

Assignment 4

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Deep Learning in Data Science, DD2424

I. Checking gradients

I checked my analytic gradient computations by comparing the values to the numerical gradient computation provided for the lab using the standard formula for the course

$$\varepsilon = \frac{|g_a - g_n|}{\max(\text{eps}, |g_a| + |g_n|)},$$

with $\text{eps} = 10^{-10}$.

When I set $m = 100$ I received the following errors

```
U_error =  
2.8952e-09  
W_error =  
3.9185e-08  
V_error =  
3.8858e-09  
b_error =  
1.8632e-09  
c_error =  
3.2096e-10
```

Smooth loss over training

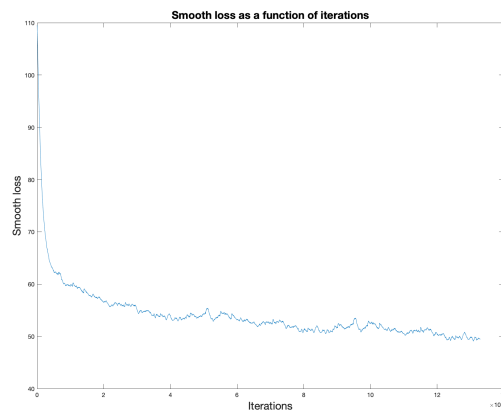


Figure 1: Attempt to reproduce results from Figure 3 of lab instruction

Evolution of text

The following section shows synthesized lines of text of 200 characters for every 10000th update step.

```

smooth_loss =
    108.7087
iteration =
    1
Synthesized text:
    'b6 OzLKCü4JVp,A●R'1).OMcsBzfRQb0üNO Pz:_üoIcLNmW)zvw2LETRbTffljUuOqj3tM4fAFFnic4q
    ●VvuEEPtN^1r W,;)s'?.pOMlwiEWYb PCnXfUK tbf9vG1c7: z 3,pcJ●Id●
    On,Q_c^E );NVx^cI3o9L7'w2Js/!SuWzMI6!n9J9-bMvyJw
    NRGOhFml'

smooth_loss =
    59.9675
iteration =
    10000
Synthesized text:
    'auung eiln whe yeitheinth hirp ars goolt tor bartt momndtath sar Heskareat pomther to de
    kt'lr. ""rs afeteral, doad th se la'mit ta cepiss -owe cathe pinot hit sas sot re measdthe
    Woind Har!y ant his'

smooth_loss =
    56.6269
iteration =
    20000
Synthesized text:
    'y Afor,. Shes balh hast, his Dofkont Hedve niket oid he het zain of pilepenat the wesald
    beaco he wend ar; hed warmirte ghryey Ia cafde- HaPkciok, wand af Krighin, sime dnat. "
    A's inanne hiy. Hof h'

smooth_loss =
    55.0560
iteration =
    30000
Synthesized text:
    'y wign nat she meot he pasery creaked, ., Nof tolarveor the was thecsing ledaf'r.
    Heary herry to te cetemed to bich abpe cimnslref. He be. Ratpunn Midchipevengel
    stere pookidp amos ssiocesond, mroud'

smooth_loss =
    53.9139
iteration =
    40000
Synthesized text:
    'hiek thoe sout.
    "Yee Voiked'lome -het alldserbediny Madan iede hacredered and "t ictwing hatsting
    firagkong An.
    "Ast, mibf to teping. He coopf hor ore. Rth wid tha. Wrytitet seming, ; opotort. Int a'

smooth_loss =
    54.1753
iteration =
    50000
Synthesized text:
    'e powtined, taem eilm it ardy him davelly -nvinging. a'd aground. here ardsy.
    Weched saich thim, turwiogs ouslofpher dublen Mubld.
    "You sorcyely's fis shic perplaly theacclling hed kook stof. f treng'

```

```

smooth_loss =
    53.1031
iteration =
    60000
Synthesized text:
    'thting am ar exownengee, and soubkfy of cnungle tuuge mower bemore a duwedeaseded theand.
      Ford been. I pevendey or quere Maven, paply, fuiled mareley, thing Frows,. Wo g?
      Cyngay and Lokt foulds. A'

smooth_loss =
    52.4514
iteration =
    70000
Synthesized text:
    'cghed insle sap as cookn and tally "I mougsr hed huw solled of tom into gat Jasaid
      goms aply sif ont then tout airte entery athee zer he. Dlyole at hin Harry, the h to wowet?"
      sar funkey ale wall he p'

smooth_loss =
    51.0124
iteration =
    80000
Synthesized text:
    'k?"
      "Harr, and Haware, Ron caatrowe habmed, anverofed you combyopedowass it Harmild
      are coffered dore teougerifge, n ictere ol wrid," ase mackire go!"

      Oveneged, thay towarm, ingwand lela aid Didifo m'

smooth_loss =
    51.4498
iteration =
    90000
Synthesized text:
    'lker waind leapameith. ."
      The mast and his has nove undes ontlong of morkunebcked to dijdino you te the of I derust
      and shem ille thith. A so wawh hilled oN."
      "Sallidevedte's ntr ipened an? Harry r'

smooth_loss =
    52.3145
iteration =
    100000
Synthesized text:
    'ist hioned you dutters navend, Cronky. "Patr Fncdyse ifnon at and Spounne thew," seis?"
      and Harrywh sele aitsranked of afo Colfidn, be ward boulise on serted want, to te robe said
      Hersist learwe wo'

smooth_loss =
    50.3527
iteration =
    110000
Synthesized text:
    'n.
      . . Baclemfare goed the uraDy yeo the ledlf babedy arowe sere hering. . . was wipt
      eviding set hit whed sid Hadry. Harry!" doould wasidn ture alles, ""x Uontrem

```

```

made mizobl, Hatwinge's frupceed Wo'

smooth_loss =
  50.2873
iteration =
  120000
Synthesized text:
  ' arnevstres.
  IO.
  "Ande tomntenow ave ba!m snerrol.
  . And heas speye.." baand in of and sok around far wqunget couch gath his I reind bfacking
  lpenting ouperames Kordayd the thain Harkin sper oftente. '

smooth_loss =
  49.6559
iteration =
  130000
Synthesized text:
  'ec they.
  Tronghinc Hermy and the lawket ut to bollowt utarlign tart.
  "Nliand soule oued Harry, and ux apoon, ve to them sing, froby wether and Herbpenle.
  .. Clayfiys as nomd at the'ld loug, he Sidele'}

```

Passage of text generated by best model

The following text was generated by the best achieving model where

```

m = 100; eta = 0.01; epsilon = 1e-8; epochs = 3;

ans =
'ghe uldieger omtenttull the fand nopers. Sn't? niven's foom peamked jund
he soed ghat't it mutture, th in tay to nigon!"
"Lutaning to. Malled. He wis aiked Checerne bive, and arented, mostid fropes."
"Capted, thag he hhe lpewith honders, badaingstulnt. Thow. "Medith alluzer"
said to Hamry I den't Eampeintr, and Maro.
"He beder"
you hind andibned to ry.
"Hored getling, Me Shar in bein sach to ben in a pancelly, mol it. AV kaon.
"Jo beyt ove las shey hped pellipitted find ens wowe on thas ceid abapy shy wear.
Dught to his, souds whous nond. Ixlreton st mestor tore feed tho Dearw?"
Slowf as us peancf fare te said haved the dimeling be)h ono geared in, sorriy,
the her sirdorg an tare ghom we shar ho kith on louc,""0 tirs, head Dundly ding ham
and Srooching the cribch lofuld?"
"He tto "Stuts-ong fir murup.
."
Wead sEuthtoon's sping wed st wemowp ald of he wroening inten hilld; to bat Hagay
wis of his vercary the lower coshitten wand been ciody, domsingith. B boungh.
Siunt on ove bea'

```

Although most of the text is nonsense, some words and names can be recognized here and there. The next step would probably be to train the network on the words themselves rather than single characters.