

2)

b)

1 hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	1.00	0.76	0.86	2589
1	0.63	0.89	0.74	1410
2	0.78	0.85	0.81	1782
3	0.40	0.73	0.52	1114
4	0.98	0.66	0.79	3105

accuracy			0.76	10000
macro avg	0.76	0.78	0.74	10000
weighted avg	0.84	0.76	0.78	10000

Test

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	1.00	0.89	0.94	258
1	0.73	0.91	0.81	158
2	0.67	0.78	0.72	170
3	0.32	0.55	0.40	107
4	0.98	0.60	0.74	307

accuracy			0.75	1000
macro avg	0.74	0.75	0.72	1000
weighted avg	0.82	0.75	0.76	1000

5 hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	1.00	0.99	1.00	1980
1	0.97	0.97	0.97	1967
2	0.90	0.92	0.91	1902
3	0.85	0.88	0.87	1940
4	0.96	0.91	0.94	2211

accuracy			0.94	10000
macro avg	0.94	0.94	0.94	10000
weighted avg	0.94	0.94	0.94	10000

Test

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.99	0.97	0.98	233
1	0.84	0.93	0.89	179
2	0.73	0.78	0.76	185
3	0.58	0.65	0.61	167
4	0.90	0.72	0.80	236

accuracy			0.82	1000
macro avg	0.81	0.81	0.81	1000
weighted avg	0.83	0.82	0.82	1000

10 hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	1.00	1.00	1.00	1977
1	0.98	0.98	0.98	1977
2	0.91	0.94	0.93	1882
3	0.90	0.88	0.89	2053
4	0.95	0.94	0.94	2111

accuracy			0.95	10000
macro avg	0.95	0.95	0.95	10000
weighted avg	0.95	0.95	0.95	10000

Test

	precision	recall	f1-score	support
0	0.99	0.99	0.99	228
1	0.87	0.93	0.90	185
2	0.73	0.80	0.76	181
3	0.67	0.66	0.66	190
4	0.89	0.77	0.82	216

accuracy			0.83	1000
macro avg	0.83	0.83	0.83	1000
weighted avg	0.84	0.83	0.83	1000

50 hidden layer size

Training

	precision	recall	f1-score	support
0	1.00	1.00	1.00	1977
1	0.98	0.99	0.98	1976
2	0.97	0.98	0.97	1940
3	0.98	0.98	0.98	2013
4	1.00	1.00	1.00	2094

accuracy			0.99	10000
macro avg	0.99	0.99	0.99	10000
weighted avg	0.99	0.99	0.99	10000

Test

	precision	recall	f1-score	support
0	0.99	1.00	0.99	228
1	0.89	0.94	0.92	188
2	0.76	0.84	0.80	182
3	0.74	0.71	0.73	195
4	0.90	0.82	0.86	207

accuracy			0.86	1000
macro avg	0.86	0.86	0.86	1000
weighted avg	0.87	0.86	0.86	1000

100 hidden layer size

Training

	precision	recall	f1-score	support
0	1.00	1.00	1.00	1977
1	0.98	0.98	0.98	1979
2	0.97	0.98	0.98	1940
3	0.99	0.98	0.99	2017
4	1.00	1.00	1.00	2087

accuracy		0.99	10000
macro avg	0.99	0.99	0.99 10000
weighted avg	0.99	0.99	0.99 10000

Test

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.98	1.00	0.99	225
1	0.88	0.93	0.90	188
2	0.78	0.81	0.79	192
3	0.72	0.72	0.72	186
4	0.91	0.81	0.86	209

accuracy		0.86	1000
macro avg	0.85	0.85	0.85 1000
weighted avg	0.86	0.86	0.86 1000

2)

c)

[1024, 512, 5] hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	1.00	0.99	1.00	1978
1	0.97	0.96	0.97	1989
2	0.93	0.94	0.94	1941
3	0.94	0.94	0.94	2013
4	0.97	0.98	0.97	2079

accuracy			0.96	10000
macro avg	0.96	0.96	0.96	10000
weighted avg	0.96	0.96	0.96	10000

Test

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.97	1.00	0.98	224
1	0.89	0.92	0.90	191
2	0.78	0.80	0.79	194
3	0.70	0.72	0.71	181
4	0.91	0.81	0.86	210

accuracy			0.85	1000
macro avg	0.85	0.85	0.85	1000
weighted avg	0.86	0.85	0.86	1000

[1024, 512, 256, 5] hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.99	0.99	0.99	1982
1	0.96	0.96	0.96	1969
2	0.91	0.90	0.90	1969
3	0.83	0.90	0.86	1855
4	0.96	0.91	0.93	2225

accuracy			0.93	10000
macro avg	0.93	0.93	0.93	10000
weighted avg	0.93	0.93	0.93	10000

Test

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.98	1.00	0.99	225
1	0.88	0.94	0.91	185
2	0.79	0.82	0.81	191
3	0.71	0.76	0.73	175
4	0.96	0.80	0.88	224

accuracy			0.87	1000
macro avg	0.86	0.87	0.86	1000
weighted avg	0.87	0.87	0.87	1000

[1024, 512, 256, 128, 5] hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	1.00	1.00	1.00	1978
1	0.99	0.98	0.99	2001
2	0.97	0.96	0.97	1986
3	0.95	0.96	0.96	1991
4	0.97	0.99	0.98	2044

accuracy 0.98 10000
macro avg 0.98 0.98 0.98 10000
weighted avg 0.98 0.98 0.98 10000

Test

	precision	recall	f1-score	support
0	1.00	1.00	1.00	229
1	0.90	0.94	0.92	189
2	0.84	0.84	0.84	199
3	0.77	0.75	0.76	191
4	0.87	0.84	0.85	192

accuracy 0.88 1000
macro avg 0.87 0.87 0.87 1000
weighted avg 0.88 0.88 0.88 1000

[1024, 512, 256, 128, 64, 5] hidden layer size

Training

	precision	recall	f1-score	support
0	0.99	1.00	0.99	1951
1	0.99	0.98	0.99	1986
2	0.98	0.98	0.98	1962
3	0.96	0.99	0.98	1953
4	1.00	0.97	0.99	2148

accuracy 0.99 10000
macro avg 0.98 0.99 0.99 10000
weighted avg 0.99 0.99 0.99 10000

Test

	precision	recall	f1-score	support
0	0.97	1.00	0.98	221
1	0.89	0.93	0.91	191
2	0.83	0.84	0.84	196
3	0.64	0.76	0.70	157
4	0.95	0.76	0.84	235

accuracy 0.86 1000
macro avg 0.86 0.86 0.85 1000
weighted avg 0.87 0.86 0.86 1000

2)d)

[1024, 512, 5] hidden layer size

Training

	precision	recall	f1-score	support
0	0.98	0.97	0.97	2006

1	0.88	0.88	0.88	1976
2	0.74	0.77	0.76	1887
3	0.67	0.71	0.69	1891
4	0.88	0.82	0.85	2240

accuracy			0.83	10000
macro avg	0.83	0.83	0.83	10000
weighted avg	0.83	0.83	0.83	10000

Test

	precision	recall	f1-score	support
0	0.97	0.99	0.98	226
1	0.84	0.90	0.87	184
2	0.69	0.76	0.73	181
3	0.64	0.66	0.65	181
4	0.91	0.75	0.82	228

accuracy			0.82	1000
macro avg	0.81	0.81	0.81	1000
weighted avg	0.82	0.82	0.82	1000

[1024, 512, 256, 5] hidden layer size

Training

	precision	recall	f1-score	support
0	0.97	0.95	0.96	2026
1	0.86	0.86	0.86	1965
2	0.71	0.76	0.74	1821
3	0.64	0.68	0.66	1879
4	0.87	0.79	0.83	2309

accuracy			0.81	10000
macro avg	0.81	0.81	0.81	10000
weighted avg	0.82	0.81	0.81	10000

Test

	precision	recall	f1-score	support
0	0.97	0.98	0.97	225
1	0.82	0.89	0.85	182
2	0.67	0.75	0.71	177
3	0.60	0.64	0.62	175
4	0.93	0.72	0.81	241

accuracy			0.80	1000
macro avg	0.80	0.80	0.79	1000
weighted avg	0.81	0.80	0.80	1000

[1024, 512, 256, 128, 5] hidden layer size

Training

	precision	recall	f1-score	support
0	1.00	1.00	1.00	1971
1	1.00	1.00	1.00	1978
2	1.00	1.00	1.00	1952
3	1.00	1.00	1.00	2008
4	1.00	1.00	1.00	2091

accuracy			1.00	10000
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macro avg	1.00	1.00	1.00	10000
weighted avg	1.00	1.00	1.00	10000

Test

	precision	recall	f1-score	support
0	0.99	1.00	1.00	227
1	0.89	0.96	0.92	185
2	0.85	0.85	0.85	200
3	0.72	0.80	0.76	169
4	0.94	0.80	0.87	219

accuracy			0.89	1000
macro avg	0.88	0.88	0.88	1000
weighted avg	0.89	0.89	0.89	1000

[1024, 512, 256, 128, 64, 5] hidden layer size

Training

	precision	recall	f1-score	support
0	1.00	0.99	1.00	1985
1	0.99	0.99	0.99	1979
2	0.98	0.98	0.98	1963
3	0.98	0.97	0.98	2020
4	0.98	1.00	0.99	2053

accuracy			0.99	10000
macro avg	0.99	0.99	0.99	10000
weighted avg	0.99	0.99	0.99	10000

Test

	precision	recall	f1-score	support
0	1.00	1.00	1.00	229
1	0.90	0.96	0.93	187
2	0.84	0.82	0.83	205
3	0.72	0.76	0.74	177
4	0.90	0.84	0.87	202

accuracy			0.88	1000
macro avg	0.87	0.87	0.87	1000
weighted avg	0.88	0.88	0.88	1000

2)

d)

[1024, 512, 5] hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.98	0.97	0.97	2006
1	0.88	0.88	0.88	1976
2	0.74	0.77	0.76	1887
3	0.67	0.71	0.69	1891
4	0.88	0.82	0.85	2240

accuracy			0.83	10000
macro avg	0.83	0.83	0.83	10000
weighted avg	0.83	0.83	0.83	10000

Test

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.97	0.99	0.98	226
1	0.84	0.90	0.87	184
2	0.69	0.76	0.73	181
3	0.64	0.66	0.65	181
4	0.91	0.75	0.82	228

accuracy			0.82	1000
macro avg	0.81	0.81	0.81	1000
weighted avg	0.82	0.82	0.82	1000

[1024, 512, 256, 5] hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.97	0.95	0.96	2026
1	0.86	0.86	0.86	1965
2	0.71	0.76	0.74	1821
3	0.64	0.68	0.66	1879
4	0.87	0.79	0.83	2309

accuracy			0.81	10000
macro avg	0.81	0.81	0.81	10000
weighted avg	0.82	0.81	0.81	10000

Test

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.97	0.98	0.97	225
1	0.82	0.89	0.85	182
2	0.67	0.75	0.71	177
3	0.60	0.64	0.62	175
4	0.93	0.72	0.81	241

accuracy			0.80	1000
macro avg	0.80	0.80	0.79	1000
weighted avg	0.81	0.80	0.80	1000

[1024, 512, 256, 128, 5] hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	1.00	1.00	1.00	1971
1	1.00	1.00	1.00	1978
2	1.00	1.00	1.00	1952
3	1.00	1.00	1.00	2008
4	1.00	1.00	1.00	2091

accuracy			1.00	10000
macro avg	1.00	1.00	1.00	10000
weighted avg	1.00	1.00	1.00	10000

Test

	precision	recall	f1-score	support
0	0.99	1.00	1.00	227
1	0.89	0.96	0.92	185
2	0.85	0.85	0.85	200
3	0.72	0.80	0.76	169
4	0.94	0.80	0.87	219

accuracy			0.89	1000
macro avg	0.88	0.88	0.88	1000
weighted avg	0.89	0.89	0.89	1000

[1024, 512, 256, 128, 64, 5] hidden layer size

Training

	precision	recall	f1-score	support
0	1.00	0.99	1.00	1985
1	0.99	0.99	0.99	1979
2	0.98	0.98	0.98	1963
3	0.98	0.97	0.98	2020
4	0.98	1.00	0.99	2053

accuracy			0.99	10000
macro avg	0.99	0.99	0.99	10000
weighted avg	0.99	0.99	0.99	10000

Test

	precision	recall	f1-score	support
0	1.00	1.00	1.00	229
1	0.90	0.96	0.93	187
2	0.84	0.82	0.83	205
3	0.72	0.76	0.74	177
4	0.90	0.84	0.87	202

accuracy			0.88	1000
macro avg	0.87	0.87	0.87	1000
weighted avg	0.88	0.88	0.88	1000

2)

e)

[1024, 512, 5] hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	1.00	0.99	0.99	1980
1	0.97	0.97	0.97	1984
2	0.94	0.95	0.95	1924
3	0.94	0.94	0.94	2025
4	0.97	0.97	0.97	2087

accuracy			0.96	10000
macro avg	0.96	0.96	0.96	10000
weighted avg	0.96	0.96	0.96	10000

Test

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.97	0.99	0.98	224
1	0.87	0.93	0.90	187
2	0.79	0.83	0.81	190
3	0.73	0.72	0.72	189
4	0.90	0.80	0.85	210

accuracy			0.86	1000
macro avg	0.85	0.85	0.85	1000
weighted avg	0.86	0.86	0.86	1000

[1024, 512, 256, 5] hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	1.00	1.00	1.00	1977
1	0.99	0.99	0.99	1985
2	0.98	0.99	0.98	1934
3	0.99	0.98	0.98	2013
4	1.00	1.00	1.00	2091

accuracy			0.99	10000
macro avg	0.99	0.99	0.99	10000
weighted avg	0.99	0.99	0.99	10000

Test

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.97	0.99	0.98	224
1	0.88	0.94	0.91	186
2	0.84	0.86	0.85	195
3	0.80	0.77	0.79	194
4	0.90	0.84	0.87	201

accuracy			0.88	1000
macro avg	0.88	0.88	0.88	1000
weighted avg	0.88	0.88	0.88	1000

[1024, 512, 256, 128, 5] hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	1.00	1.00	1.00	1971
1	1.00	1.00	1.00	1980
2	1.00	1.00	1.00	1950
3	1.00	1.00	1.00	2002
4	1.00	1.00	1.00	2097

accuracy			1.00	10000
macro avg	1.00	1.00	1.00	10000
weighted avg	1.00	1.00	1.00	10000

Test

	precision	recall	f1-score	support
0	1.00	1.00	1.00	229
1	0.90	0.98	0.94	183
2	0.86	0.87	0.87	196
3	0.80	0.79	0.79	188
4	0.92	0.84	0.88	204

accuracy			0.90	1000
macro avg	0.90	0.90	0.90	1000
weighted avg	0.90	0.90	0.90	1000

[1024, 512, 256, 128, 64, 5] hidden layer size

Training

	precision	recall	f1-score	support
0	1.00	1.00	1.00	1971
1	1.00	1.00	1.00	1976
2	1.00	1.00	1.00	1951
3	0.99	1.00	0.99	1987
4	1.00	0.99	0.99	2115

accuracy			1.00	10000
macro avg	1.00	1.00	1.00	10000
weighted avg	1.00	1.00	1.00	10000

Test

	precision	recall	f1-score	support
0	0.99	1.00	1.00	227
1	0.95	0.96	0.95	196
2	0.84	0.91	0.87	183
3	0.74	0.79	0.76	174
4	0.94	0.80	0.86	220

accuracy			0.90	1000
macro avg	0.89	0.89	0.89	1000
weighted avg	0.90	0.90	0.90	1000

2)

f)

[512] hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.97	0.93	0.95	2042
1	0.82	0.82	0.82	1976
2	0.69	0.71	0.70	1906
3	0.66	0.69	0.68	1913
4	0.86	0.83	0.84	2163

accuracy			0.80	10000
macro avg	0.80	0.80	0.80	10000
weighted avg	0.80	0.80	0.80	10000

Test

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.91	0.98	0.94	214
1	0.80	0.77	0.78	206
2	0.61	0.66	0.63	183
3	0.59	0.62	0.61	179
4	0.87	0.74	0.80	218

accuracy			0.76	1000
macro avg	0.76	0.75	0.75	1000
weighted avg	0.77	0.76	0.76	1000

[512, 256] hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.97	0.94	0.95	2025
1	0.84	0.84	0.84	1974
2	0.71	0.73	0.72	1911
3	0.65	0.69	0.67	1889
4	0.86	0.82	0.84	2201

accuracy			0.81	10000
macro avg	0.81	0.80	0.81	10000
weighted avg	0.81	0.81	0.81	10000

Test

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.93	0.98	0.95	216
1	0.79	0.80	0.79	196
2	0.64	0.67	0.65	189
3	0.57	0.60	0.58	179
4	0.84	0.72	0.78	220

accuracy			0.76	1000
macro avg	0.75	0.75	0.75	1000
weighted avg	0.76	0.76	0.76	1000

[512, 256, 128] hidden layer size

Training

	precision	recall	f1-score	support
--	-----------	--------	----------	---------

0	0.97	0.95	0.96	2010
1	0.85	0.86	0.85	1975

2	0.74	0.76	0.75	1905
3	0.68	0.71	0.70	1929
4	0.86	0.82	0.84	2181

accuracy			0.82	10000
macro avg	0.82	0.82	0.82	10000
weighted avg	0.82	0.82	0.82	10000

Test

	precision	recall	f1-score	support
0	0.95	0.98	0.96	222
1	0.76	0.83	0.80	181
2	0.66	0.67	0.67	196
3	0.57	0.59	0.58	179
4	0.86	0.72	0.78	222

accuracy			0.77	1000
macro avg	0.76	0.76	0.76	1000
weighted avg	0.77	0.77	0.77	1000

[512, 256, 128, 64] hidden layer size

Training

	precision	recall	f1-score	support
0	0.98	0.96	0.97	2011
1	0.87	0.86	0.86	1999
2	0.72	0.75	0.73	1871
3	0.66	0.68	0.67	1956
4	0.85	0.82	0.83	2163

accuracy			0.82	10000
macro avg	0.82	0.81	0.81	10000
weighted avg	0.82	0.82	0.82	10000

Test

	precision	recall	f1-score	support
0	0.97	0.99	0.98	224
1	0.82	0.87	0.84	188
2	0.66	0.72	0.69	183
3	0.61	0.64	0.62	179
4	0.90	0.75	0.82	226

accuracy			0.80	1000
macro avg	0.79	0.79	0.79	1000
weighted avg	0.80	0.80	0.80	1000