

Table-3: Relative errors between numerical and analytic Gradients of biases

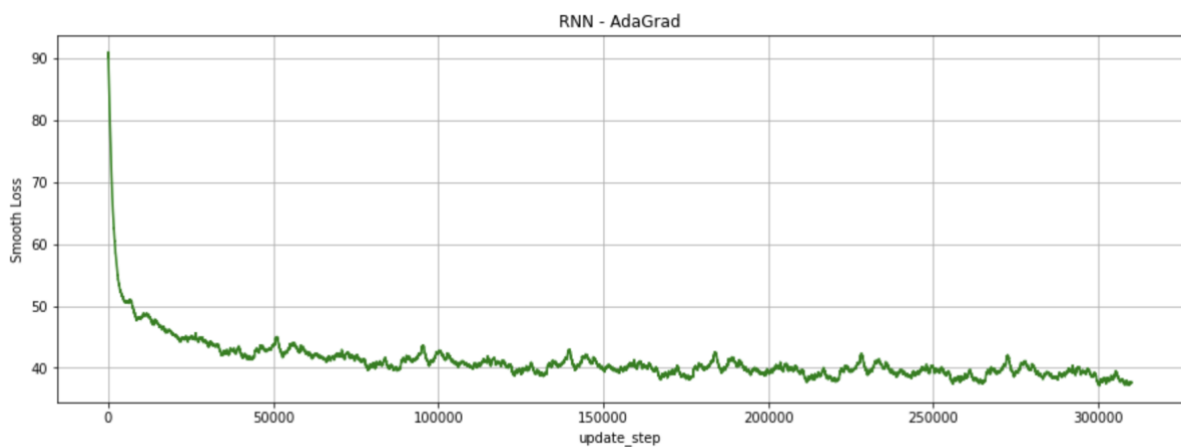
## Q2: GRAPH OF THE SMOOTH LOSS FUNCTION

Include a graph of the smooth loss function for a longish training run (at least 2 epochs).

A2:

Parameter	Value
K	80
m	100
eta	0.1
seq_length	25
sig	0.01
n_epochs	7

Table-4: Parameters used for Training RNN - AdaGrad



Picture-1: RNN – Ada Grad Smooth Loss by update step

## Q3: EVOLUTION OF THE SYNTHESIZED TEXT

Show the evolution of the text synthesized by your RNN during training by including a sample of synthesized text (200 characters long) before the first and before every 10,000th update steps when you train for 100,000 update steps.

A3:

\*\*\*\*\* update\_step: 0 ..... smooth\_loss: 90.18372351968591

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4flfCHBT2\_uR z'KQZswk/SLIk/ü3JYM03Z;rUxn97p\_kBXzKHk1xL.Ltl6x1KMtM}fx3,'cSF(EFp4Gp  
Z9W0 ijk,DWgGd  
YTFNA'axfVn1mTWMZe\_Fü^npQNPox2,FZFQ\_mnS;;jL0q-UaWH-6qE\_"HUb

\*\*\*\*\* update\_step: 10.000 ..... smooth\_loss: 90.18372351968591

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harrse torillsy hermars?"  
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\*\*\*\*\* update\_step: 20.000 ..... smooth\_loss: 45.275206236112766

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, aid ther'd hirs, bagn. Bit he hid - and Real oo sough eaghted," you  
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\*\*\*\*\* update\_step: 30.000 ..... smooth\_loss: 44.02861031888586

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pper, a some be whitenely. Her gas Non eavorts fivelgs oo

\*\*\*\*\* update\_step: 40.000 ..... smooth\_loss: 42.798313717351114

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urshrout anked thooking thing hes raben; Vordor often pome Treft gors,  
was wandedstacheved ret stingles bry at and Harrim, masen

\*\*\*\*\* update\_step: 50.000 ..... smooth\_loss: 43.637645450952874

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ngly and was have wyovery has upzing mene might. Hhenly a

\*\*\*\*\* update\_step: 60.000 ..... smooth\_loss: 42.41268752881072

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hiu by avor slange, cooned it hir forir moggold harm theme did that it.  
Lroughtings, shant."  
"Ge've it havustially by deed, Hand

\*\*\*\*\* update\_step: 70.000 ..... smooth\_loss: 42.05942290065522

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Bumbeto op?" said Flets he kefting now" Dor. Rand were offe the farve.  
Thes obIouse. Harry wazarmy "Head sace not

\*\*\*\*\* update\_step: 80.000 ..... smooth\_loss: 40.45303970326621

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dayeblinger as'rond nother at and suddoundoutly?"

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"Dumblize lake a swaafy. "Bo the lath, was

\*\*\*\*\* update\_step: 90.000 ..... smooth\_loss: 41.05749847589323

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cak Fill clower the curley, them kand oWher me grother wazcrss? Snoped  
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\*\*\*\*\* update\_step: 100.000 ..... smooth\_loss: 42.20117163248899

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\*\*\*\*\* update\_step: 150.000 ..... smooth\_loss: 39.7850998238802

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inkenting for Crouch a more whobleood bely hour and its of flanded's a  
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\*\*\*\*\* update\_step: 200.000 ..... smooth\_loss: 39.46531265367112

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ack poice mowned sint -'W han blinger. . . want, and te'll, tehing ffor  
-baulding, here ses!" said Hoglle, but do the Deast, ow to

\*\*\*\*\* update\_step: 250.000 ..... smooth\_loss: 40.17442111034912

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trred the Cighter live he hid simptiok, compluldy its terozing the slen  
ineve Preeps cincros aid put speiled, raly beet ap voive s

\*\*\*\*\* update\_step: 310.000 ..... smooth\_loss: 37.63871074327056

as ned Crought. I right.  
Harry sack. "Enwy, and bel" pulled a soment. Gown quartres, clulmled  
what the curdory, Harry one whink all of keed, But younten of whime to  
black, that Harry taskhing pair

## Q4: A PASSAGE OF 1000-CHARACTERS

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A passage of length 1000 characters synthesized from your best model (the one that achieved the lowest loss).

## A4:

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The lowest loss was at the update\_step 300391 with the value of 37.14203943906468

\*\*\*\*\* Best Model >> Synthesized text (1000 characters):

iveres weir to gourge.

"They bay nevions then but She, thent it was Gry you dy harh antigs, on  
ly about aventroons everyparn, givengered with the know old?"

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ocketthere them and Harry. They was would-foom into the back, his fit  
tting at Gorried wive bleothed erse bight intucks, sirausn't is to mefe  
ps was the had mose."

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"Not ezormennlels than a stay and acounxtring your preas of himleed and  
that chose was at myed on the shacorme it wold, and Harry. The going  
Morted on him when in her red arrive.

"On," said Harry. "Well, shear danly all loyew him Viktor thought tell  
wers."

"Mr. Crous, hove tecored to the bange.

"I eye hend. he hade Aps' about her cave?" Maxtmen to by then in the w  
alls, you been suieventince of, Sefused keep. He chose," said Fres."

"Hermagot ovo," he say judged from when feem on the trouk, That houseat  
led tIries that thing your, will in