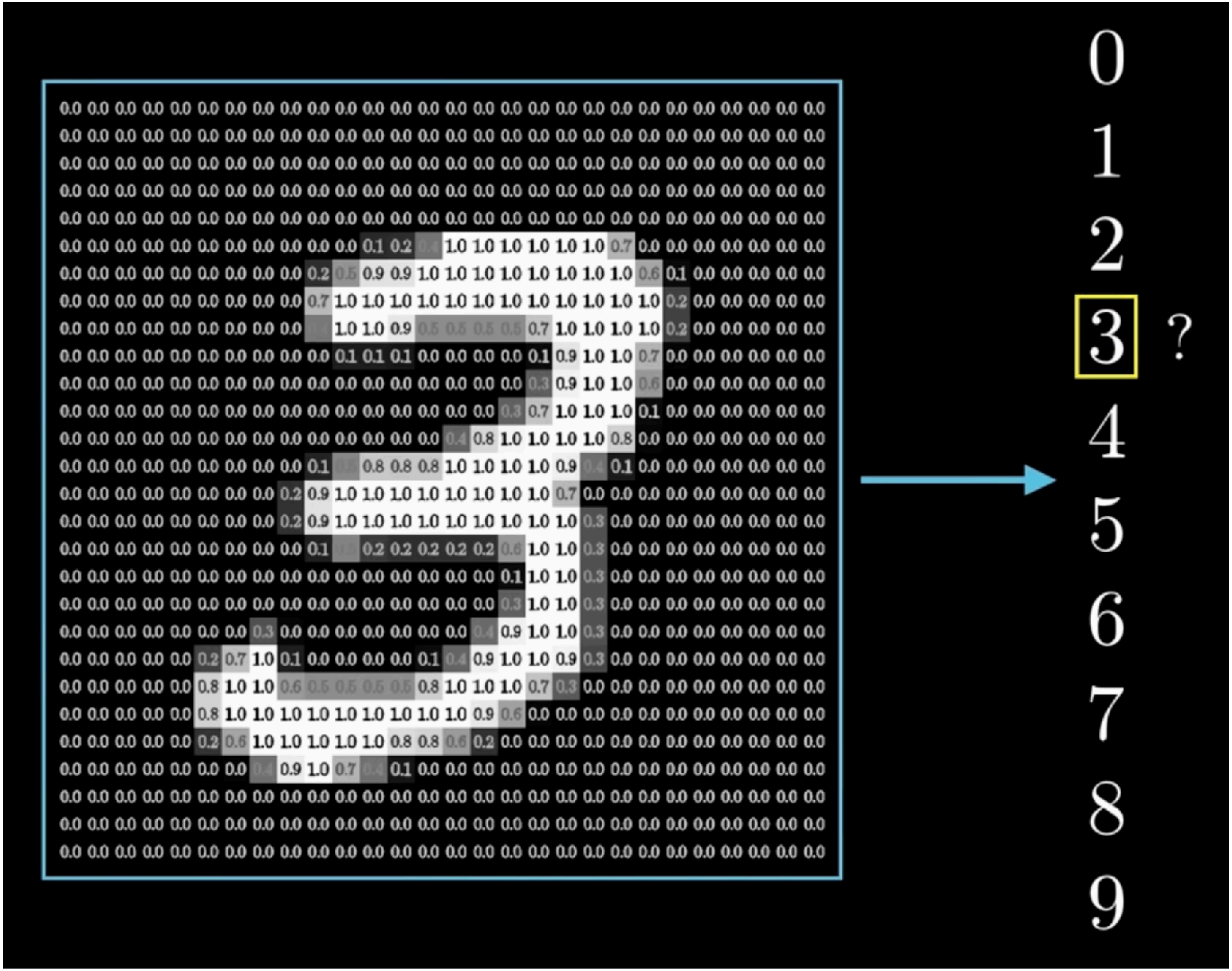
Reseau Neuronale

Reference:

Youtube: 3Blue1Brown “But what is a neural network? | Deep learning chapter 1”


0
1
2
3
?
4
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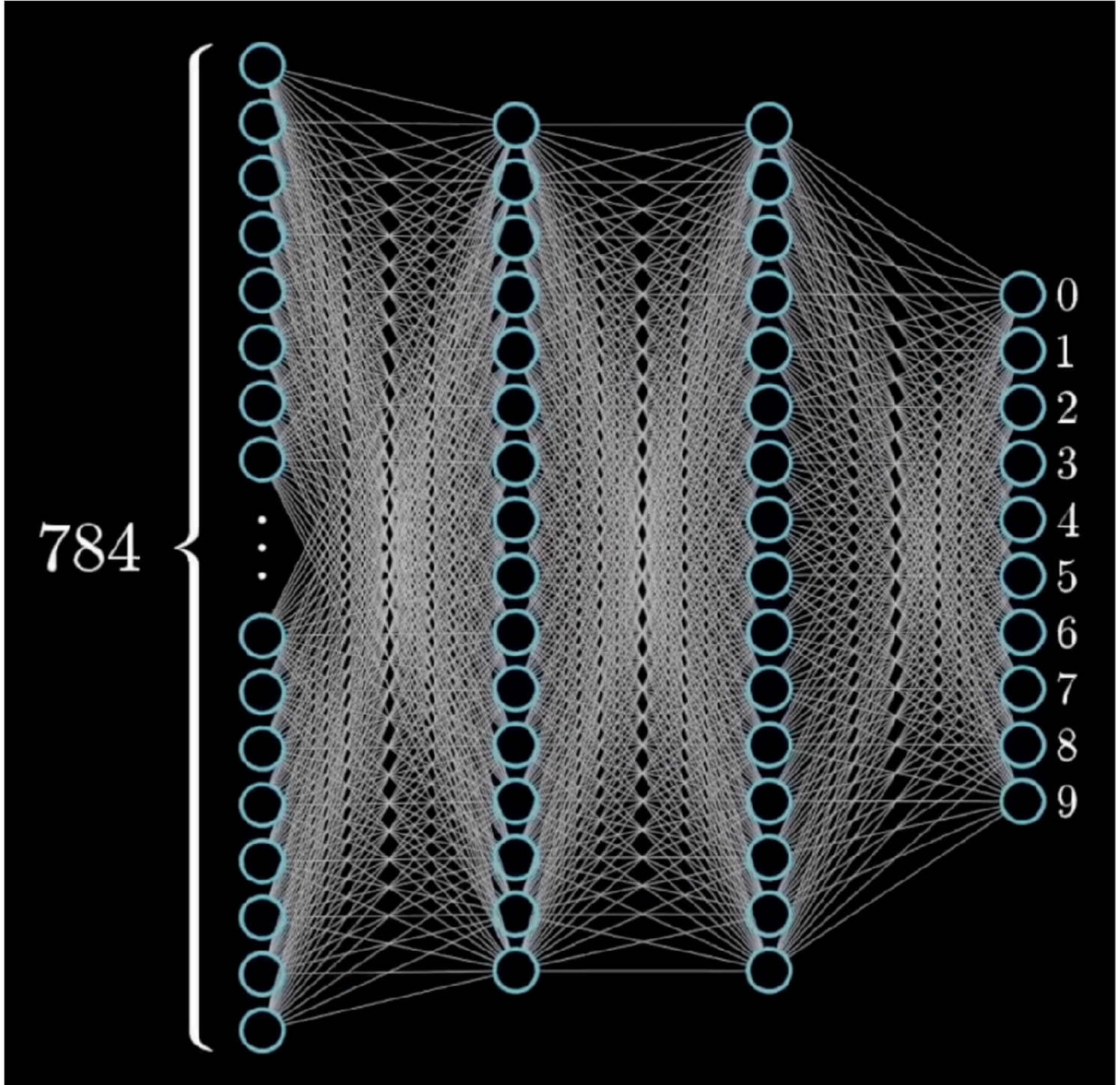
8
9


784
0
1
2
3
4
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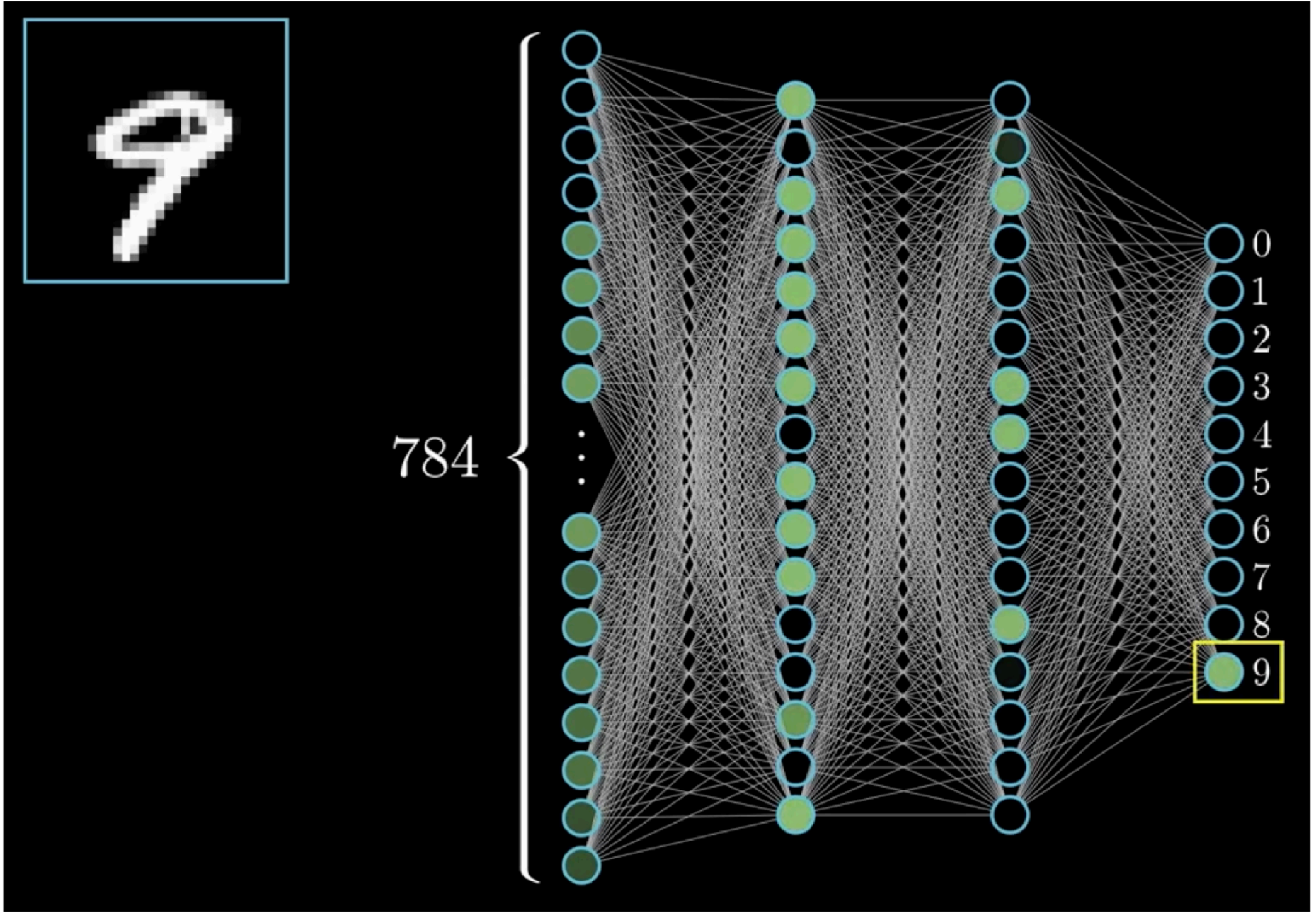
8
9


784
0
1
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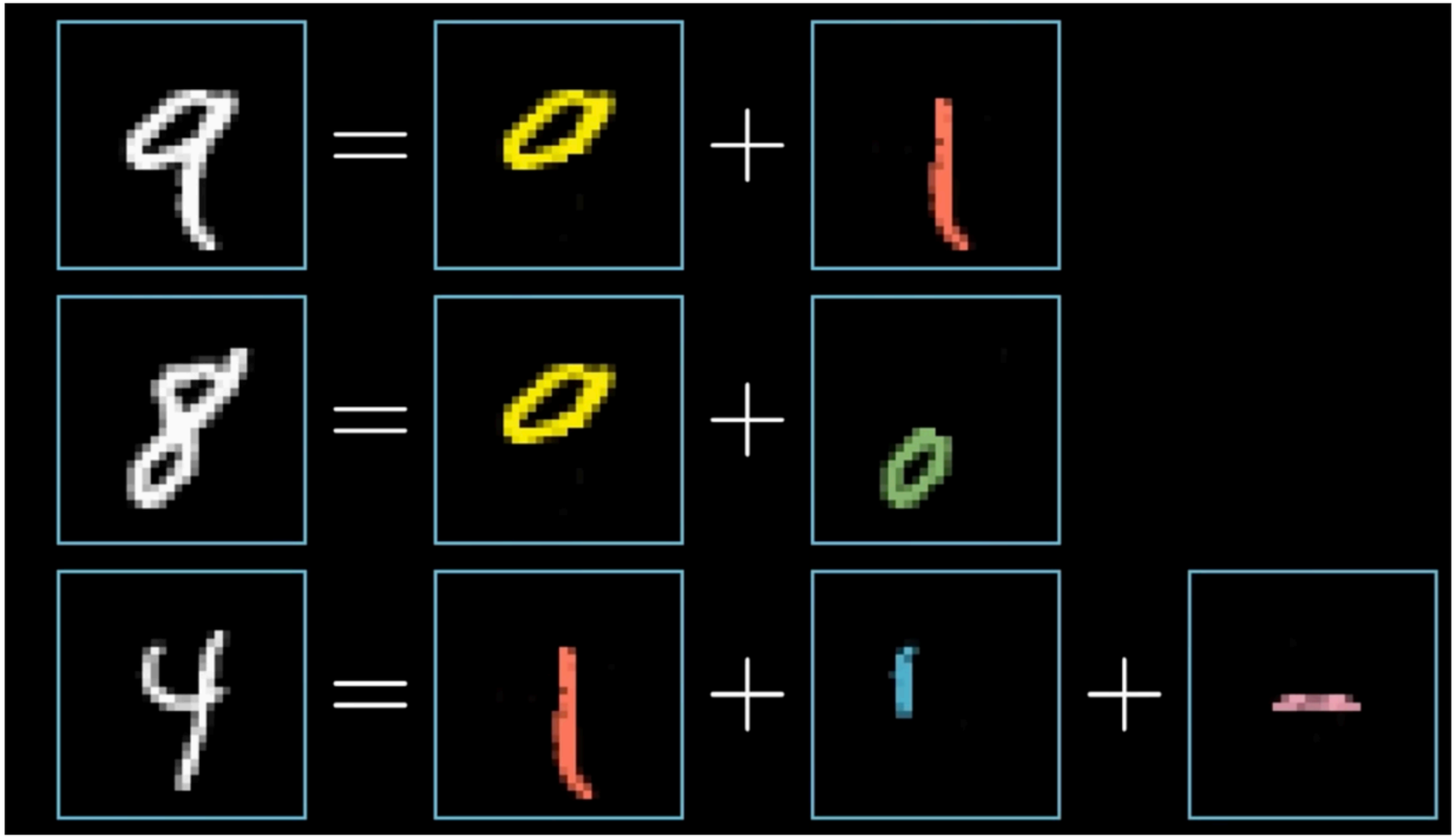
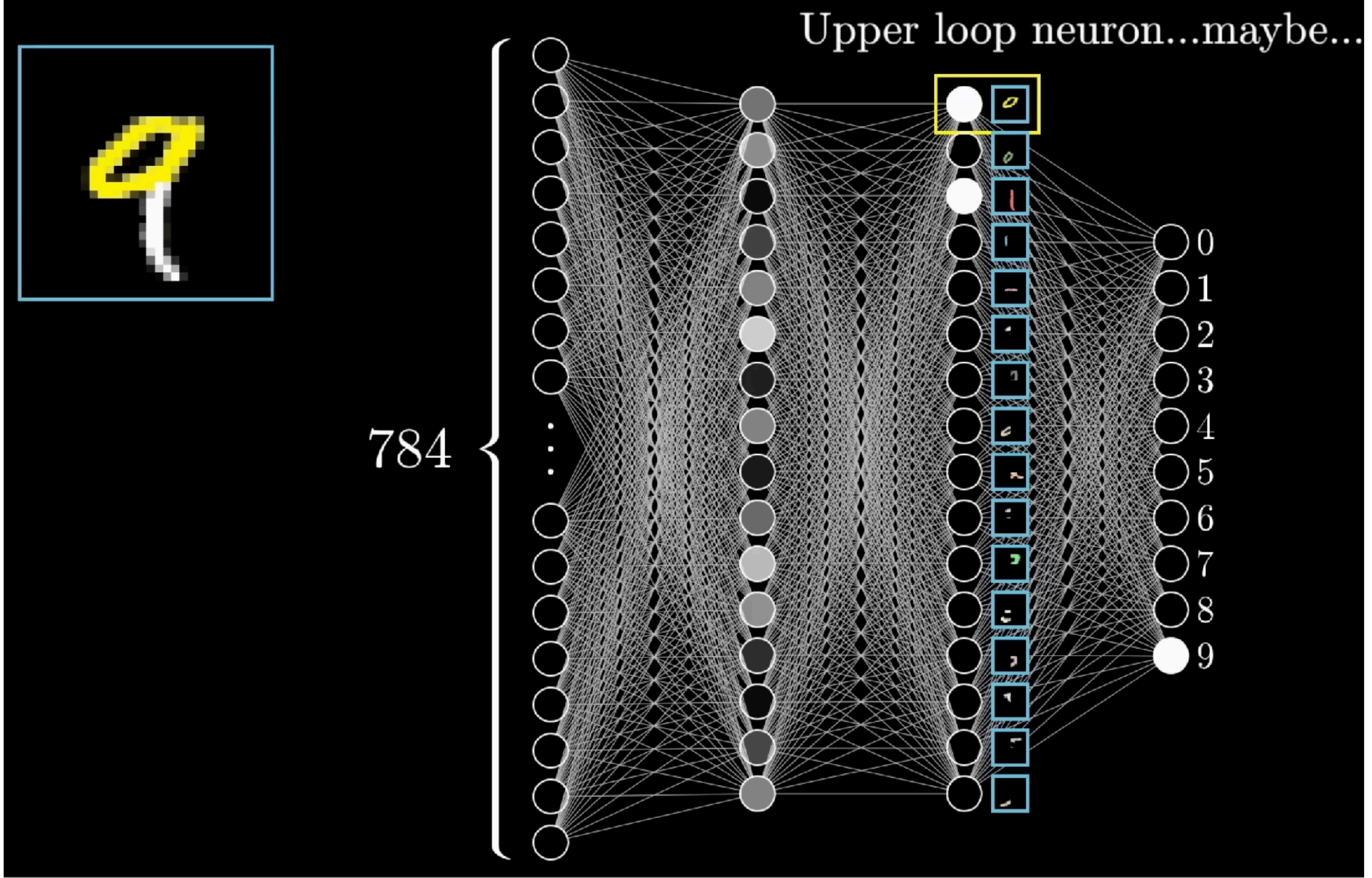
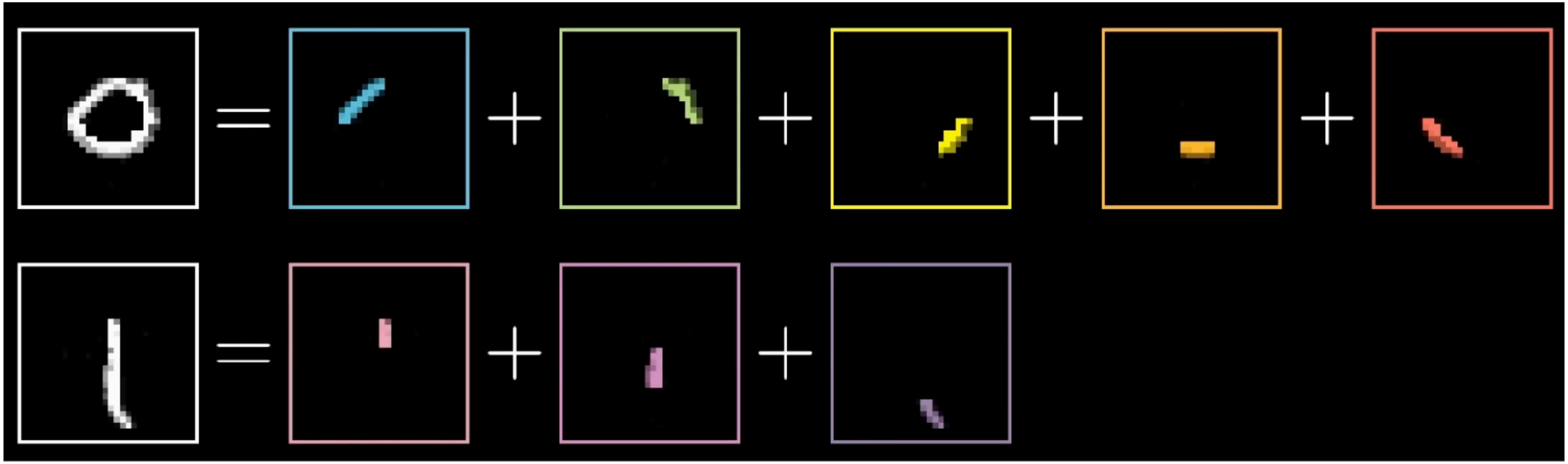
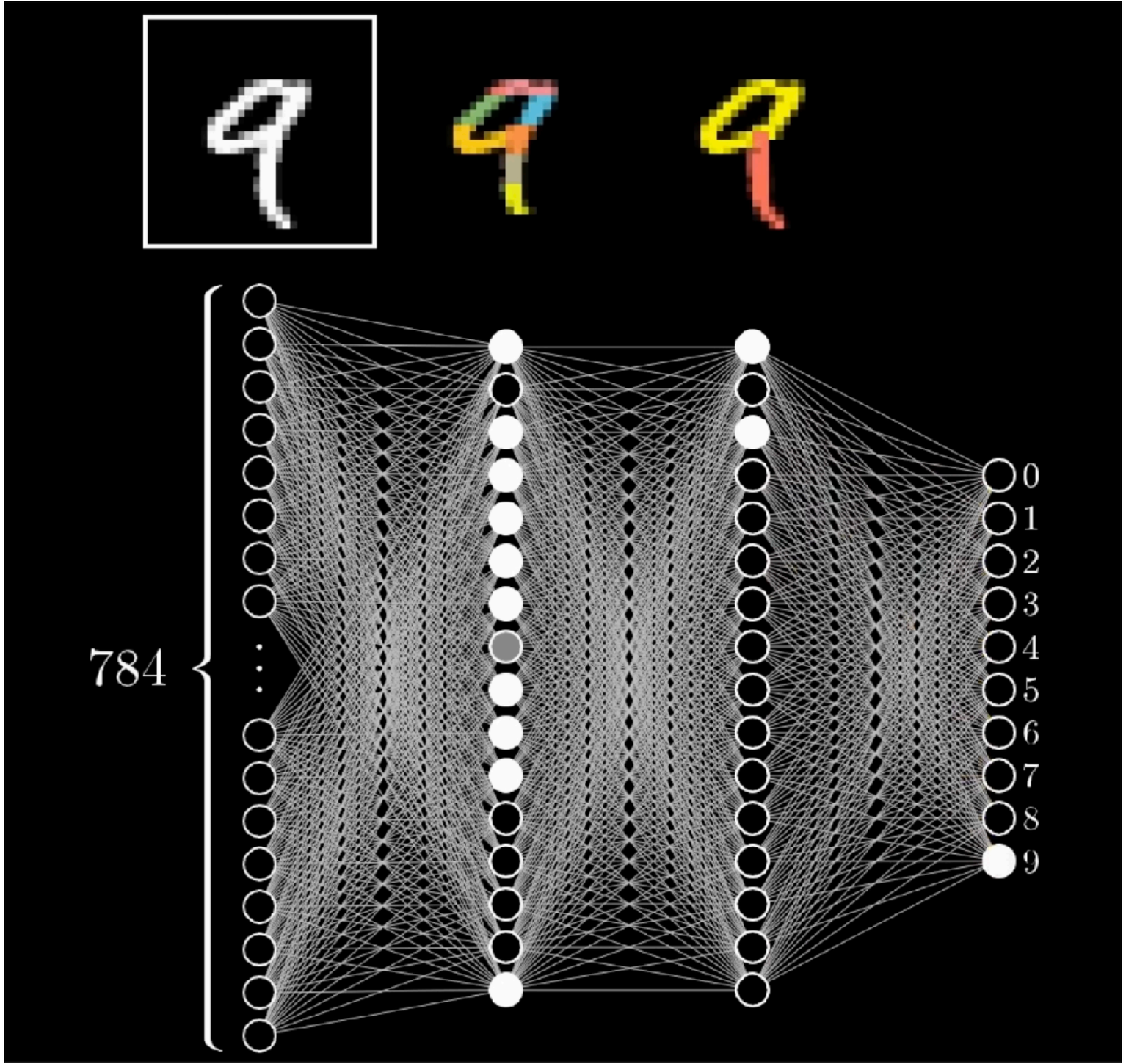
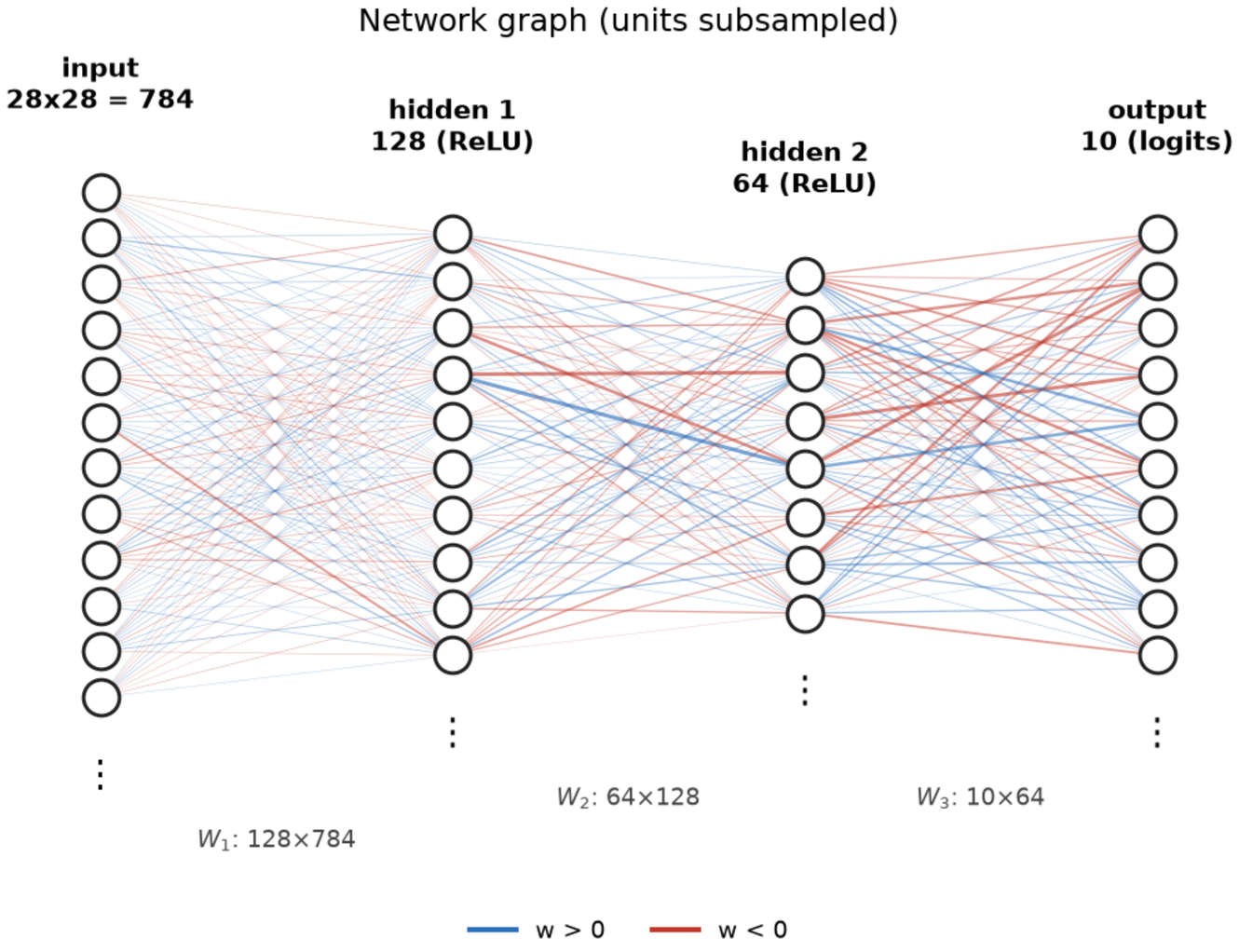


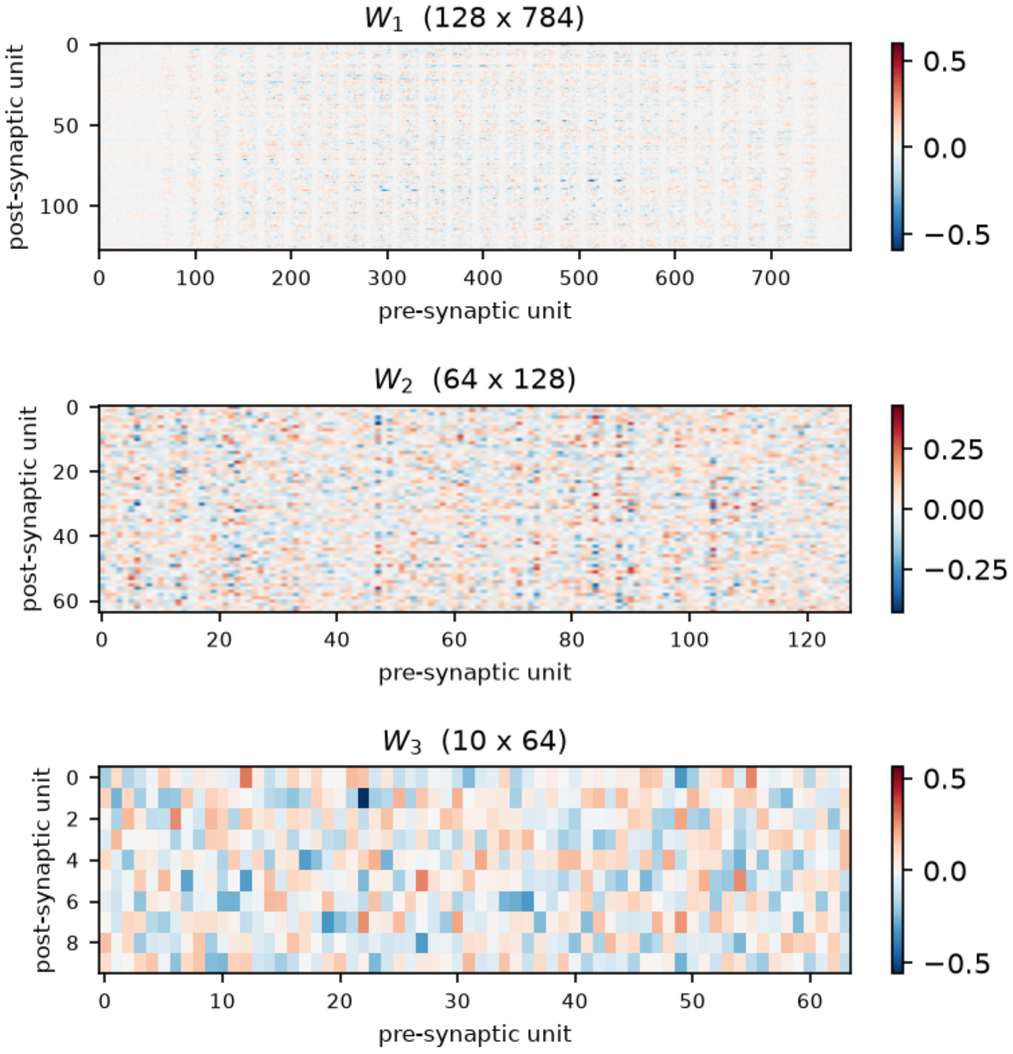

Upper loop neuron...maybe...
784
0
1
2
3
4
5
6
7
8
9



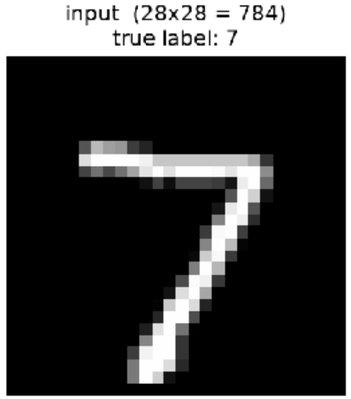

784
0
1
2
3
4
5
6
7
8
9

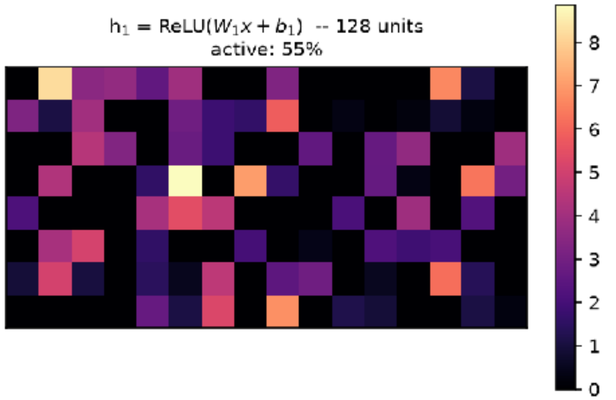
MLP for MNIST: 784 → 128 → 64 → 10

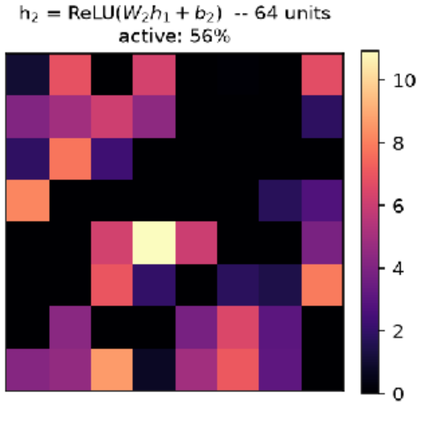


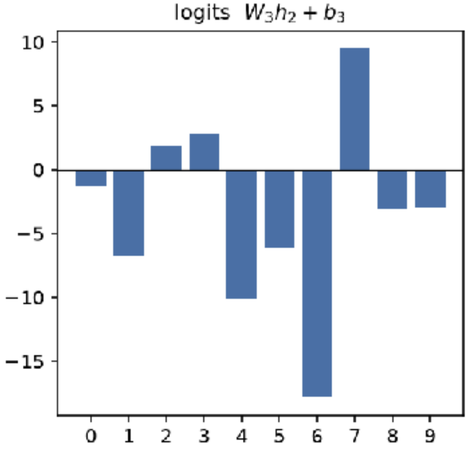


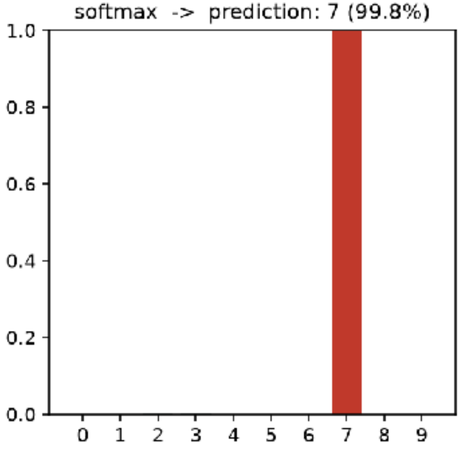
One digit through the network

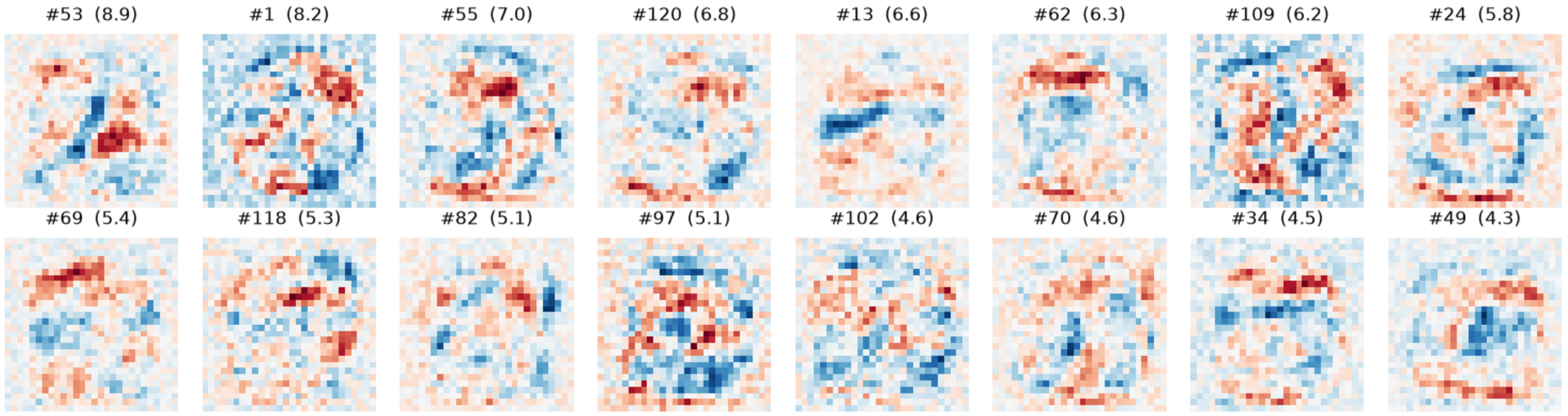


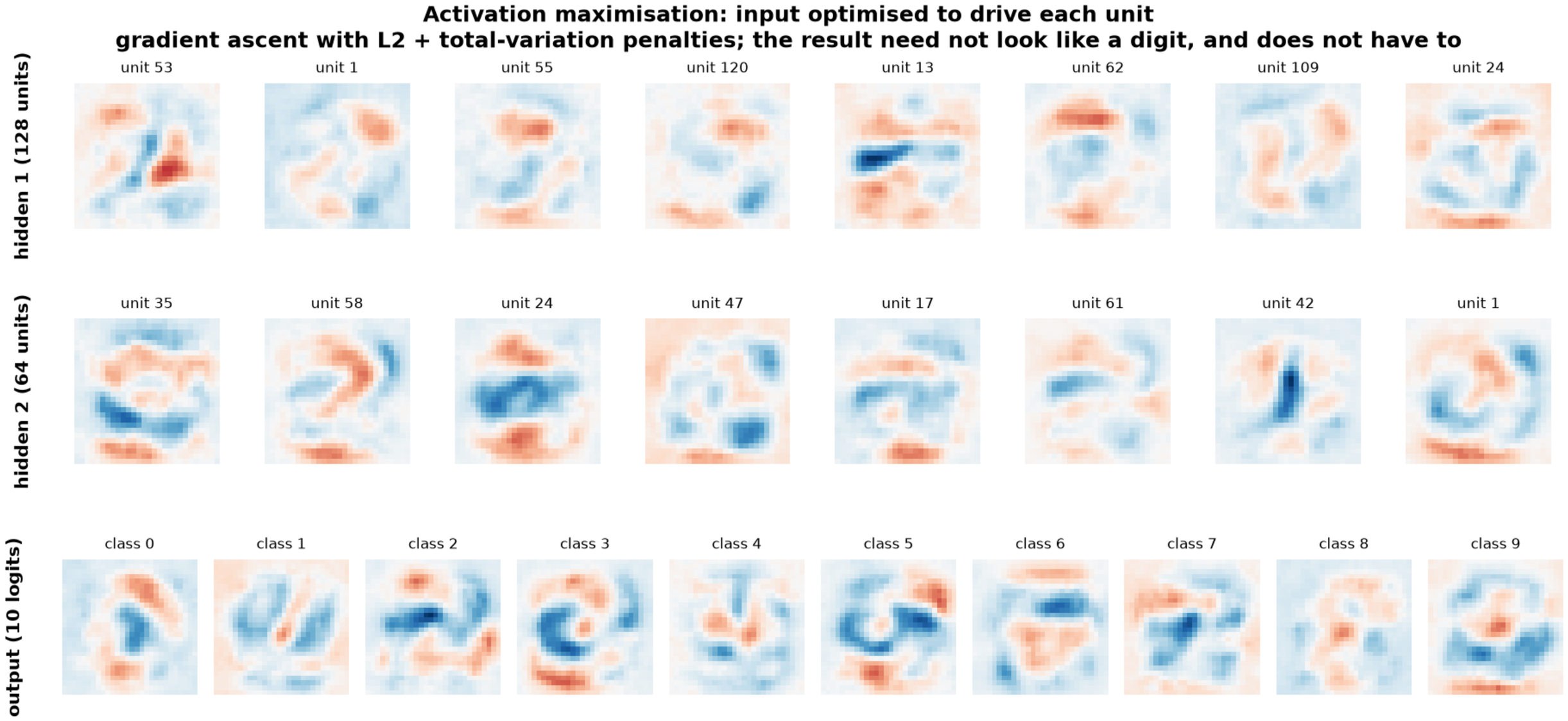


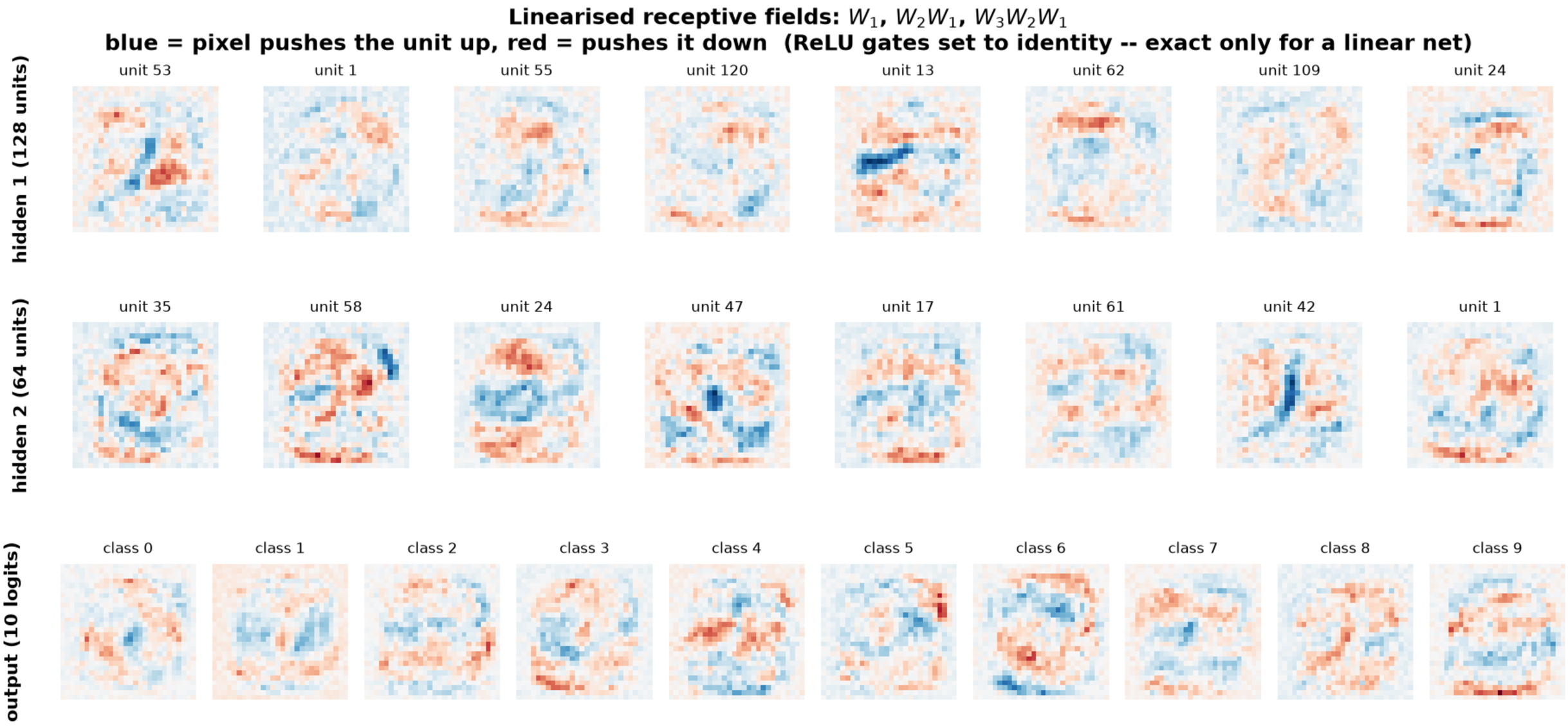


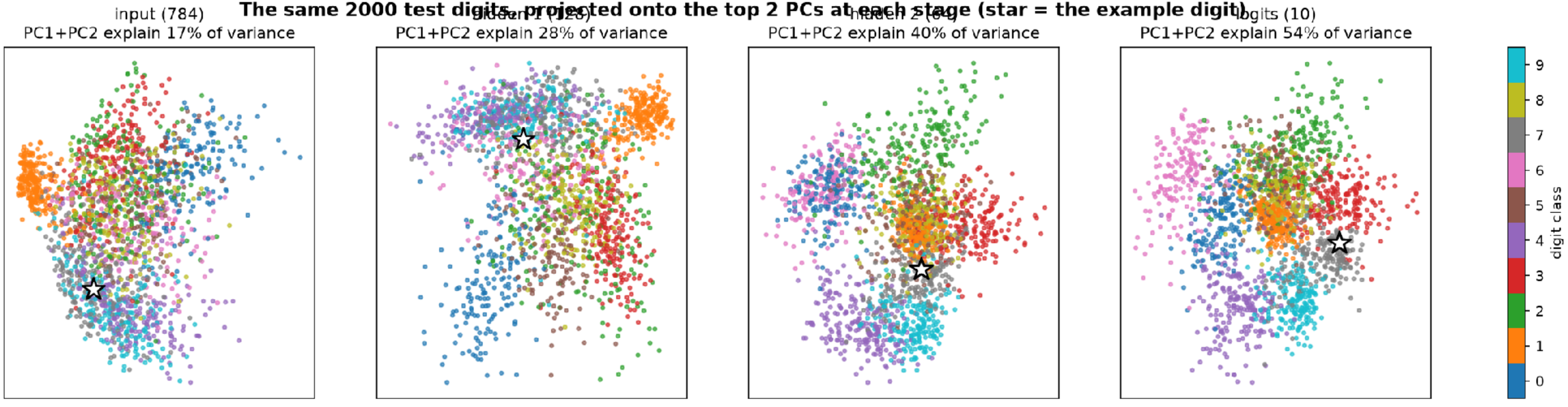





Rows of W_1 reshaped to 28x28 — the 16 hidden-1 units most activated by this digit
(blue = excitatory pixel, red = inhibitory; value in brackets = activation)
#53 (8.9)
#1 (8.2)
#55 (7.0)
#120 (6.8)
#13 (6.6)
#62 (6.3)
#109 (6.2)
#24 (5.8)
#69 (5.4)
#118 (5.3)
#82 (5.1)
#97 (5.1)
#102 (4.6)
#70 (4.6)
#34 (4.5)
#49 (4.3)


Activation maximisation: input optimised to drive each unit
gradient ascent with L2 + total-variation penalties; the result need not look like a digit, and does not have to
hidden 1 (128 units)
unit 53
unit 1
unit 55
unit 120
unit 13
unit 62
unit 109
unit 24
hidden 2 (64 units)
unit 35
unit 58
unit 24
unit 47
unit 17
unit 61
unit 42
unit 1
output (10 logits)
class 0
class 1
class 2
class 3
class 4
class 5
class 6
class 7
class 8
class 9


Linearised receptive fields: W_1, W_2W_1, $W_3W_2W_1$
blue = pixel pushes the unit up, red = pushes it down (ReLU gates set to identity -- exact only for a linear net)
hidden 1 (128 units)
unit 53
unit 1
unit 55
unit 120
unit 13
unit 62
unit 109
unit 24
hidden 2 (64 units)
unit 35
unit 58
unit 24
unit 47
unit 17
unit 61
unit 42
unit 1
output (10 logits)
class 0
class 1
class 2
class 3
class 4
class 5
class 6
class 7
class 8
class 9


The same 2000 test digits, projected onto the top 2 PCs at each stage (star = the example digit)
input (784)
PC1+PC2 explain 17% of variance
hidden 1 (128)
PC1+PC2 explain 28% of variance
hidden 2 (64)
PC1+PC2 explain 40% of variance
logits (10)
PC1+PC2 explain 54% of variance
digit class
0
1
2
3
4
5
6
7
8
9