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In [2]: runfile('/Users/noemi/Documents/Uni/Astrostatistics/working/lec22.py', wdir='/Users/noemi/Documents/Uni/Astrostatistics/working')
```

--- FIRST NEURAL NETWORK ---
Model: "sequential"

Layer (type)	Output Shape	Param #
hidden (Dense)	(None, 5)	25
output (Dense)	(None, 1)	6

Total params: 31 (124.00 B)
Trainable params: 31 (124.00 B)
Non-trainable params: 0 (0.00 B)

None

Training the classifier:

Epoch 1/10
1094/1094 1s 668us/step - accuracy: 0.8923 - loss: 0.3877
Epoch 2/10
1094/1094 1s 622us/step - accuracy: 0.9158 - loss: 0.2435
Epoch 3/10
1094/1094 1s 674us/step - accuracy: 0.9336 - loss: 0.1849
Epoch 4/10
1094/1094 1s 776us/step - accuracy: 0.9481 - loss: 0.1472
Epoch 5/10
1094/1094 1s 658us/step - accuracy: 0.9584 - loss: 0.1283
Epoch 6/10
1094/1094 1s 712us/step - accuracy: 0.9643 - loss: 0.1187
Epoch 7/10
1094/1094 1s 685us/step - accuracy: 0.9659 - loss: 0.1133
Epoch 8/10
1094/1094 1s 656us/step - accuracy: 0.9674 - loss: 0.1099
Epoch 9/10
1094/1094 1s 616us/step - accuracy: 0.9683 - loss: 0.1077
Epoch 10/10
1094/1094 1s 611us/step - accuracy: 0.9690 - loss: 0.1061

Predicting on test set:

469/469 0s 588us/step

Completeness: 0.8743
Contamination: 0.0807
Accuracy: 0.9705

--- OPTIMIZATION ---

--- Starting trial: run-0
{'num_units': 5, 'optimizer': 'SGD', 'activation': 'relu', 'learning_rate': 0.001}
Epoch 1/5
1094/1094 1s 576us/step - accuracy: 0.5162 - loss: 0.6933
Epoch 2/5
1094/1094 1s 569us/step - accuracy: 0.8947 - loss: 0.4661
Epoch 3/5
1094/1094 1s 568us/step - accuracy: 0.8880 - loss: 0.3689
Epoch 4/5
1094/1094 1s 564us/step - accuracy: 0.8871 - loss: 0.3288
Epoch 5/5
1094/1094 1s 567us/step - accuracy: 0.8874 - loss: 0.3134
469/469 0s 508us/step - accuracy: 0.8918 - loss: 0.3046
469/469 0s 540us/step

--- Starting trial: run-1
{'num_units': 5, 'optimizer': 'SGD', 'activation': 'relu', 'learning_rate': 0.0031622776601683794}

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--- Starting trial: run-1
{'num_units': 5, 'optimizer': 'SGD', 'activation': 'relu', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 562us/step - accuracy: 0.8580 - loss: 0.3487
Epoch 2/5
1094/1094 1s 649us/step - accuracy: 0.8675 - loss: 0.2964
Epoch 3/5
1094/1094 1s 557us/step - accuracy: 0.8877 - loss: 0.2816
Epoch 4/5
1094/1094 1s 662us/step - accuracy: 0.9021 - loss: 0.2670
Epoch 5/5
1094/1094 1s 620us/step - accuracy: 0.9077 - loss: 0.2524
469/469 0s 576us/step - accuracy: 0.9159 - loss: 0.2372
469/469 0s 560us/step
--- Starting trial: run-2
{'num_units': 5, 'optimizer': 'SGD', 'activation': 'relu', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 1s 589us/step - accuracy: 0.8586 - loss: 0.3722
Epoch 2/5
1094/1094 1s 567us/step - accuracy: 0.8839 - loss: 0.2855
Epoch 3/5
1094/1094 1s 570us/step - accuracy: 0.9083 - loss: 0.2518
Epoch 4/5
1094/1094 1s 550us/step - accuracy: 0.9204 - loss: 0.2196
Epoch 5/5
1094/1094 1s 550us/step - accuracy: 0.9313 - loss: 0.1910
469/469 0s 557us/step - accuracy: 0.9391 - loss: 0.1736
469/469 0s 615us/step
--- Starting trial: run-3
{'num_units': 5, 'optimizer': 'SGD', 'activation': 'tanh', 'learning_rate': 0.001}
Epoch 1/5
1094/1094 1s 593us/step - accuracy: 0.9005 - loss: 0.4972
Epoch 2/5
1094/1094 1s 607us/step - accuracy: 0.8940 - loss: 0.3401
Epoch 3/5
1094/1094 1s 557us/step - accuracy: 0.8891 - loss: 0.3085
Epoch 4/5
1094/1094 1s 563us/step - accuracy: 0.8870 - loss: 0.2959
Epoch 5/5
1094/1094 1s 555us/step - accuracy: 0.8874 - loss: 0.2886
469/469 0s 503us/step - accuracy: 0.8902 - loss: 0.2797
469/469 0s 613us/step
--- Starting trial: run-4
{'num_units': 5, 'optimizer': 'SGD', 'activation': 'tanh', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 714us/step - accuracy: 0.8943 - loss: 0.3809
Epoch 2/5
1094/1094 1s 670us/step - accuracy: 0.8829 - loss: 0.2873
Epoch 3/5
1094/1094 1s 604us/step - accuracy: 0.8863 - loss: 0.2677
Epoch 4/5
1094/1094 1s 607us/step - accuracy: 0.8929 - loss: 0.2531
Epoch 5/5
1094/1094 1s 600us/step - accuracy: 0.9005 - loss: 0.2414
469/469 0s 547us/step - accuracy: 0.9070 - loss: 0.2284
469/469 0s 543us/step
--- Starting trial: run-5
{'num_units': 5, 'optimizer': 'SGD', 'activation': 'tanh', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 1s 629us/step - accuracy: 0.8732 - loss: 0.3472
Epoch 2/5
1094/1094 1s 589us/step - accuracy: 0.8885 - loss: 0.2599
Epoch 3/5
1094/1094 1s 564us/step - accuracy: 0.9086 - loss: 0.2305
Epoch 4/5
1094/1094 1s 575us/step - accuracy: 0.9239 - loss: 0.2102
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X Console 37/A

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1094/1094 1s 504us/step - accuracy: 0.9000 - loss: 0.2500
Epoch 4/5
1094/1094 1s 575us/step - accuracy: 0.9239 - loss: 0.2102
Epoch 5/5
1094/1094 1s 583us/step - accuracy: 0.9324 - loss: 0.1949
469/469 0s 525us/step - accuracy: 0.9404 - loss: 0.1819
469/469 0s 554us/step
--- Starting trial: run-6
{'num_units': 5, 'optimizer': 'adam', 'activation': 'relu', 'learning_rate': 0.001}
Epoch 1/5
1094/1094 1s 685us/step - accuracy: 0.9155 - loss: 0.2697
Epoch 2/5
1094/1094 1s 697us/step - accuracy: 0.9458 - loss: 0.1503
Epoch 3/5
1094/1094 1s 670us/step - accuracy: 0.9602 - loss: 0.1281
Epoch 4/5
1094/1094 1s 656us/step - accuracy: 0.9633 - loss: 0.1229
Epoch 5/5
1094/1094 1s 605us/step - accuracy: 0.9651 - loss: 0.1210
469/469 0s 498us/step - accuracy: 0.9658 - loss: 0.1209
469/469 0s 525us/step
--- Starting trial: run-7
{'num_units': 5, 'optimizer': 'adam', 'activation': 'relu', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 620us/step - accuracy: 0.9110 - loss: 0.3131
Epoch 2/5
1094/1094 1s 629us/step - accuracy: 0.9584 - loss: 0.1296
Epoch 3/5
1094/1094 1s 662us/step - accuracy: 0.9649 - loss: 0.1162
Epoch 4/5
1094/1094 1s 620us/step - accuracy: 0.9669 - loss: 0.1106
Epoch 5/5
1094/1094 1s 612us/step - accuracy: 0.9676 - loss: 0.1081
469/469 0s 511us/step - accuracy: 0.9677 - loss: 0.1112
469/469 0s 612us/step
--- Starting trial: run-8
{'num_units': 5, 'optimizer': 'adam', 'activation': 'relu', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 2s 748us/step - accuracy: 0.9291 - loss: 0.2085
Epoch 2/5
1094/1094 1s 693us/step - accuracy: 0.9656 - loss: 0.1213
Epoch 3/5
1094/1094 1s 700us/step - accuracy: 0.9673 - loss: 0.1134
Epoch 4/5
1094/1094 1s 686us/step - accuracy: 0.9680 - loss: 0.1085
Epoch 5/5
1094/1094 1s 643us/step - accuracy: 0.9681 - loss: 0.1060
469/469 0s 514us/step - accuracy: 0.9683 - loss: 0.1068
469/469 0s 550us/step
--- Starting trial: run-9
{'num_units': 5, 'optimizer': 'adam', 'activation': 'tanh', 'learning_rate': 0.001}
Epoch 1/5
1094/1094 1s 656us/step - accuracy: 0.7881 - loss: 0.4139
Epoch 2/5
1094/1094 1s 646us/step - accuracy: 0.9083 - loss: 0.2185
Epoch 3/5
1094/1094 1s 630us/step - accuracy: 0.9300 - loss: 0.1766
Epoch 4/5
1094/1094 1s 635us/step - accuracy: 0.9491 - loss: 0.1515
Epoch 5/5
1094/1094 1s 634us/step - accuracy: 0.9553 - loss: 0.1376
469/469 0s 515us/step - accuracy: 0.9593 - loss: 0.1311
469/469 0s 569us/step
--- Starting trial: run-10
{'num_units': 5, 'optimizer': 'adam', 'activation': 'tanh', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
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Console 37/A

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--- Starting trial: run-10
{'num_units': 5, 'optimizer': 'adam', 'activation': 'tanh', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 2s 769us/step - accuracy: 0.8082 - loss: 0.3755
Epoch 2/5
1094/1094 1s 729us/step - accuracy: 0.9489 - loss: 0.1474
Epoch 3/5
1094/1094 1s 707us/step - accuracy: 0.9631 - loss: 0.1160
Epoch 4/5
1094/1094 1s 634us/step - accuracy: 0.9652 - loss: 0.1099
Epoch 5/5
1094/1094 1s 615us/step - accuracy: 0.9673 - loss: 0.1081
469/469 0s 501us/step - accuracy: 0.9677 - loss: 0.1090
469/469 0s 530us/step
--- Starting trial: run-11
{'num_units': 5, 'optimizer': 'adam', 'activation': 'tanh', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 1s 610us/step - accuracy: 0.9097 - loss: 0.2355
Epoch 2/5
1094/1094 1s 695us/step - accuracy: 0.9625 - loss: 0.1143
Epoch 3/5
1094/1094 1s 732us/step - accuracy: 0.9669 - loss: 0.1076
Epoch 4/5
1094/1094 1s 677us/step - accuracy: 0.9681 - loss: 0.1060
Epoch 5/5
1094/1094 1s 686us/step - accuracy: 0.9687 - loss: 0.1046
469/469 0s 608us/step - accuracy: 0.9705 - loss: 0.1044
469/469 0s 540us/step
--- Starting trial: run-12
{'num_units': 7, 'optimizer': 'SGD', 'activation': 'relu', 'learning_rate': 0.001}
Epoch 1/5
1094/1094 1s 587us/step - accuracy: 0.8560 - loss: 0.4679
Epoch 2/5
1094/1094 1s 610us/step - accuracy: 0.8560 - loss: 0.3540
Epoch 3/5
1094/1094 1s 585us/step - accuracy: 0.8564 - loss: 0.3339
Epoch 4/5
1094/1094 1s 569us/step - accuracy: 0.8578 - loss: 0.3224
Epoch 5/5
1094/1094 1s 577us/step - accuracy: 0.8597 - loss: 0.3128
469/469 0s 519us/step - accuracy: 0.8636 - loss: 0.3018
469/469 0s 544us/step
--- Starting trial: run-13
{'num_units': 7, 'optimizer': 'SGD', 'activation': 'relu', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 583us/step - accuracy: 0.8878 - loss: 0.4302
Epoch 2/5
1094/1094 1s 580us/step - accuracy: 0.8868 - loss: 0.2948
Epoch 3/5
1094/1094 1s 586us/step - accuracy: 0.8957 - loss: 0.2802
Epoch 4/5
1094/1094 1s 584us/step - accuracy: 0.9023 - loss: 0.2686
Epoch 5/5
1094/1094 1s 576us/step - accuracy: 0.9093 - loss: 0.2585
469/469 0s 516us/step - accuracy: 0.9167 - loss: 0.2438
469/469 0s 539us/step
--- Starting trial: run-14
{'num_units': 7, 'optimizer': 'SGD', 'activation': 'relu', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 1s 607us/step - accuracy: 0.8747 - loss: 0.3382
Epoch 2/5
1094/1094 1s 567us/step - accuracy: 0.9025 - loss: 0.2505
Epoch 3/5
1094/1094 1s 570us/step - accuracy: 0.9183 - loss: 0.2203
Epoch 4/5
1094/1094 1s 576us/step - accuracy: 0.9281 - loss: 0.1974
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Console 37/A

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Epoch 4/5
1094/1094 1s 576us/step - accuracy: 0.9281 - loss: 0.1974
Epoch 5/5
1094/1094 1s 623us/step - accuracy: 0.9357 - loss: 0.1784
469/469 0s 619us/step - accuracy: 0.9439 - loss: 0.1641
469/469 0s 536us/step
--- Starting trial: run-15
{'num_units': 7, 'optimizer': 'SGD', 'activation': 'tanh', 'learning_rate': 0.001}
Epoch 1/5
1094/1094 1s 590us/step - accuracy: 0.4166 - loss: 0.7706
Epoch 2/5
1094/1094 1s 633us/step - accuracy: 0.8695 - loss: 0.3769
Epoch 3/5
1094/1094 1s 559us/step - accuracy: 0.8700 - loss: 0.3327
Epoch 4/5
1094/1094 1s 626us/step - accuracy: 0.8722 - loss: 0.3195
Epoch 5/5
1094/1094 1s 572us/step - accuracy: 0.8745 - loss: 0.3118
469/469 0s 511us/step - accuracy: 0.8808 - loss: 0.3007
469/469 0s 574us/step
--- Starting trial: run-16
{'num_units': 7, 'optimizer': 'SGD', 'activation': 'tanh', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 611us/step - accuracy: 0.7435 - loss: 0.4932
Epoch 2/5
1094/1094 1s 629us/step - accuracy: 0.8798 - loss: 0.3043
Epoch 3/5
1094/1094 1s 639us/step - accuracy: 0.8901 - loss: 0.2849
Epoch 4/5
1094/1094 1s 603us/step - accuracy: 0.8983 - loss: 0.2699
Epoch 5/5
1094/1094 1s 627us/step - accuracy: 0.9056 - loss: 0.2576
469/469 0s 522us/step - accuracy: 0.9135 - loss: 0.2438
469/469 0s 591us/step
--- Starting trial: run-17
{'num_units': 7, 'optimizer': 'SGD', 'activation': 'tanh', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 1s 622us/step - accuracy: 0.8785 - loss: 0.3540
Epoch 2/5
1094/1094 1s 637us/step - accuracy: 0.8940 - loss: 0.2658
Epoch 3/5
1094/1094 1s 645us/step - accuracy: 0.9117 - loss: 0.2320
Epoch 4/5
1094/1094 1s 592us/step - accuracy: 0.9210 - loss: 0.2110
Epoch 5/5
1094/1094 1s 574us/step - accuracy: 0.9266 - loss: 0.1953
469/469 0s 517us/step - accuracy: 0.9325 - loss: 0.1835
469/469 0s 535us/step
--- Starting trial: run-18
{'num_units': 7, 'optimizer': 'adam', 'activation': 'relu', 'learning_rate': 0.001}
Epoch 1/5
1094/1094 1s 647us/step - accuracy: 0.7333 - loss: 0.4674
Epoch 2/5
1094/1094 1s 625us/step - accuracy: 0.9514 - loss: 0.1468
Epoch 3/5
1094/1094 1s 650us/step - accuracy: 0.9598 - loss: 0.1290
Epoch 4/5
1094/1094 1s 631us/step - accuracy: 0.9630 - loss: 0.1238
Epoch 5/5
1094/1094 1s 666us/step - accuracy: 0.9647 - loss: 0.1215
469/469 0s 513us/step - accuracy: 0.9658 - loss: 0.1193
469/469 0s 540us/step
--- Starting trial: run-19
{'num_units': 7, 'optimizer': 'adam', 'activation': 'relu', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 666us/step - accuracy: 0.9157 - loss: 0.2379
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--- Starting trial: run-19
{'num_units': 7, 'optimizer': 'adam', 'activation': 'relu', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 666us/step - accuracy: 0.9157 - loss: 0.2379
Epoch 2/5
1094/1094 1s 675us/step - accuracy: 0.9647 - loss: 0.1199
Epoch 3/5
1094/1094 1s 690us/step - accuracy: 0.9669 - loss: 0.1171
Epoch 4/5
1094/1094 1s 629us/step - accuracy: 0.9671 - loss: 0.1142
Epoch 5/5
1094/1094 1s 653us/step - accuracy: 0.9673 - loss: 0.1107
469/469 0s 559us/step - accuracy: 0.9683 - loss: 0.1085
469/469 0s 531us/step
--- Starting trial: run-20
{'num_units': 7, 'optimizer': 'adam', 'activation': 'relu', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 1s 601us/step - accuracy: 0.9332 - loss: 0.2058
Epoch 2/5
1094/1094 1s 614us/step - accuracy: 0.9665 - loss: 0.1153
Epoch 3/5
1094/1094 1s 623us/step - accuracy: 0.9672 - loss: 0.1080
Epoch 4/5
1094/1094 1s 684us/step - accuracy: 0.9675 - loss: 0.1047
Epoch 5/5
1094/1094 1s 656us/step - accuracy: 0.9685 - loss: 0.1030
469/469 0s 506us/step - accuracy: 0.9669 - loss: 0.1076
469/469 0s 606us/step
--- Starting trial: run-21
{'num_units': 7, 'optimizer': 'adam', 'activation': 'tanh', 'learning_rate': 0.001}
Epoch 1/5
1094/1094 2s 714us/step - accuracy: 0.8811 - loss: 0.3072
Epoch 2/5
1094/1094 1s 723us/step - accuracy: 0.9272 - loss: 0.1956
Epoch 3/5
1094/1094 1s 643us/step - accuracy: 0.9479 - loss: 0.1495
Epoch 4/5
1094/1094 1s 620us/step - accuracy: 0.9585 - loss: 0.1274
Epoch 5/5
1094/1094 1s 623us/step - accuracy: 0.9630 - loss: 0.1176
469/469 0s 516us/step - accuracy: 0.9654 - loss: 0.1159
469/469 0s 541us/step
--- Starting trial: run-22
{'num_units': 7, 'optimizer': 'adam', 'activation': 'tanh', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 627us/step - accuracy: 0.8993 - loss: 0.2922
Epoch 2/5
1094/1094 1s 640us/step - accuracy: 0.9583 - loss: 0.1320
Epoch 3/5
1094/1094 1s 622us/step - accuracy: 0.9630 - loss: 0.1161
Epoch 4/5
1094/1094 1s 621us/step - accuracy: 0.9663 - loss: 0.1093
Epoch 5/5
1094/1094 1s 619us/step - accuracy: 0.9682 - loss: 0.1042
469/469 0s 511us/step - accuracy: 0.9687 - loss: 0.1049
469/469 0s 542us/step
--- Starting trial: run-23
{'num_units': 7, 'optimizer': 'adam', 'activation': 'tanh', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 1s 638us/step - accuracy: 0.9268 - loss: 0.2038
Epoch 2/5
1094/1094 1s 612us/step - accuracy: 0.9680 - loss: 0.1045
Epoch 3/5
1094/1094 1s 617us/step - accuracy: 0.9699 - loss: 0.1006
Epoch 4/5
1094/1094 1s 621us/step - accuracy: 0.9696 - loss: 0.0997
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Console 37/A

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Epoch 4/5
1094/1094 1s 621us/step - accuracy: 0.9696 - loss: 0.0997
Epoch 5/5
1094/1094 1s 625us/step - accuracy: 0.9693 - loss: 0.0991
469/469 0s 600us/step - accuracy: 0.9701 - loss: 0.1025
469/469 0s 628us/step
--- Starting trial: run-24
{'num_units': 9, 'optimizer': 'SGD', 'activation': 'relu', 'learning_rate': 0.001}
Epoch 1/5
1094/1094 1s 634us/step - accuracy: 0.8927 - loss: 0.3038
Epoch 2/5
1094/1094 1s 602us/step - accuracy: 0.8927 - loss: 0.2871
Epoch 3/5
1094/1094 1s 565us/step - accuracy: 0.8959 - loss: 0.2795
Epoch 4/5
1094/1094 1s 588us/step - accuracy: 0.8991 - loss: 0.2730
Epoch 5/5
1094/1094 1s 577us/step - accuracy: 0.9019 - loss: 0.2668
469/469 0s 500us/step - accuracy: 0.9057 - loss: 0.2571
469/469 0s 543us/step
--- Starting trial: run-25
{'num_units': 9, 'optimizer': 'SGD', 'activation': 'relu', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 634us/step - accuracy: 0.8560 - loss: 0.5057
Epoch 2/5
1094/1094 1s 629us/step - accuracy: 0.8560 - loss: 0.3267
Epoch 3/5
1094/1094 1s 621us/step - accuracy: 0.8617 - loss: 0.2994
Epoch 4/5
1094/1094 1s 620us/step - accuracy: 0.8701 - loss: 0.2807
Epoch 5/5
1094/1094 1s 567us/step - accuracy: 0.8797 - loss: 0.2658
469/469 0s 506us/step - accuracy: 0.8915 - loss: 0.2514
469/469 0s 533us/step
--- Starting trial: run-26
{'num_units': 9, 'optimizer': 'SGD', 'activation': 'relu', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 1s 560us/step - accuracy: 0.8023 - loss: 0.4109
Epoch 2/5
1094/1094 1s 561us/step - accuracy: 0.9030 - loss: 0.2309
Epoch 3/5
1094/1094 1s 652us/step - accuracy: 0.9258 - loss: 0.1935
Epoch 4/5
1094/1094 1s 577us/step - accuracy: 0.9383 - loss: 0.1698
Epoch 5/5
1094/1094 1s 642us/step - accuracy: 0.9455 - loss: 0.1540
469/469 0s 531us/step - accuracy: 0.9507 - loss: 0.1449
469/469 0s 529us/step
--- Starting trial: run-27
{'num_units': 9, 'optimizer': 'SGD', 'activation': 'tanh', 'learning_rate': 0.001}
Epoch 1/5
1094/1094 1s 651us/step - accuracy: 0.4458 - loss: 0.7933
Epoch 2/5
1094/1094 1s 617us/step - accuracy: 0.8983 - loss: 0.3389
Epoch 3/5
1094/1094 1s 583us/step - accuracy: 0.8950 - loss: 0.3091
Epoch 4/5
1094/1094 1s 583us/step - accuracy: 0.8944 - loss: 0.3017
Epoch 5/5
1094/1094 1s 635us/step - accuracy: 0.8947 - loss: 0.2977
469/469 0s 668us/step - accuracy: 0.8946 - loss: 0.2882
469/469 0s 545us/step
--- Starting trial: run-28
{'num_units': 9, 'optimizer': 'SGD', 'activation': 'tanh', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 674us/step - accuracy: 0.8922 - loss: 0.4552
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Console 37/A

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--- Starting trial: run-28
{'num_units': 9, 'optimizer': 'SGD', 'activation': 'tanh', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 674us/step - accuracy: 0.8033 - loss: 0.4552
Epoch 2/5
1094/1094 1s 731us/step - accuracy: 0.8725 - loss: 0.3026
Epoch 3/5
1094/1094 1s 673us/step - accuracy: 0.8790 - loss: 0.2856
Epoch 4/5
1094/1094 1s 666us/step - accuracy: 0.8856 - loss: 0.2710
Epoch 5/5
1094/1094 1s 599us/step - accuracy: 0.8936 - loss: 0.2582
469/469 0s 501us/step - accuracy: 0.8990 - loss: 0.2453
469/469 0s 540us/step
--- Starting trial: run-29
{'num_units': 9, 'optimizer': 'SGD', 'activation': 'tanh', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 1s 672us/step - accuracy: 0.8887 - loss: 0.3321
Epoch 2/5
1094/1094 1s 664us/step - accuracy: 0.9039 - loss: 0.2529
Epoch 3/5
1094/1094 1s 672us/step - accuracy: 0.9140 - loss: 0.2297
Epoch 4/5
1094/1094 1s 613us/step - accuracy: 0.9210 - loss: 0.2107
Epoch 5/5
1094/1094 1s 626us/step - accuracy: 0.9271 - loss: 0.1945
469/469 0s 512us/step - accuracy: 0.9321 - loss: 0.1813
469/469 0s 532us/step
--- Starting trial: run-30
{'num_units': 9, 'optimizer': 'adam', 'activation': 'relu', 'learning_rate': 0.001}
Epoch 1/5
1094/1094 1s 678us/step - accuracy: 0.9280 - loss: 0.2882
Epoch 2/5
1094/1094 1s 666us/step - accuracy: 0.9576 - loss: 0.1307
Epoch 3/5
1094/1094 1s 703us/step - accuracy: 0.9632 - loss: 0.1207
Epoch 4/5
1094/1094 1s 767us/step - accuracy: 0.9654 - loss: 0.1166
Epoch 5/5
1094/1094 1s 664us/step - accuracy: 0.9665 - loss: 0.1132
469/469 0s 669us/step - accuracy: 0.9674 - loss: 0.1129
469/469 0s 563us/step
--- Starting trial: run-31
{'num_units': 9, 'optimizer': 'adam', 'activation': 'relu', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 624us/step - accuracy: 0.8418 - loss: 0.3057
Epoch 2/5
1094/1094 1s 625us/step - accuracy: 0.9640 - loss: 0.1206
Epoch 3/5
1094/1094 1s 681us/step - accuracy: 0.9660 - loss: 0.1160
Epoch 4/5
1094/1094 1s 619us/step - accuracy: 0.9672 - loss: 0.1124
Epoch 5/5
1094/1094 1s 623us/step - accuracy: 0.9672 - loss: 0.1094
469/469 0s 514us/step - accuracy: 0.9690 - loss: 0.1080
469/469 0s 543us/step
--- Starting trial: run-32
{'num_units': 9, 'optimizer': 'adam', 'activation': 'relu', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 1s 620us/step - accuracy: 0.9382 - loss: 0.1741
Epoch 2/5
1094/1094 1s 649us/step - accuracy: 0.9666 - loss: 0.1097
Epoch 3/5
1094/1094 1s 728us/step - accuracy: 0.9680 - loss: 0.1059
Epoch 4/5
1094/1094 1s 661us/step - accuracy: 0.9685 - loss: 0.1045
```

X Console 37/A

```
--- Starting trial: run-32
{'num_units': 9, 'optimizer': 'adam', 'activation': 'relu', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 1s 620us/step - accuracy: 0.9382 - loss: 0.1741
Epoch 2/5
1094/1094 1s 649us/step - accuracy: 0.9666 - loss: 0.1097
Epoch 3/5
1094/1094 1s 728us/step - accuracy: 0.9680 - loss: 0.1059
Epoch 4/5
1094/1094 1s 661us/step - accuracy: 0.9685 - loss: 0.1045
Epoch 5/5
1094/1094 1s 719us/step - accuracy: 0.9686 - loss: 0.1037
469/469 0s 698us/step - accuracy: 0.9682 - loss: 0.1055
469/469 0s 595us/step
--- Starting trial: run-33
{'num_units': 9, 'optimizer': 'adam', 'activation': 'tanh', 'learning_rate': 0.001}
Epoch 1/5
1094/1094 2s 745us/step - accuracy: 0.8817 - loss: 0.3403
Epoch 2/5
1094/1094 1s 789us/step - accuracy: 0.9212 - loss: 0.2111
Epoch 3/5
1094/1094 1s 695us/step - accuracy: 0.9420 - loss: 0.1584
Epoch 4/5
1094/1094 1s 653us/step - accuracy: 0.9584 - loss: 0.1300
Epoch 5/5
1094/1094 1s 657us/step - accuracy: 0.9640 - loss: 0.1180
469/469 0s 535us/step - accuracy: 0.9665 - loss: 0.1150
469/469 0s 651us/step
--- Starting trial: run-34
{'num_units': 9, 'optimizer': 'adam', 'activation': 'tanh', 'learning_rate': 0.0031622776601683794}
Epoch 1/5
1094/1094 1s 693us/step - accuracy: 0.8063 - loss: 0.3706
Epoch 2/5
1094/1094 1s 725us/step - accuracy: 0.9548 - loss: 0.1337
Epoch 3/5
1094/1094 1s 657us/step - accuracy: 0.9675 - loss: 0.1093
Epoch 4/5
1094/1094 1s 662us/step - accuracy: 0.9690 - loss: 0.1024
Epoch 5/5
1094/1094 1s 713us/step - accuracy: 0.9694 - loss: 0.0991
469/469 0s 584us/step - accuracy: 0.9711 - loss: 0.1018
469/469 0s 610us/step
--- Starting trial: run-35
{'num_units': 9, 'optimizer': 'adam', 'activation': 'tanh', 'learning_rate': 0.01}
Epoch 1/5
1094/1094 1s 683us/step - accuracy: 0.8748 - loss: 0.2711
Epoch 2/5
1094/1094 1s 797us/step - accuracy: 0.9666 - loss: 0.1128
Epoch 3/5
1094/1094 1s 746us/step - accuracy: 0.9688 - loss: 0.1030
Epoch 4/5
1094/1094 1s 795us/step - accuracy: 0.9700 - loss: 0.0988
Epoch 5/5
1094/1094 1s 754us/step - accuracy: 0.9701 - loss: 0.0979
469/469 0s 592us/step - accuracy: 0.9703 - loss: 0.0991
469/469 0s 614us/step
```

--- OPTIMIZED NEURAL NETWORK ---

Optimized parameters
Number of nodes: 9
Activation function: tanh
Optimizer: adam
Learning rate: 0.1628e-03

--- OPTIMIZED NEURAL NETWORK ---

Optimized parameters
Number of nodes: 9
Activation function: tanh
Optimizer: adam
Learning rate: 3.162e-03
Model: "sequential"

Layer (type)	Output Shape	Param #
hidden (Dense)	(None, 9)	45
output (Dense)	(None, 1)	10

Total params: 55 (220.00 B)
Trainable params: 55 (220.00 B)
Non-trainable params: 0 (0.00 B)

None

Training the classifier:

Epoch 1/10
1094/1094 2s 820us/step - accuracy: 0.9086 - loss: 0.2328
Epoch 2/10
1094/1094 1s 746us/step - accuracy: 0.9614 - loss: 0.1243
Epoch 3/10
1094/1094 1s 764us/step - accuracy: 0.9668 - loss: 0.1110
Epoch 4/10
1094/1094 1s 688us/step - accuracy: 0.9687 - loss: 0.1071
Epoch 5/10
1094/1094 1s 764us/step - accuracy: 0.9697 - loss: 0.1045
Epoch 6/10
1094/1094 1s 746us/step - accuracy: 0.9699 - loss: 0.1018
Epoch 7/10
1094/1094 1s 737us/step - accuracy: 0.9702 - loss: 0.0996
Epoch 8/10
1094/1094 1s 798us/step - accuracy: 0.9703 - loss: 0.0981
Epoch 9/10
1094/1094 1s 784us/step - accuracy: 0.9703 - loss: 0.0970
Epoch 10/10
1094/1094 1s 778us/step - accuracy: 0.9705 - loss: 0.0963

Predicting on test set:

469/469 0s 629us/step

Completeness: 0.9045
Contamination: 0.0992
Accuracy: 0.9715

Confusion matrix:
[[12594 218]
 [209 1979]]

Predicting on the whole set:
1563/1563 1s 599us/step

In [3]: |