

Homework week 4

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1 Validating Gradient Computation

The analytical gradient computations were verified against the provided numerical gradient function. The numerical function computes gradients for each parameter by perturbing them slightly and observing the resulting change in the loss function. This change is then divided by the perturbation size to approximate the gradient.

The implemented analytical gradients were compared to the numerical gradients element-wise. A metric like the maximum relative error or average relative error can be calculated to quantify the discrepancy. If the errors were consistently small (e.g., below a threshold like $1e-5$), it would indicate a high level of confidence in the correctness of the analytical gradients. We assess the relative error ε as:

$$\varepsilon = \frac{|g_a - g_n|}{\max(|g_a|, |g_n|)} \quad (1)$$

where $\xi = 1 \times 10^{-5}$ is the numerical discretization for computing the gradient, and g_a and g_n denote the gradient from analytical and numerical methods, respectively.

Table 1: Gradient Evaluation Metrics

Gradient	Absolute Error (max)	Relative Error (max)
W	3.06×10^{-7}	5.36×10^{-6}
V	4.11×10^{-7}	2.71×10^{-6}
U	2.34×10^{-7}	2.71×10^{-8}
b	2.1×10^{-8}	4.11×10^{-8}
c	3.1×10^{-8}	2.48×10^{-9}

2 Loss & Text Synthesis

Multiple instants of the synthesized text is printed along the training stage.

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1 Epoch 1 Synthesized txt:
2 v
3 'QtG1"S!gi!aZ2qzvqhPcbn/9"N?Nf(L.W4yiwPQa-f wcNjnJS
4 yQktXd"/NDpEzq
5 ow6zh qW.E}MzEr0-;wn,oYMci7MkC : D j d h j L y1AN ?!(0.1 e7 "nzMo 'I ZYGSikJ ;DkD3MV4!6
   DfEjNwm9;U6M}TJ.3c_JsHF? "}c-J2vJe6eyTDZIfc9N 0zhS!
6
7 Epoch 10,000 Synthesized text:
8 he milkle, uowcin marrea frron.
9 "Mxpin" said Ha hith. Ban aopouif hapmad therdmeding lhery Ebear,"
10 "Er) tubene Rouths, Weat an Wean,"
11 "Iss heleiR beyouich ito garly."
12 "Mr Harpining sadt- on to wind
13
14 Epoch 20,000 Synthesized text:
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15 one and for, he dack fire - oee the, caid. "at wate ceackid youthing hisen," Harry he
    hat ale ganw foring him - Ofockid ong My. . ally aplay. Sand leam the kRat a didkent
    ot tond I dow in Harry has
16
17 Epoch 30,000 Synthesized text:
18 ack this mowly, ands overed booked bool -fobly puoge, thater," tre.
19 "Comm.
20 Klad fromit the she knowe a deak, stry pall luon thea he lart, haw tharr; gombinthing
    stoot lean and curle and crestlaurent
21
22 Epoch 40,000 Synthesized text:
23 theis nothpiont a colw've hapreling the Duvenlt the prentt of It atlicl Vofcetly fel
    there. Now I thine.
24 Meos noth and surt gooringort seall wenen't the meantts wos Dandsiok; of themsierting?"
25 "Bay
26
27 Epoch 50,000 Synthesized text:
28 and they wizandy to yould. Mr, fanntwiziot -"A grey fet touth lack Chem as alyem
    trimes thote an a mimtand hap aidmite in's sploment up tizarnet then, mookeliy the
    coldor," "And pall the Ron a te bo
29
30 Epoch 60,000 Synthesized text:
31 n olstly, of rut bharone the thion to they and ood then a kne liblely alow," earry arrus
    ,?"
32 "Yoined saide theyon, ewion pall to deaty of Hemmer dowarwas," sall - her Mavenseplis?"
    seablest in of whe
33
34 Epoch 70,000 Synthesized text:
35 lppair,.
36 "Arould beenw -" Dumblooded sie pally. "But with they be infurmste sto nepain!. .
37 Ssee anim to core the - aps Ron'led and Robbie was his a pulped ofser lookin spound his
    wangitil levory lanf
38
39 Epoch 80,000 Synthesized text:
40 ad of terte sind hiby the at end you helf that the ways tottre stiled wald the aime to
    to foblang one chat on the forry noveym of Mwordainione Harry madeserd as thim of
    here donded se lutu, Hermoones.
41
42 Epoch 90,000 Synthesized text:
43 s, out doers carnawd, hasking creps the dirk Earge. "Ne that was the hous foryeh and
    itionow mads locking has he straed, and hach wored. That tricy dirtly.
44 Theag ar mage dighe pelt his, wo diddern
45
46 Epoch 100,000 Synthesized text:
47 he ware syee dokin losksed- able whech.
48 "I hay extertared a pecly seme.
49 "Oll, Yes, with seff they, reaned y?" said Harry. The Murd ingulf sao sime it," sit
    palny-end carampeary tleat saided on bad is

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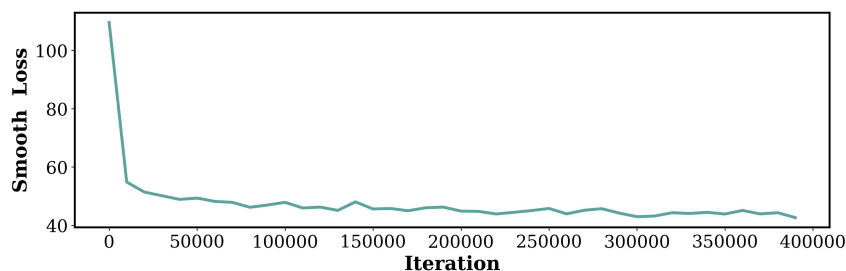


Figure 1: Smooth training loss.

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1 Epoch 400,000 with a smooth Loss: 42.611341744587286 and Synthesized text:
2 EKdEd blarmy, sortury at theivens igpore, sponto not, eyay," said Faking down with on he
   seilly, see whos his suppous is beel it and Skarxy, and tay slobbered."
3 "Dady comen! oright. Dedobly a would yoa geve Earing his to pobling tow your quith on
   them awaym. It way is the arrupatter a the ways skees timorod seound of My. Frkings,
   A strombstrick to wasted iging nouff tile's bemer up but the could that the sminst
   neeme, weren," he. Mrssimed as Dumbledort," said He wizald to combrestusing hes wow
   Schefulbortedy you.. His Harry!
4 "Saming and the could tell. A wizenet my mook Stest before, and tain got Harrid Quickly
   with them his of his will susulled were disnout now maugh you's, shimpaded not ssown
   kucth to look, he didn't mord fooniver low, agaid Pooncling it are happevuking to
   these, I maked Harroud he were bemre sup, in the surrily reild, wast's painept," He
   Ronce mow takes," said Cerul somo't!" up gight in you wall huppeth and Rining were
   he hord," said Butdlouling, under a through

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3 Code

https://github.com/Laicram8/DeepLearning_2024