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CS 4981 011

4/6/2022

**Week 4 Lab**

1. Include the table of results from the bayesopt function.

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| Iter | Eval Result | Obj | Obj Runtime | Best So Far (observed) | Best So Far (estim) | Secti-on Depth | Initial Learn Rate | Mome-ntum | L2 Reg |
| 1 | Best | 0.3724 | 464.7282 | 0.3724 | 0.3724 | 1 | 0.0845 | 0.8088 | 5.1156e-09 |
| 2 | Accept | 0.4772 | 642.4592 | 0.3724 | 0.3776 | 3 | 0.4808 | 0.9662 | 0.0092 |
| 3 | Best | 0.2402 | 559.4659 | 0.2402 | 0.2502 | 2 | 0.1336 | 0.9543 | 1.1370e-10 |
| 4 | Accept | 0.3310 | 630.4366 | 0.2402 | 0.2501 | 3 | 0.0312 | 0.8597 | 0.0002 |
| 5 | Accept | 0.2606 | 558.5586 | 0.2402 | 0.2405 | 2 | 0.0901 | 0.9459 | 1.2331e-10 |
| 6 | Best | 0.2210 | 558.5409 | 0.2210 | 0.2210 | 2 | 0.4459 | 0.9104 | 1.0051e-10 |
| 7 | Accept | 0.3130 | 399.8832 | 0.2210 | 0.2210 | 1 | 0.0823 | 0.9562 | 1.3430e-07 |
| 8 | Accept | 0.2942 | 391.3977 | 0.2210 | 0.2214 | 1 | 0.3111 | 0.8768 | 3.6940e-07 |
| 9 | Accept | 0.2920 | 542.1569 | 0.2210 | 0.2210 | 2 | 0.9829 | 0.9763 | 3.2373e-10 |
| 10 | Accept | 0.3852 | 390.3175 | 0.2210 | 0.2210 | 1 | 0.0235 | 0.9280 | 3.2401e-06 |
| 11 | Accept | 0.2222 | 544.8500 | 0.2210 | 0.2210 | 2 | 0.2430 | 0.9040 | 6.3619e-10 |
| 12 | Accept | 0.2286 | 545.3494 | 0.2210 | 0.2211 | 2 | 0.4823 | 0.8017 | 9.2643e-10 |
| 13 | Accept | 0.4560 | 542.3290 | 0.2210 | 0.2210 | 2 | 0.2838 | 0.9557 | 0.0089 |
| 14 | Accept | 0.2222 | 627.6662 | 0.2210 | 0.2210 | 3 | 0.3476 | 0.8662 | 1.3105e-10 |
| 15 | Accept | 0.2772 | 402.0124 | 0.2210 | 0.2210 | 1 | 0.6207 | 0.8611 | 1.0722e-09 |
| 16 | Accept | 0.2260 | 548.8060 | 0.2210 | 0.2211 | 2 | 0.3171 | 0.8650 | 1.0043e-10 |
| 17 | Accept | 0.2444 | 622.3979 | 0.2210 | 0.2211 | 3 | 0.2122 | 0.9684 | 2.4024e-10 |
| 18 | Best | 0.2138 | 626.6766 | 0.2138 | 0.2138 | 3 | 0.8437 | 0.8016 | 1.3659e-10 |
| 19 | Best | 0.2112 | 630.9214 | 0.2112 | 0.2112 | 3 | 0.6447 | 0.8111 | 3.3403e-09 |
| 20 | Best | 0.2110 | 628.1634 | 0.2110 | 0.2110 | 3 | 0.8187 | 0.8458 | 5.8175e-10 |
| 21 | Accept | 0.2260 | 623.7157 | 0.2110 | 0.2111 | 3 | 0.9912 | 0.8072 | 2.5610e-09 |
| 22 | Accept | 0.2158 | 622.5342 | 0.2110 | 0.2129 | 3 | 0.5347 | 0.8520 | 9.1330e-10 |
| 23 | Accept | 0.2238 | 622.4998 | 0.2110 | 0.2153 | 3 | 0.5832 | 0.8214 | 3.1839e-10 |
| 24 | Accept | 0.2168 | 620.8326 | 0.2110 | 0.2147 | 3 | 0.7925 | 0.8511 | 1.1769e-10 |
| 25 | Accept | 0.2264 | 622.5197 | 0.2110 | 0.2164 | 3 | 0.6237 | 0.8360 | 7.7081e-10 |
| 26 | Accept | 0.2140 | 620.6587 | 0.2110 | 0.2165 | 3 | 0.7744 | 0.8021 | 1.0691e-10 |
| 27 | Accept | 0.2266 | 621.4199 | 0.2110 | 0.2166 | 3 | 0.8212 | 0.8200 | 1.0199e-10 |
| 28 | Accept | 0.2150 | 621.2237 | 0.2110 | 0.2164 | 3 | 0.5922 | 0.8002 | 1.8277e-09 |
| 29 | Accept | 0.2294 | 621.6891 | 0.2110 | 0.2174 | 3 | 0.5935 | 0.8062 | 1.1939e-09 |
| 30 | Accept | 0.2224 | 547.3057 | 0.2110 | 0.2174 | 2 | 0.4818 | 0.8688 | 1.1631e-09 |

* 1. Discuss the progress of the algorithm by commenting on how the objective function value (final loss function value of each network on the validation sets) and the hyperparameters were varied by the algorithm.
     1. After the first half of the iterations, the objective got down consistently to a little under 0.23. However, I didn’t notice any major trend with the hyperparameters that led to this value because the hyperparameters continued to fluctuate all over the place, other than momentum which stayed around 0.82.
  2. Does the algorithm seem to be exploring the space, or quickly settling in on particular hyperparameter values?
     1. It looks like the algorithm is exploring the space because the initial learn rate, momentum, and L2 regularization are all constantly changing with no noticeable pattern.

1. Include the 10-class confusion matrix for your final network and discuss the results.

Table

Description automatically generated

* 1. Are classes balanced in this validation set?
     1. Yes.
  2. Are any classes easily confused?
     1. Cats and dogs are somewhat easily confused. Given that the true class is cat, the most commonly incorrectly predicted class is dog, and the case is the same vice versa.
  3. Is one class particularly challenging for the network to classify?
     1. Cat is the most challenging for the network to classify, with the lowest number of correct predictions and a recall of only 54%.

1. Include any other graphs or results that you think are relevant or interesting.

Chart, line chart

Description automatically generated

1. Summarize your key questions or open issues.
   1. What parts of the lab were hard to understand?
      1. There was no noticeable trend in the hyperparameters that led to lower objective values and I’m not sure if that was intentional or not.
   2. Did you run into errors and were you able to solve them?
      1. No errors.
   3. Are there topics you’d like to learn more about next?
      1. Not particularly.