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1 C:\Users\Sapan\Downloads\4p76Assign1\assign1\venv\Scripts\python.exe C:/Users/Sapan/
  Downloads/4p76Assign1/assign1/main.py
2 Enter 1 for Digits classification, Enter 2 for Cancer classification: 1
3 Enter number of tests to compare (only works on 3), if don't want to run tests just
  single run enter 1: 3
4 Give name to your Test for files: digit_epoch
5
6 Test no.: 0
7 Enter number of neurons for hidden layer: 25
8 Enter number of epochs: 10
9 Enter 1 for sigmoid or 2 for tanh activation function: 1
10 Enter learning rate: 0.17
11 Enter Momentum: 0.15
12 Running-----
13 Fold no.: 0
14 Accumulated sum error over epochs: [35545.94043204164, 11412.90246393614, 6986.
  42577027179, 5234.055515920045, 5009.432298878617, 3294.502056402003, 1799.2953369362438
  , 1375.167120133887, 1121.7638966052257, 1064.021150857543]
15
16 Correct classification validation set: 1535
17
18 Correct classification test set: 3521
19 end of fold
20
21 Running-----
22 Fold no.: 1
23 Accumulated sum error over epochs: [38537.770791874755, 18188.37343862733, 11384.
  540466514098, 5492.743481027248, 5072.262874349433, 4432.948697793394, 3678.7794429948244
  , 2631.8554161319457, 1819.9498480060709, 1399.2374325361175]
24
25 Correct classification validation set: 1507
26
27 Correct classification test set: 3468
28 end of fold
29
30 Running-----
31 Fold no.: 2
32 Accumulated sum error over epochs: [42316.91940617772, 34758.320242318594, 31615.
  787978814056, 30564.357266348743, 25628.962155900615, 21312.53252585343, 9288.
  889931488919, 4797.826492224514, 2196.035966501876, 1145.5532163113182]
33
34 Correct classification validation set: 1559
35
36 Correct classification test set: 3580
37 end of fold
38
39 Running-----
40 Fold no.: 3
41 Accumulated sum error over epochs: [39748.810901610035, 20526.10344728025, 7354.
  438118313061, 4810.426684601432, 4362.6873978899575, 3635.096401149109, 3058.
  1724666612417, 1812.4026607272299, 1552.0281846213531, 1083.7242096221437]
42
43 Correct classification validation set: 1567
44
45 Correct classification test set: 3554
46 end of fold
47
48 Fold test accuracies%: [88.02499999999999, 86.7, 89.5, 88.85]
49 Fold validation accuracies%: [87.76443682104059, 86.16352201257862, 89.136649514008, 89.
  59405374499714]
50 Mean fold validation accuracies%: 88.16466552315609
51
52 Test no.: 1
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```
53 Enter number of neurons for hidden layer: 25
54 Enter number of epochs: 30
55 Enter 1 for sigmoid or 2 for tanh activation function: 1
56 Enter learning rate: 1.7
57 Enter Momentum: 0.15
58 Running-----
59 Fold no.: 0
60 Accumulated sum error over epochs: [41061.16614910464, 21502.13256041258, 5536.
05353278854, 3170.5652413521266, 1647.14151058174, 1331.2911385611449, 1190.
3749388932658, 1028.1022656148969, 1011.0823778398393, 921.6383492130371, 900.
5356724217093, 862.3224123122309, 835.5089400407783, 799.1628014420861, 764.
8526454721285, 775.4269600693112, 731.2184266537841, 749.1867152974078, 737.
5537328357495, 735.2376302663422, 712.1099298465317, 664.0268472238896, 664.
8662268619345, 657.9372401964023, 653.0583531318472, 620.927297608303, 648.3858703224057
, 606.2942849544415, 630.1611056615644, 576.3369627256252]
61
62 Correct classification validation set: 1631
63
64 Correct classification test set: 3702
65 end of fold
66
67 Running-----
68 Fold no.: 1
69 Accumulated sum error over epochs: [40408.12700302688, 22377.09288568733, 14503.
519394984269, 9450.170786934308, 3626.458101237322, 1296.761268970697, 1020.640272171354
, 853.9805599347508, 708.1901626816864, 671.7162694310279, 674.687353543287, 600.
9978197009513, 571.2950560226326, 560.2330057285308, 545.9684029699034, 513.
6117719621851, 480.96092044248513, 502.1776206164981, 498.5697282821997, 474.
96069457394765, 436.6292532453677, 443.7754645120823, 440.3986016454258, 422.
15329057975856, 399.25443002967864, 393.91383398640744, 372.0124474597704, 381.
6825872696645, 336.33155139962054, 350.6392411356318]
70
71 Correct classification validation set: 1625
72
73 Correct classification test set: 3740
74 end of fold
75
76 Running-----
77 Fold no.: 2
78 Accumulated sum error over epochs: [34749.45032554247, 14770.968074834216, 9614.
925810176795, 5143.465235880456, 1587.1605837589377, 1131.6608725798574, 1058.
5125801220142, 943.996240557815, 868.1498360769122, 832.3381915236994, 758.4454887175393
, 732.8908373047209, 686.081170671011, 662.3205130429374, 591.5134880310845, 613.
5511811604166, 640.2503340771872, 564.2842209588177, 575.3919470350546, 576.
5374257964537, 561.185441875814, 549.5245784145977, 524.9335893826387, 468.361089127643
, 447.4218025034071, 476.3317035662237, 452.0680329699142, 468.03822775853905, 429.
9327016887455, 418.93302491344576]
79
80 Correct classification validation set: 1628
81
82 Correct classification test set: 3708
83 end of fold
84
85 Running-----
86 Fold no.: 3
87 Accumulated sum error over epochs: [39649.89566456089, 20491.27972382006, 8793.
699637020458, 5362.542582966474, 5223.9383466308345, 5052.229682132589, 3080.
105580962961, 1805.983588813762, 1328.1906035571699, 1167.9666119146434, 1073.
0541821653756, 865.6010079446635, 855.6748182601581, 792.9493063138552, 783.
0798559899066, 771.1411015169349, 691.6703768001995, 679.7739839452953, 659.
4363599581812, 635.149462333503, 598.5432022687831, 609.2188196956355, 623.9354211603113
, 604.1050449579726, 522.608214763066, 607.6552245474267, 542.4537341954914, 542.
699097537082, 525.2346221196526, 536.5970468786469]
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88
89 Correct classification validation set: 1639
90
91 Correct classification test set: 3728
92 end of fold
93
94 Fold test accuracies%: [92.55, 93.5, 92.7, 93.2]
95 Fold validation accuracies%: [93.25328759291024, 92.91023441966838, 93.08176100628931,
93.71069182389937]
96 Mean fold validation accuracies%: 93.23899371069183
97
98 Test no.: 2
99 Enter number of neurons for hidden layer: 25
100 Enter number of epochs: 50
101 Enter 1 for sigmoid or 2 for tanh activation function: 1
102 Enter learning rate: 1.7
103 Enter Momentum: 0.15
104 Running-----
105 Fold no.: 0
106 Accumulated sum error over epochs: [28096.53976092851, 14401.927651539452, 10512.
901535781146, 7844.311591758632, 2317.0934027595354, 1184.8064533590154, 1071.
2985911397764, 969.0745631316712, 920.5503951278099, 871.4888468797766, 879.682629319324
, 806.7189126615662, 757.0211466696189, 677.469529533433, 666.4812920716021, 639.
3765590406651, 654.5883542095245, 629.7598407432334, 622.5749207017082, 625.
0056022017557, 594.7954567419796, 628.6166716582447, 539.8200919724578, 554.
0694992758824, 574.3002329986007, 553.2019631223284, 513.4496057266172, 514.
6577924420986, 540.3413079860528, 529.5500884827684, 495.042595037598, 493.8243434837715
, 511.2618667488847, 459.33821079043344, 507.98321731500516, 424.14040838566615, 447.
3717956053513, 403.43326918610916, 400.15101635092213, 430.16848335139525, 424.
4702741182587, 429.0628964487177, 468.5263871848483, 410.51903069438805, 411.
29777125399823, 385.9275867491413, 406.80455762877193, 382.88351904815806, 371.
29989000711265, 342.06716949834197]
107
108 Correct classification validation set: 1613
109
110 Correct classification test set: 3728
111 end of fold
112
113 Running-----
114 Fold no.: 1
115 Accumulated sum error over epochs: [41923.83880143528, 14067.624358077404, 13971.
614764391219, 12354.879257798026, 4901.727580079112, 2819.0878343414724, 1325.
9297834067158, 1064.168155819647, 949.9615405140893, 848.6492550250487, 844.
9927869263374, 772.4941606524878, 720.8265746307138, 698.0756006115364, 652.
0171363966625, 582.1493281287547, 560.8303711843413, 542.1284729633876, 565.
2328736472323, 517.329748503986, 527.2241726819843, 520.1678319153189, 484.8020196614146
, 461.17635361803804, 456.5635798263754, 437.7166395623683, 472.01876720871354, 396.
9731171556394, 402.7874754863477, 410.5166774942726, 347.9268492510483, 364.
6514403235203, 357.7396068485271, 336.07095415544484, 415.0946953313404, 330.
93287785540366, 307.79791198487953, 350.1808212132614, 315.6204939139976, 338.
2815272567198, 349.05808179165416, 339.2927600658036, 299.36785338715106, 285.
8818450153208, 320.0403865633764, 300.58733876506284, 315.7289223302875, 311.
25055710250444, 321.2969449696901, 289.91858366063923]
116
117 Correct classification validation set: 1649
118
119 Correct classification test set: 3756
120 end of fold
121
122 Running-----
123 Fold no.: 2
124 Accumulated sum error over epochs: [42611.42481087032, 27944.49976483918, 17446.
74798354864, 10520.230641080536, 9098.562221933907, 4750.122564526873, 2241.862114026778
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124 , 1585.9739551993252, 1341.9674522741166, 1149.4544707457453, 1031.8674362886109, 983.
0780176818788, 924.0281637902721, 873.5065030904633, 837.363415558437, 834.1453544953724
, 809.9503810923571, 751.1777318846622, 705.8823890566622, 649.5483486962045, 678.
6616368454091, 669.4989824563792, 690.0231778787685, 579.7049315556213, 592.
9158334496003, 571.674918687023, 586.9620059959578, 541.4627159753763, 557.6250970508452
, 493.30386386059905, 575.4479103562401, 577.4435305787831, 504.38774870979404, 506.
640759863464, 510.72091779250826, 474.9291241255256, 458.5375390067354, 481.
7863620402096, 466.33177649001425, 432.2956057585479, 402.93449357231725, 440.
91986844612546, 441.83577613993907, 457.4087092361963, 416.0894775146926, 418.
1092133336529, 416.94950986163946, 381.4069621292572, 413.8924036066289, 384.
42424521200485]

125
126 Correct classification validation set: 1603
127
128 Correct classification test set: 3677
129 end of fold
130
131 Running-----
132 Fold no.: 3
133 Accumulated sum error over epochs: [36429.35193451061, 9574.870245064416, 5165.
789498517637, 4160.470015903636, 2146.007050529504, 1263.241331108712, 1103.355383455952
, 1034.0152840433004, 964.185757409331, 878.5275254904176, 852.6689792306636, 749.
4518379063176, 677.3283491754169, 716.3076775573547, 678.1683701002291, 611.95432196408
, 618.7860253333164, 599.3442600657962, 603.3442271260337, 592.1612350016495, 564.
7098255920123, 560.9026827934558, 551.5575873658877, 539.9928211278879, 506.
0326810794218, 496.85513634896125, 507.3657544748777, 479.0169061516496, 490.
7449695696061, 490.11648067723604, 463.50000448878905, 475.52557421225106, 456.
82251898815514, 460.5575416480765, 461.54311087182003, 403.56407299792363, 415.
5243313073847, 448.959196073282, 423.55892583817723, 435.6793935642492, 417.
9158318008603, 426.884542787333, 430.8504548213261, 378.34754996230345, 375.
3372860718205, 395.9502170458457, 399.17535997732267, 382.32165482837144, 389.
269517877105, 365.2056993887272]

134
135 Correct classification validation set: 1631
136
137 Correct classification test set: 3754
138 end of fold
139
140 Fold test accuracies%: [93.2, 93.89999999999999, 91.925, 93.85]
141 Fold validation accuracies%: [92.22412807318467, 94.2824471126358, 91.65237278444826,
93.25328759291024]
142 Mean fold validation accuracies%: 92.85305889079474
143
144 Test results:
145     test0  test1  test2
146 0  88.025  92.55  93.200
147 1  86.700  93.50  93.900
148 2  89.500  92.70  91.925
149 3  88.850  93.20  93.850
150 Test stats:
151     test0     test1     test2
152 count  4.000000  4.000000  4.000000
153 mean   88.268750  92.987500  93.21875
154 std    1.207507  0.440407  0.91955
155 min    86.700000  92.550000  91.92500
156 25%    87.693750  92.662500  92.88125
157 50%    88.437500  92.950000  93.52500
158 75%    89.012500  93.275000  93.86250
159 max    89.500000  93.500000  93.90000
160
161 Validation results:
162     test0     test1     test2
163 0  87.764437  93.253288  92.224128

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```
164 1 86.163522 92.910234 94.282447
165 2 89.136650 93.081761 91.652373
166 3 89.594054 93.710692 93.253288
167 Valid stats:
168          test0      test1      test2
169 count    4.000000    4.000000    4.000000
170 mean     88.164666    93.238994    92.853059
171 std       1.544092     0.344242     1.160536
172 min      86.163522    92.910234    91.652373
173 25%      87.364208    93.038879    92.081189
174 50%      88.450543    93.167524    92.738708
175 75%      89.251001    93.367639    93.510577
176 max      89.594054    93.710692    94.282447
177
178 shapiro test for testing accuracies
179 test0 stats=0.9716, p=0.8515
180 test1 stats=0.9311, p=0.6010
181 test2 stats=0.8466, p=0.2154
182
183 shapiro test for validation accuracies
184 test0 stats=0.9349, p=0.6235
185 test1 stats=0.9419, p=0.6658
186 test2 stats=0.9690, p=0.8355
187
188 ANOVA test
189          sum_sq    df      F      PR(>F)
190 df_test.iloc[:, 1] 0.076368 1.0 0.034241 0.883515
191 df_test.iloc[:, 2] 0.664509 1.0 0.297947 0.681914
192 Residual          2.230292 1.0      NaN      NaN
193
194 t-tests:
195 Ttest_indResult(statistic=-7.342565604004228, pvalue=0.0022667909330218537)
196 Ttest_indResult(statistic=-0.45362080227446666, pvalue=0.6720242651602344)
197 Ttest_indResult(statistic=-6.522699022047383, pvalue=0.0008141588519336742)
198
199 Statistically better mean available, the one with highest average accuracy
200
201 Process finished with exit code 0
202
```