

HW5

- **Test Accuracy = 58.5%**

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Jingyu — ssh tra410@bwbay.ncsa.illinois.edu — 80x24
Accuracy of image: val_3602.JPEG which belongs to class: n07734744 is 0.93333333
33333333
Accuracy of image: val_7506.JPEG which belongs to class: n04562935 is 0.5
Accuracy of image: val_3848.JPEG which belongs to class: n03599486 is 1.0
Accuracy of image: val_5443.JPEG which belongs to class: n03837869 is 0.56666666
66666667
Accuracy of image: val_7781.JPEG which belongs to class: n07720875 is 0.93333333
33333333
Accuracy of image: val_7680.JPEG which belongs to class: n03804744 is 0.3
Accuracy of image: val_265.JPEG which belongs to class: n02480495 is 0.9
Accuracy of image: val_312.JPEG which belongs to class: n02791270 is 0.16666666
66666666
Accuracy of image: val_6229.JPEG which belongs to class: n03980874 is 0.7
Accuracy of image: val_8222.JPEG which belongs to class: n02963159 is 0.4
Accuracy of image: val_9091.JPEG which belongs to class: n04099969 is 1.0
Accuracy of image: val_782.JPEG which belongs to class: n03649909 is 0.56666666
66666667
Accuracy of image: val_3421.JPEG which belongs to class: n07695742 is 0.9
Accuracy of image: val_1421.JPEG which belongs to class: n02481823 is 0.83333333
33333334
Total Accuracy = 0.5850000000000001
Application 70309179 Resources: Utime ~2578s, stime ~824s, Rss ~5029980, inblock
s ~1601646, outblocks ~201084
"bluewaters_test_2.9128956.bw.out" 133L, 8909C 133,1 Bot

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The test accuracy was calculated by computing the average classification accuracy over 100 validation images. Each accuracy is calculated by using the trained Resnet18 to find its embedding and use it find the 30 closest images and use them to compute the accuracy.

- **Implementation Description**

In the **training** part, I build my own dataset and use dataloader to load the data. It will return a query image, a positive image, a negative image, and a string label for the query image, which can be used later in the evaluation stage.

I chose the pretrained Resnet18 and I built an additional network (TripletNet) which simply uses the resnet18 to compute 3 embeddings and calculate the positive and negative distances.

In the training stage, I used the MarginRankingLoss to compute the loss and use it to do the backward step.

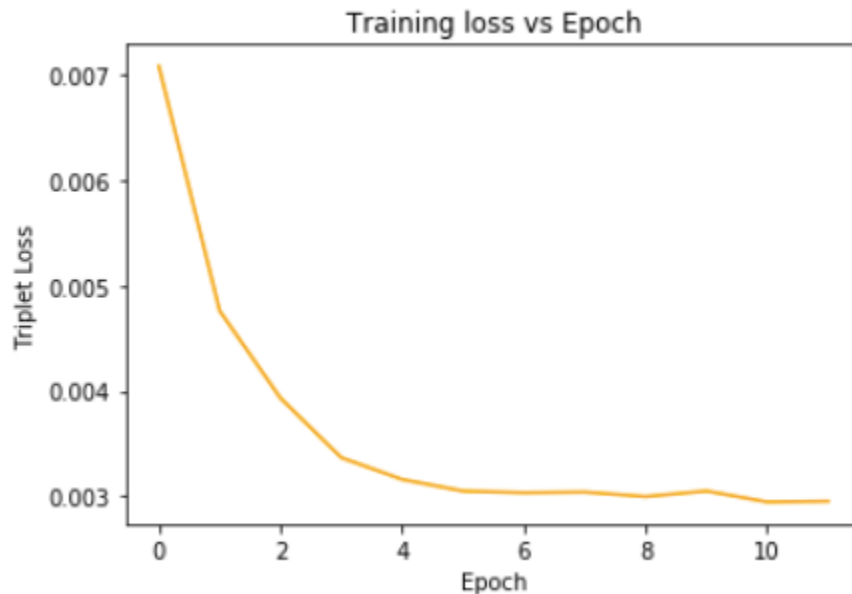
In the **evaluation** part, I load the trained resnet18 model and I built my own dataset and dataloader to load one validation and string class label at a time.

Then I load all the training data again and computer each embedding and store them into a numpy array. I built a dictionary which the key is the index of the image and the value is the string class label (nxxxxxxx).

The test accuracy was calculated by computing the average classification accuracy over 100 validation images. Each accuracy is calculated by using the trained Resnet18 to find its embedding and use it find the 30 closest images and use them to compute the accuracy.

- **Quantitative results**

The 12 training losses are: 7.089E-3, 4.763E-3, 3.932E-3, 3.367E-3, 3.160E-3, 3.05E-3, 3.034E-3, 3.04E-3, 2.997E-3, 3.05E-3, 2.946E-3, 2.953E-3



The final test precision is 58.5%

- Sample 5 different validation images and evaluate:

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~ — ssh tra410@bwby.ncsa.illinois.edu
~ — ssh tra410@bwby.ncsa.illinois.edu

[tra410@nid09256:~/scratch/HW5] python evaluate.py
Ultimate Version
Loading array and dictionary
Finish loading array and dictionary
Fit Start
Fit Done
Val Image # 0
For Val image: val_5660.JPEG from class: n03983396 Top 10 results are:
Image name: n02823428_83.JPEG image class: n02823428 distance: 11.600847974384907
Image name: n03983396_125.JPEG image class: n03983396 distance: 12.412160990916293
Image name: n03983396_381.JPEG image class: n03983396 distance: 12.46838854232006
Image name: n03983396_176.JPEG image class: n03983396 distance: 12.485070127036932
Image name: n02823428_428.JPEG image class: n02823428 distance: 12.907928806746046
Image name: n02823428_15.JPEG image class: n02823428 distance: 13.066398296046293
Image name: n02823428_492.JPEG image class: n02823428 distance: 13.306239475649503
Image name: n02823428_55.JPEG image class: n02823428 distance: 13.380499769920396
Image name: n03983396_269.JPEG image class: n03983396 distance: 13.488655972317689
Image name: n03983396_187.JPEG image class: n03983396 distance: 13.538540107526735
For Val image: val_5660.JPEG from class: n03983396 Bottom 10 results are:
Image name: n02795169_408.JPEG image class: n02795169 distance: 23.848009940431695
Image name: n04070727_370.JPEG image class: n04070727 distance: 23.848175827187053
Image name: n03085013_44.JPEG image class: n03085013 distance: 23.84827534288288
Image name: n02906734_2.JPEG image class: n02906734 distance: 23.848539006581447
Image name: n02948072_325.JPEG image class: n02948072 distance: 23.848686880811645
Image name: n04456115_41.JPEG image class: n04456115 distance: 23.848783912000805
Image name: n02795169_257.JPEG image class: n02795169 distance: 23.84891533014345
Image name: n03393912_153.JPEG image class: n03393912 distance: 23.84906415689971
Image name: n03447447_30.JPEG image class: n03447447 distance: 23.849286481831797
Image name: n04070727_138.JPEG image class: n04070727 distance: 23.849383665502984
Val Image # 1
For Val image: val_1344.JPEG from class: n01774750 Top 10 results are:
Image name: n01774750_274.JPEG image class: n01774750 distance: 13.972396923638165
Image name: n04417672_434.JPEG image class: n04417672 distance: 14.030565939184685
Image name: n01774750_437.JPEG image class: n01774750 distance: 14.311466168721212
Image name: n02892201_242.JPEG image class: n02892201 distance: 14.631665398521621
Image name: n01950731_474.JPEG image class: n01950731 distance: 14.672993168048833
Image name: n04597913_258.JPEG image class: n04597913 distance: 14.791294414617271
Image name: n09193705_280.JPEG image class: n09193705 distance: 14.896245975349728
Image name: n03160309_118.JPEG image class: n03160309 distance: 14.902632859521272
Image name: n01945685_493.JPEG image class: n01945685 distance: 15.015227467747975
Image name: n01950731_132.JPEG image class: n01950731 distance: 15.139142376680965
For Val image: val_1344.JPEG from class: n01774750 Bottom 10 results are:
Image name: n03250847_354.JPEG image class: n03250847 distance: 19.970177088946812
Image name: n02415577_62.JPEG image class: n02415577 distance: 19.97039673829149
Image name: n09428293_453.JPEG image class: n09428293 distance: 19.970560504701734
Image name: n02132136_218.JPEG image class: n02132136 distance: 19.97069516081754
Image name: n04562935_405.JPEG image class: n04562935 distance: 19.970787296748156
Image name: n07871810_418.JPEG image class: n07871810 distance: 19.970864036999384
Image name: n02132136_166.JPEG image class: n02132136 distance: 19.970917193476875
Image name: n09193705_410.JPEG image class: n09193705 distance: 19.971146404402724
Image name: n03388043_364.JPEG image class: n03388043 distance: 19.971335336521225
Image name: n02190166_277.JPEG image class: n02190166 distance: 19.97153827403452

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Val Image # 2

For Val image: val_7799.JPEG from class: n09428293 Top 10 results are:

Image name: n09428293_324.JPEG image class: n09428293 distance: 12.717525606999805
Image name: n09428293_408.JPEG image class: n09428293 distance: 14.083363988745452
Image name: n04540053_401.JPEG image class: n04540053 distance: 14.847525186483628
Image name: n09193705_15.JPEG image class: n09193705 distance: 14.923041137948562
Image name: n04366367_96.JPEG image class: n04366367 distance: 14.969712684870592
Image name: n09428293_417.JPEG image class: n09428293 distance: 15.022068694008015
Image name: n09428293_328.JPEG image class: n09428293 distance: 15.159571585513428
Image name: n09428293_366.JPEG image class: n09428293 distance: 15.162201528350407
Image name: n09428293_404.JPEG image class: n09428293 distance: 15.163831692952238
Image name: n09332890_369.JPEG image class: n09332890 distance: 15.251609147458359

For Val image: val_7799.JPEG from class: n09428293 Bottom 10 results are:

Image name: n03937543_447.JPEG image class: n03937543 distance: 21.783294150011848
Image name: n03970156_373.JPEG image class: n03970156 distance: 21.783474567154368
Image name: n02769748_389.JPEG image class: n02769748 distance: 21.783681563960144
Image name: n04487081_381.JPEG image class: n04487081 distance: 21.783736453277285
Image name: n04149813_359.JPEG image class: n04149813 distance: 21.783909440103994
Image name: n03733131_219.JPEG image class: n03733131 distance: 21.783981900095533
Image name: n04487081_88.JPEG image class: n04487081 distance: 21.784000564663316
Image name: n09246464_408.JPEG image class: n09246464 distance: 21.784146213018566
Image name: n04540053_100.JPEG image class: n04540053 distance: 21.78419658848526
Image name: n04008634_97.JPEG image class: n04008634 distance: 21.784483746622797

Val Image # 3

For Val image: val_3564.JPEG from class: n01629819 Top 10 results are:

Image name: n01629819_363.JPEG image class: n01629819 distance: 12.452662320301757
Image name: n01629819_477.JPEG image class: n01629819 distance: 12.691638103239924
Image name: n01629819_480.JPEG image class: n01629819 distance: 12.841142445871167
Image name: n01629819_429.JPEG image class: n01629819 distance: 12.928230653066274
Image name: n01629819_327.JPEG image class: n01629819 distance: 13.145624069676584
Image name: n01629819_186.JPEG image class: n01629819 distance: 13.407076784114937
Image name: n01629819_15.JPEG image class: n01629819 distance: 13.779459628220927
Image name: n01629819_319.JPEG image class: n01629819 distance: 13.807509817920891
Image name: n01629819_79.JPEG image class: n01629819 distance: 13.815687160445192
Image name: n01629819_272.JPEG image class: n01629819 distance: 13.899831945132581

For Val image: val_3564.JPEG from class: n01629819 Bottom 10 results are:

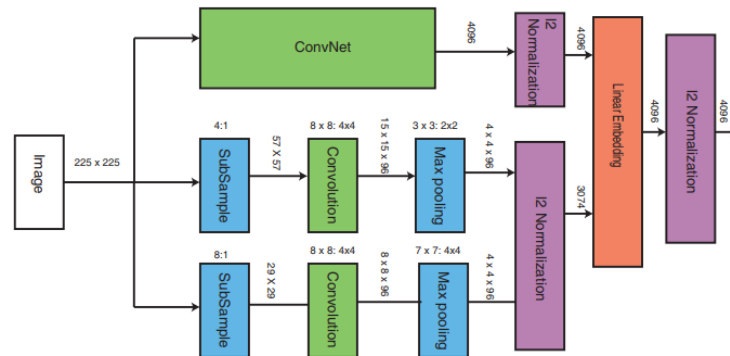
Image name: n04008634_217.JPEG image class: n04008634 distance: 21.734597803830955
Image name: n01742172_49.JPEG image class: n01742172 distance: 21.734646406047627
Image name: n02795169_351.JPEG image class: n02795169 distance: 21.734784972626162
Image name: n03388043_29.JPEG image class: n03388043 distance: 21.734827704321063
Image name: n07753592_438.JPEG image class: n07753592 distance: 21.734852512099714
Image name: n02231487_146.JPEG image class: n02231487 distance: 21.734879842037323
Image name: n02281406_380.JPEG image class: n02281406 distance: 21.735030368405212
Image name: n04465501_464.JPEG image class: n04465501 distance: 21.73515535888512
Image name: n09332890_54.JPEG image class: n09332890 distance: 21.735248854709727
Image name: n03838899_16.JPEG image class: n03838899 distance: 21.73540201866035


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Val Image # 4
For Val image: val_6502.JPEG from class: n02132136 Top 10 results are:
Image name: n02132136_18.JPEG image class: n02132136 distance: 12.61936813091655
Image name: n02132136_391.JPEG image class: n02132136 distance: 13.203449879426387
Image name: n02132136_44.JPEG image class: n02132136 distance: 13.4830580519443
Image name: n02132136_190.JPEG image class: n02132136 distance: 13.519908118095664
Image name: n02132136_84.JPEG image class: n02132136 distance: 13.831673653790475
Image name: n02132136_282.JPEG image class: n02132136 distance: 13.88885960597799
Image name: n02132136_195.JPEG image class: n02132136 distance: 13.942989071428752
Image name: n02132136_277.JPEG image class: n02132136 distance: 13.9433052592839
Image name: n02132136_299.JPEG image class: n02132136 distance: 14.00077665010176
Image name: n02415577_401.JPEG image class: n02415577 distance: 14.119493131893005
For Val image: val_6502.JPEG from class: n02132136 Bottom 10 results are:
Image name: n01944390_327.JPEG image class: n01944390 distance: 21.248142393740743
Image name: n03992509_133.JPEG image class: n03992509 distance: 21.248150194294258
Image name: n02403003_85.JPEG image class: n02403003 distance: 21.248152229989834
Image name: n02423022_403.JPEG image class: n02423022 distance: 21.24821840373079
Image name: n01855672_389.JPEG image class: n01855672 distance: 21.248220821132975
Image name: n01774750_362.JPEG image class: n01774750 distance: 21.248803201958843
Image name: n02406410_362.JPEG image class: n02406410 distance: 21.24887723273574
Image name: n02123045_279.JPEG image class: n02123045 distance: 21.248997265965798
Image name: n02058221_393.JPEG image class: n02058221 distance: 21.249279178711145
Image name: n02125311_426.JPEG image class: n02125311 distance: 21.24930849354434
tra410@nid09256:~/scratch/HW5> █

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- To improve performance, we can make the architecture more complex like the one in the paper



Or we can draw image from the same class as the query image when sampling negative images if the image satisfies the margin constraint T_r :

$$r_{i,i+} - r_{i,i-} \geq T_r, \forall t_i = (p_i, p_i^+, p_i^-)$$