Learning...

Epoch 1

Epoch 2

Epoch 3

Epoch 4

Epoch 5

Epoch 6

Epoch 7

Epoch 8

Epoch 9

Epoch 10

Done.

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Parameters:

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Epochs: 10

Grid size: 10x10

h (neighbourhood function) type: bubble

alpha function type: simple\_div

Starting vicinities: 3

Random seed: 0

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Quantization error: 0.374757224726566

Topographic error: 0.02

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Resulting grid:

(showing input vectors' classes)

1 2 3 4 5 6 7 8 9 10

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1 |\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_3\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_22222\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_11111111\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_1\_|

2 |\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_2\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_22\_|\_\_\_\_\_\_\_\_\_22222222\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_22\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_11111111\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_1\_|

3 |\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_33\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_22\_|\_\_\_\_\_\_\_\_\_\_\_222222\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_11\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|

4 |\_\_\_\_\_\_\_\_\_\_\_\_33233\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_2\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_2\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_22\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_11\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|

5 |\_\_\_\_\_\_\_\_\_\_\_\_\_\_333\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_3\_|\_\_\_\_\_\_\_\_\_\_\_\_23333\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_23\_|\_\_\_\_\_\_\_\_\_\_\_\_22222\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_1111\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|

6 |\_\_\_\_\_\_\_\_\_\_\_\_\_\_333\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_2222\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_1111111\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|

7 |\_\_\_\_\_\_\_\_\_\_\_\_33333\_|\_\_\_\_\_\_\_\_\_\_\_\_33333\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_2\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_222\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_1\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|

8 |\_\_\_\_\_\_\_\_\_\_\_\_\_3333\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_22\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|

9 |\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_33\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_3\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|

10 |\_\_\_\_\_\_\_3333333333\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_33\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_33\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_22\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|\_1111111111111111\_|\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_|

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Training statistics:

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Grid after training:

[[[5.31110682 2.54817456 4.42709152 1.58154797]

[5.43231908 2.55330127 4.2421732 1.45077357]

[5.48899991 2.56185885 4.20303414 1.39750883]

[5.48255288 2.5510821 4.16007346 1.37060273]

[5.31421837 2.48000821 3.81451519 1.20126257]

[5.18071573 2.78377 2.80479807 0.75672204]

[5.07071205 2.88306554 2.49141741 0.62997878]

[4.89752481 2.94306608 2.0281199 0.45606442]

[4.70173186 3.10244361 1.40824168 0.19676183]

[4.70177726 3.10244975 1.41215859 0.19682453]]

[[5.618611 2.62658324 4.73290401 1.68440353]

[5.61551839 2.60759088 4.45867418 1.52945458]

[5.63792373 2.60860616 4.38346613 1.46962428]

[5.62752232 2.61781223 4.31841665 1.4345514 ]

[5.5231807 2.55596315 3.9487491 1.22607197]

[5.25418367 2.80967005 2.93862141 0.80588287]

[5.1042443 2.89888467 2.53610487 0.64452922]

[4.93732057 2.96077349 2.08570648 0.47340725]

[4.72591388 3.12423541 1.41492941 0.19347652]

[4.72425348 3.12325274 1.41360192 0.19339019]]

[[5.81914845 2.70194882 4.87487692 1.74629126]

[5.88655319 2.75690459 4.61141304 1.59774578]

[5.88194062 2.74316943 4.51793592 1.53029628]

[5.88105218 2.7471398 4.47533663 1.50456067]

[5.88619837 2.74649696 4.26035768 1.36822372]

[5.43882995 3.02225202 2.94871035 0.82456272]

[5.28726466 3.0425056 2.63188634 0.68903015]

[5.19505087 3.10856507 2.32928599 0.58089771]

[4.89918491 3.30402636 1.417109 0.20075931]

[4.89918491 3.30402636 1.417109 0.20075931]]

[[5.93042749 2.71244636 4.97707199 1.76473052]

[5.97499417 2.76165912 4.67086507 1.59842456]

[5.96994998 2.75844777 4.58314932 1.54834893]

[5.96691359 2.77323489 4.54290165 1.52051255]

[5.98384659 2.79438562 4.3386453 1.39667337]

[5.49832384 3.03920276 3.0143287 0.84522963]

[5.33447525 3.06526056 2.65413518 0.69505231]

[5.25758827 3.11363674 2.40382401 0.60968539]

[4.90664433 3.31206436 1.41526704 0.20438335]

[4.90664433 3.31206436 1.41526704 0.20438335]]

[[6.14360999 2.8828632 5.3396351 1.97823746]

[6.16615193 2.87666778 4.98530279 1.76279113]

[6.17259352 2.8749145 4.91633603 1.72202269]

[6.17551489 2.89288545 4.87741108 1.69620474]

[6.1635923 2.88292103 4.48899015 1.46000396]

[5.60260139 3.13412703 3.01109915 0.84673836]

[5.45375805 3.16081543 2.6809368 0.70996756]

[5.37018262 3.21004836 2.40507436 0.61708421]

[4.97385888 3.37008574 1.40945561 0.21300408]

[4.97385888 3.37008574 1.40945561 0.21300408]]

[[6.22584055 2.93073835 5.443054 2.05388754]

[6.26777025 2.94686916 5.13511836 1.85480871]

[6.27575662 2.93734843 5.08052698 1.81470878]

[6.25833618 2.95474117 5.03507014 1.78971746]

[6.29011885 2.96382309 4.59505522 1.5182583 ]

[5.62902269 3.30238964 2.81162392 0.77553685]

[5.54048747 3.32817229 2.54907739 0.66269589]

[5.47610088 3.36081303 2.37755076 0.60340191]

[5.0817391 3.49263816 1.41872847 0.2119948 ]

[5.0817391 3.49263816 1.41872847 0.2119948 ]]

[[6.51144873 3.00648054 5.64799752 2.11254909]

[6.54921524 3.03063668 5.27093014 1.87216087]

[6.54698048 3.01373767 5.2240686 1.82751987]

[6.54001376 3.01656464 5.18795873 1.79929652]

[6.61693267 3.07405273 4.71362418 1.51509596]

[6.1028775 3.30387818 3.48639515 1.03404 ]

[6.01969463 3.32009834 3.25972985 0.9349456 ]

[5.95862914 3.35289894 3.10761259 0.87823943]

[5.14541828 3.55616437 1.42673001 0.22948268]

[5.14541828 3.55616437 1.42673001 0.22948268]]

[[6.72818383 3.08113627 5.86154981 2.15819702]

[6.7323701 3.08126995 5.43504193 1.89743158]

[6.73736646 3.07104388 5.4034984 1.87124505]

[6.67269251 3.0670367 5.28987205 1.82813003]

[6.69992082 3.10158182 4.73279471 1.51347472]

[6.10602021 3.32514145 3.40584405 0.99703842]

[5.97915218 3.3768504 3.09402171 0.86701849]

[5.94770014 3.39438138 3.01597782 0.83169477]

[5.16857606 3.58119896 1.43254429 0.22549217]

[5.16857606 3.58119896 1.43254429 0.22549217]]

[[6.80412282 3.10167732 5.93453365 2.18097057]

[6.79852243 3.09816565 5.44658343 1.88955091]

[6.79015093 3.09155429 5.4095908 1.86974368]

[6.72588221 3.08925645 5.29381277 1.83024145]

[6.7224542 3.10885504 4.74202456 1.52465196]

[6.14474942 3.33086554 3.44563189 1.01580493]

[6.04079668 3.37901415 3.18318029 0.90307803]

[5.98793732 3.40592157 3.05874186 0.84886714]

[5.17591832 3.59223795 1.43425456 0.22557571]

[5.17591832 3.59223795 1.43425456 0.22557571]]

[[6.86442397 3.1291925 6.03433468 2.2133728 ]

[6.90397039 3.12724073 5.60855278 1.94237595]

[6.89507672 3.12281763 5.58265125 1.93236051]

[6.82657456 3.11586329 5.4869139 1.90787933]

[6.91160218 3.14234684 4.7698825 1.47285978]

[6.42814895 3.34065872 3.72051135 1.07864735]

[6.29657626 3.38997207 3.45863561 0.98162553]

[6.241278 3.41742084 3.31835241 0.91863362]

[5.2339307 3.65609843 1.45288739 0.24395757]

[5.2339307 3.65609843 1.45288739 0.24395757]]]

Winner neurons together with a list of pairs indicating

associated input vectors' classes and their numbers:

(5, 8): [[1, 1], [1, 13], [1, 52], [1, 85], [1, 118], [1, 121], [1, 130]]

(9, 4): [[2, 2], [2, 8]]

(7, 0): [[3, 3], [3, 75], [3, 123], [3, 135]]

(1, 8): [[1, 4], [1, 19], [1, 28], [1, 76], [1, 88], [1, 91], [1, 103], [1, 112]]

(5, 4): [[2, 5], [2, 14], [2, 20], [2, 107]]

(3, 0): [[3, 6], [3, 60], [2, 101], [3, 129], [3, 150]]

(1, 9): [[1, 7]]

(9, 0): [[3, 9], [3, 18], [3, 24], [3, 30], [3, 54], [3, 57], [3, 69], [3, 93], [3, 96], [3, 108]]

(0, 9): [[1, 10]]

(1, 4): [[2, 11], [2, 38], [2, 44], [2, 59], [2, 89], [2, 98], [2, 119], [2, 128]]

(5, 0): [[3, 12], [3, 48], [3, 147]]

(6, 0): [[3, 15], [3, 27], [3, 87], [3, 99], [3, 111]]

(9, 8): [[1, 16], [1, 31], [1, 43], [1, 46], [1, 49], [1, 55], [1, 58], [1, 61], [1, 64], [1, 94], [1, 97], [1, 100], [1, 109], [1, 133], [1, 139], [1, 145]]

(2, 3): [[2, 17], [2, 50]]

(0, 0): [[3, 21]]

(4, 8): [[1, 22], [1, 70], [1, 79], [1, 148]]

(1, 5): [[2, 23], [2, 146]]

(0, 8): [[1, 25], [1, 37], [1, 40], [1, 115], [1, 124], [1, 127], [1, 136], [1, 142]]

(6, 4): [[2, 26], [2, 47], [2, 77]]

(0, 4): [[2, 29], [2, 32], [2, 92], [2, 95], [2, 131]]

(6, 1): [[3, 33], [3, 51], [3, 114], [3, 138], [3, 144]]

(2, 8): [[1, 34], [1, 73]]

(3, 4): [[2, 35], [2, 113]]

(4, 0): [[3, 36], [3, 45], [3, 105]]

(9, 3): [[3, 39], [3, 120]]

(4, 4): [[2, 41], [2, 71], [2, 74], [2, 125], [2, 143]]

(2, 0): [[3, 42], [3, 66]]

(2, 4): [[2, 53], [2, 65], [2, 116], [2, 137], [2, 140], [2, 149]]

(3, 2): [[2, 56]]

(4, 3): [[2, 62], [3, 117]]

(8, 0): [[3, 63], [3, 132]]

(3, 8): [[1, 67], [1, 106]]

(4, 2): [[2, 68], [3, 72], [3, 81], [3, 84], [3, 102]]

(9, 1): [[3, 78], [3, 90]]

(7, 4): [[2, 80], [2, 110]]

(6, 8): [[1, 82]]

(6, 3): [[2, 83]]

(3, 3): [[2, 86]]

(1, 1): [[2, 104]]

(1, 3): [[2, 122], [2, 134]]

(8, 3): [[3, 126]]

(4, 1): [[3, 141]]