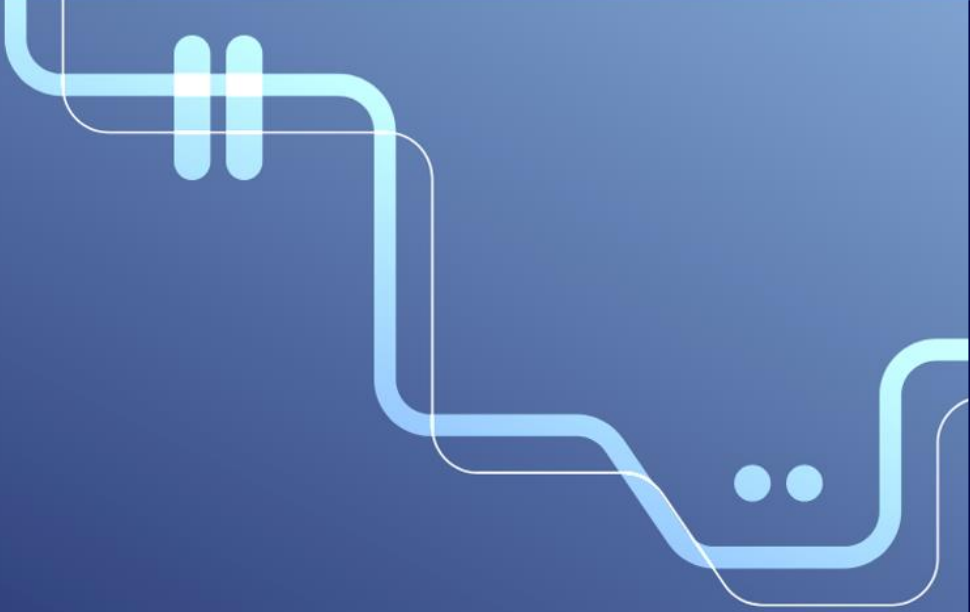


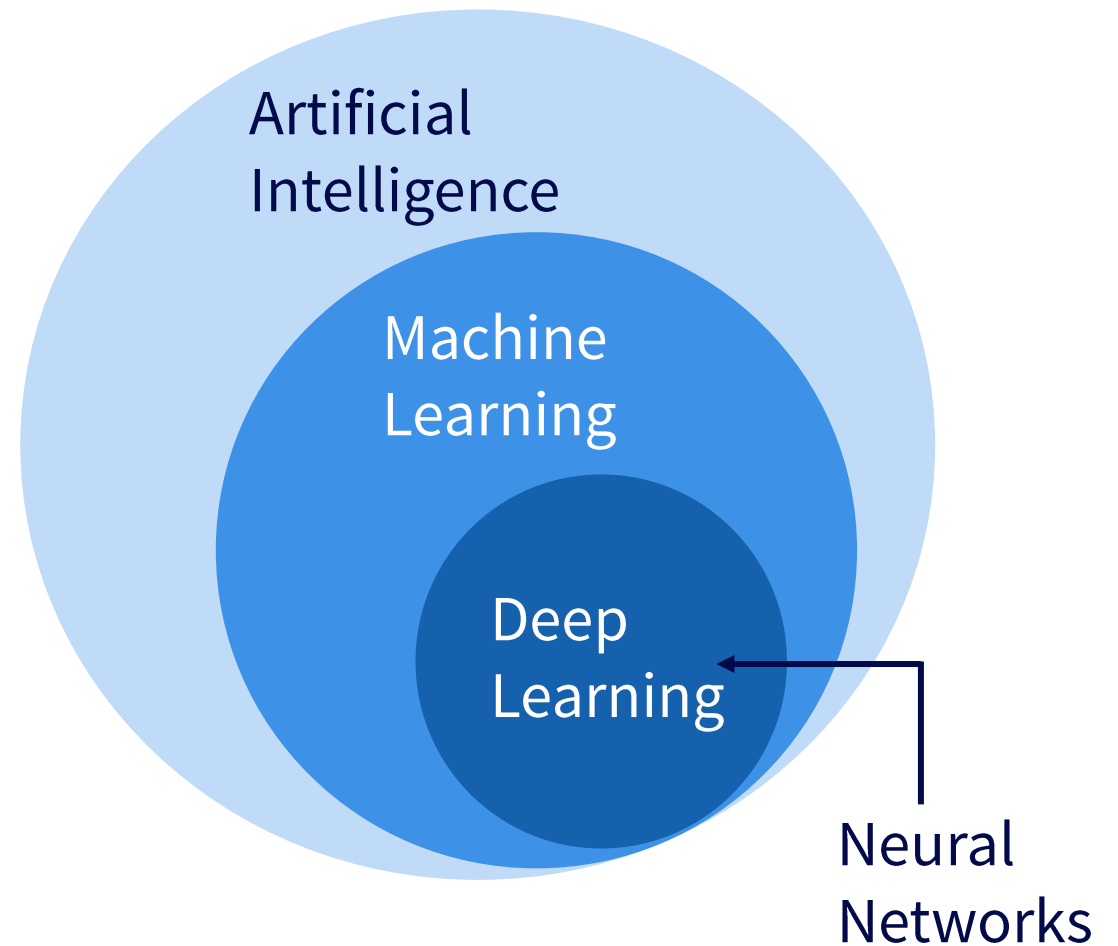
A decorative graphic in the top right corner consisting of several light blue lines and shapes. It includes a horizontal line with two vertical bars, a vertical line, a horizontal line, a diagonal line, and two small circles, all connected by smooth curves.

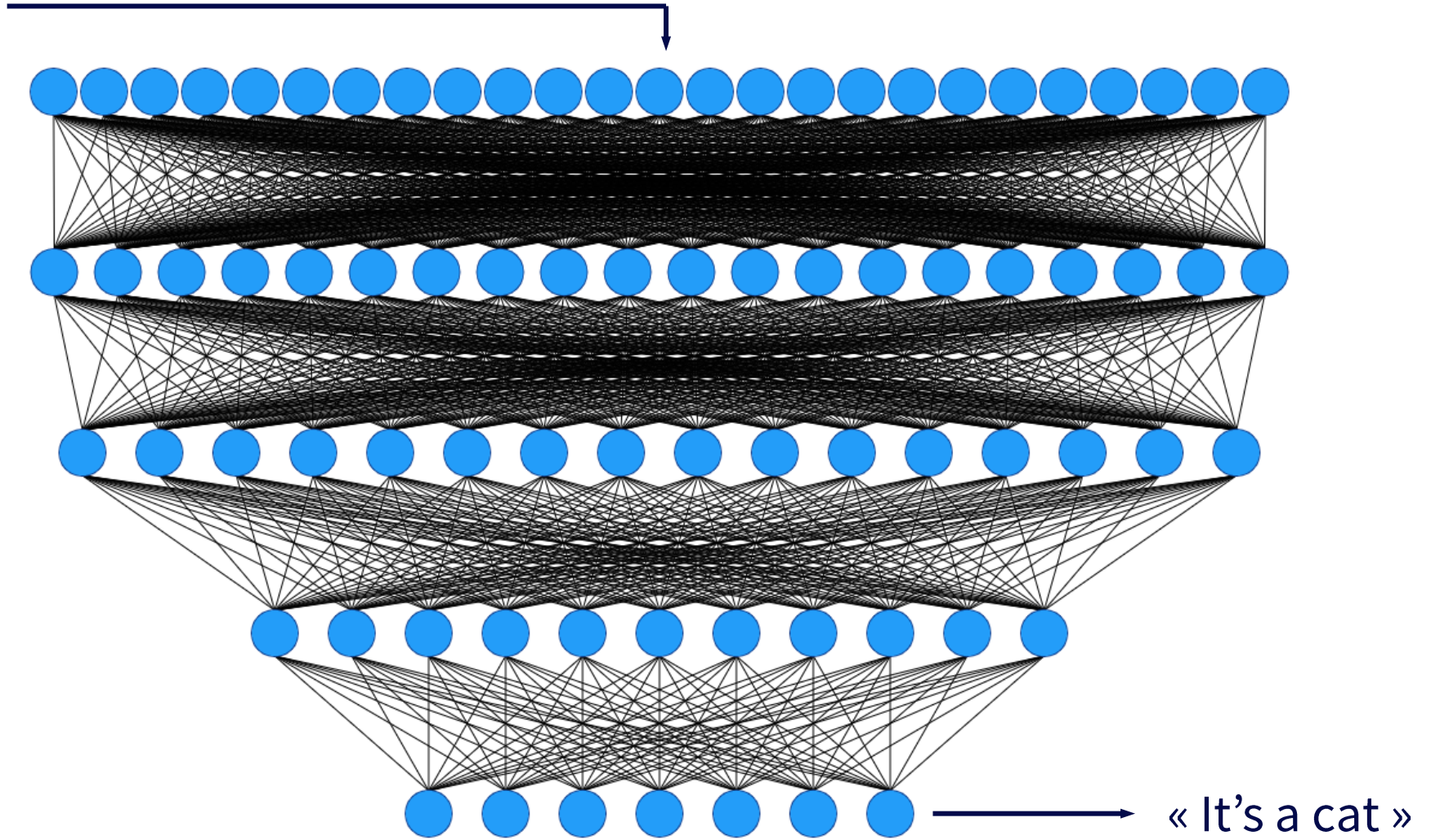
# Introduction to deep learning



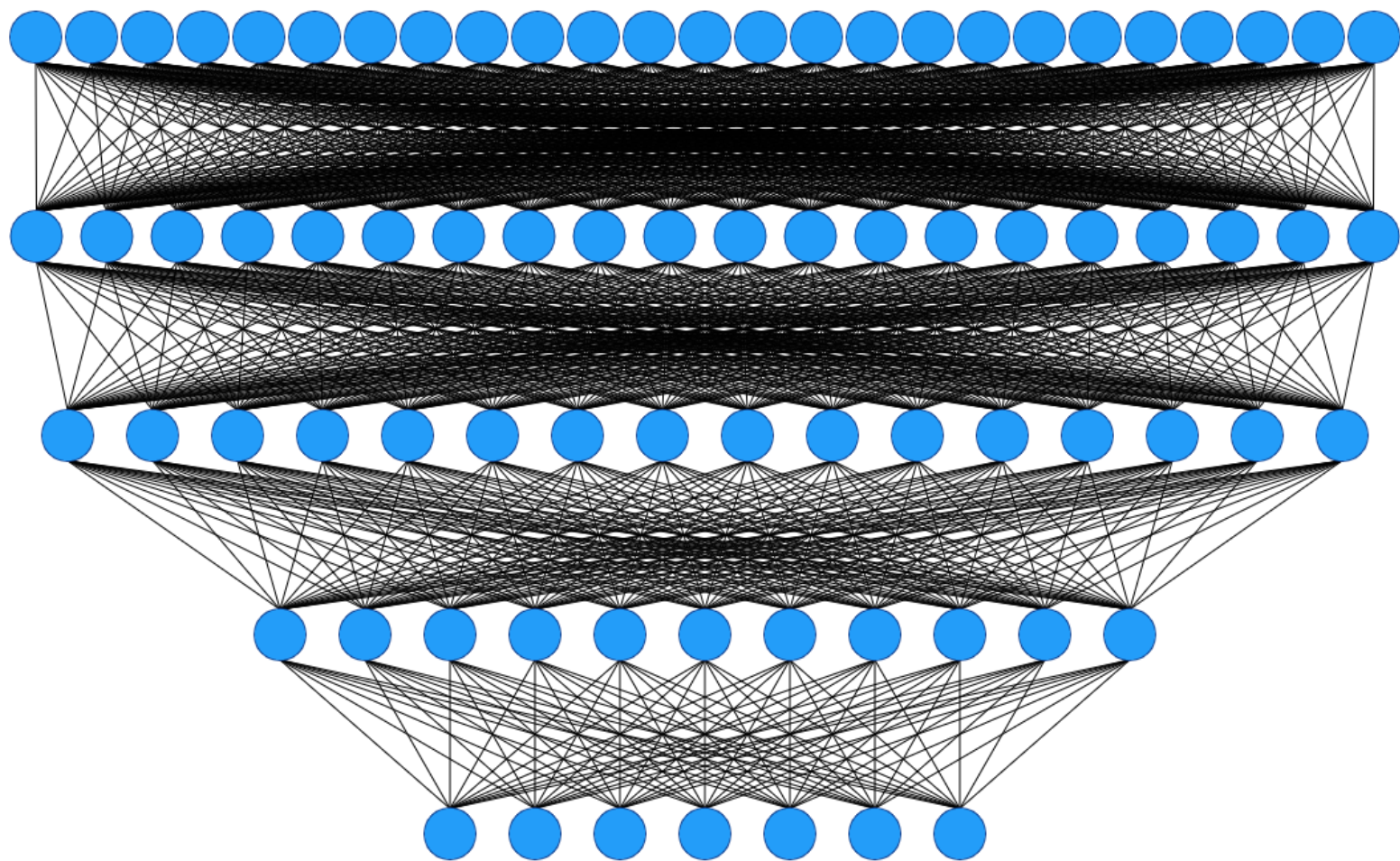
**What are we  
talking about?**

# Introduction

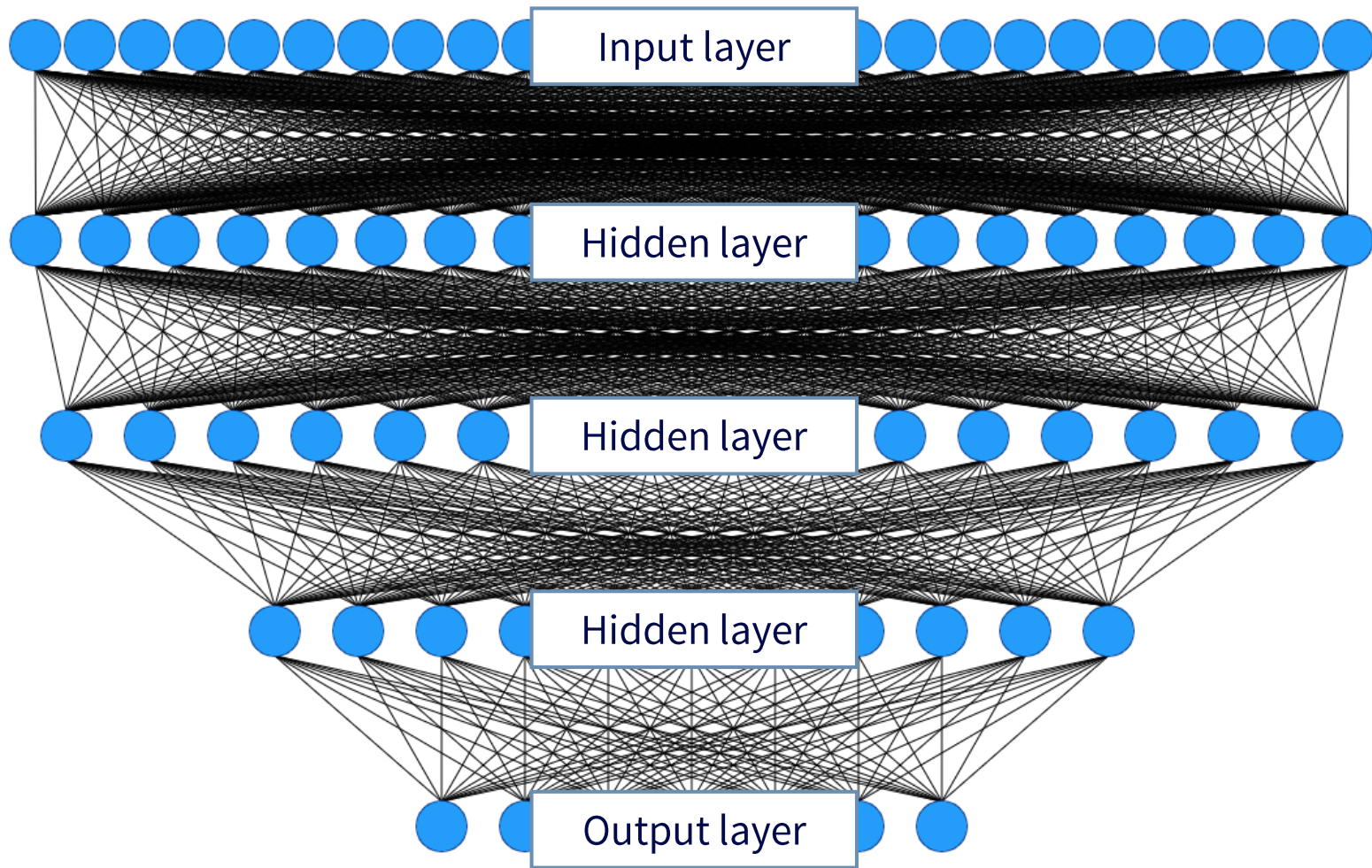


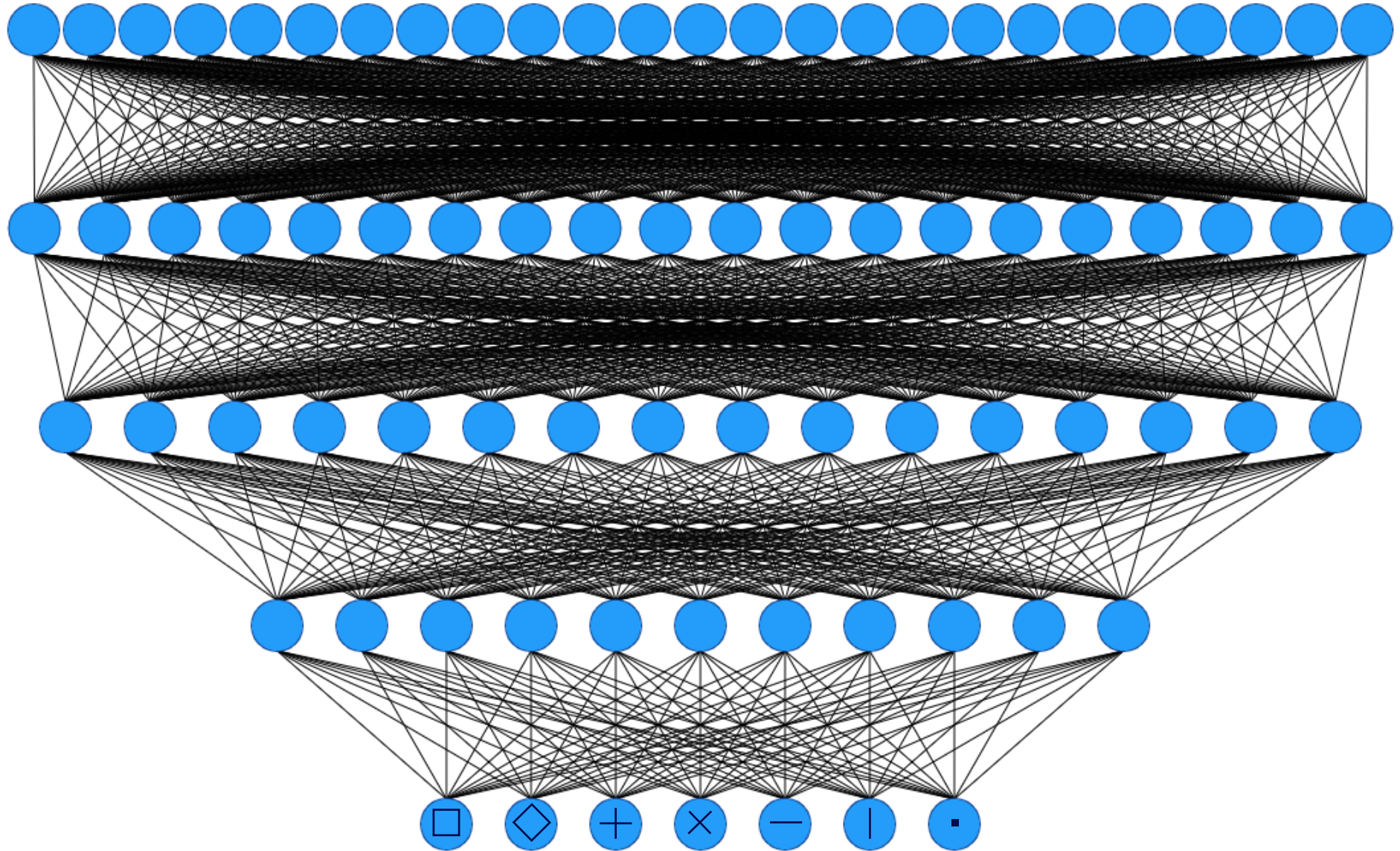
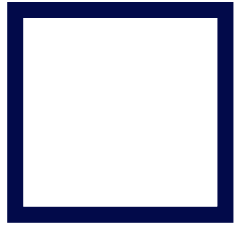


« It's a cat »



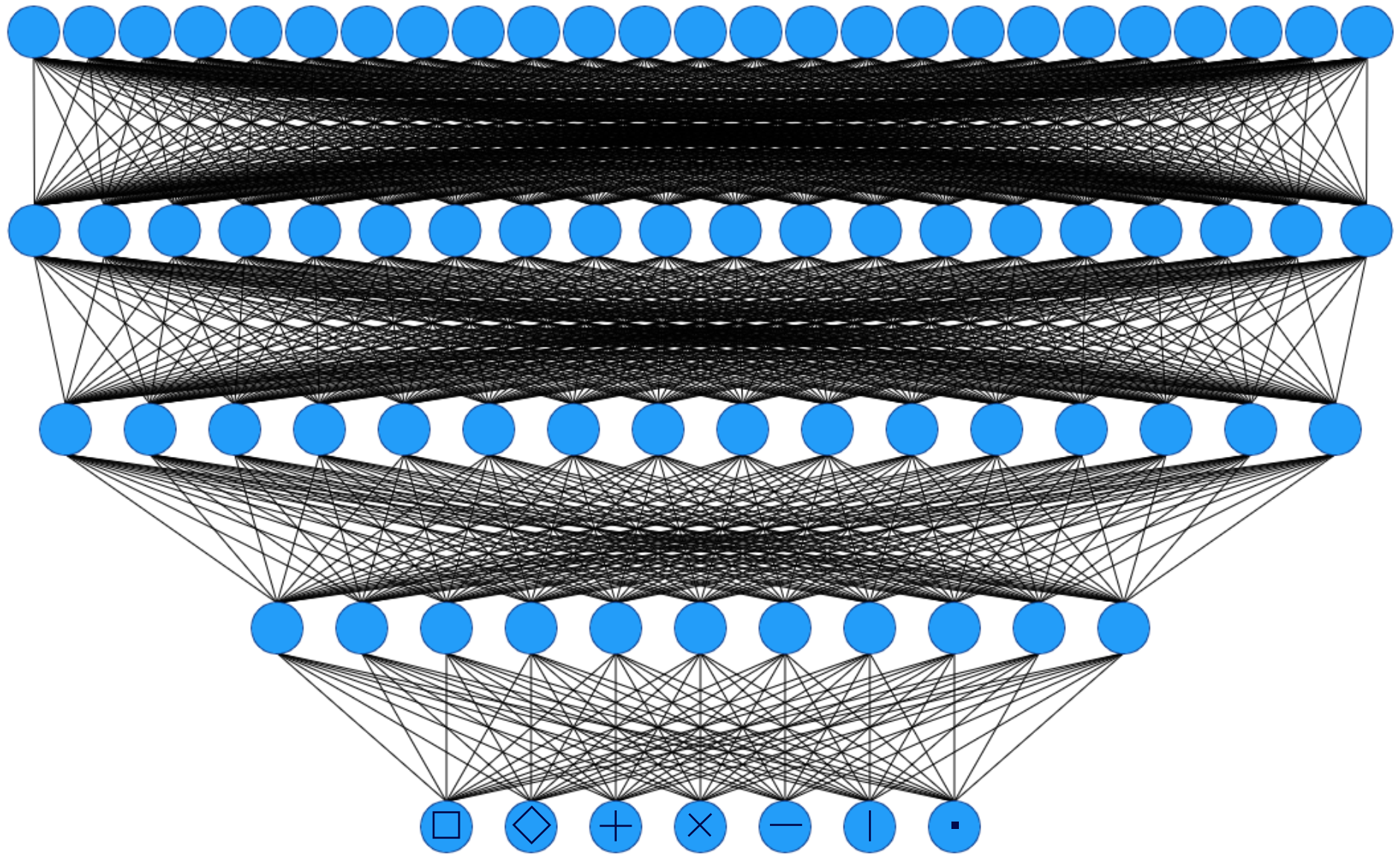


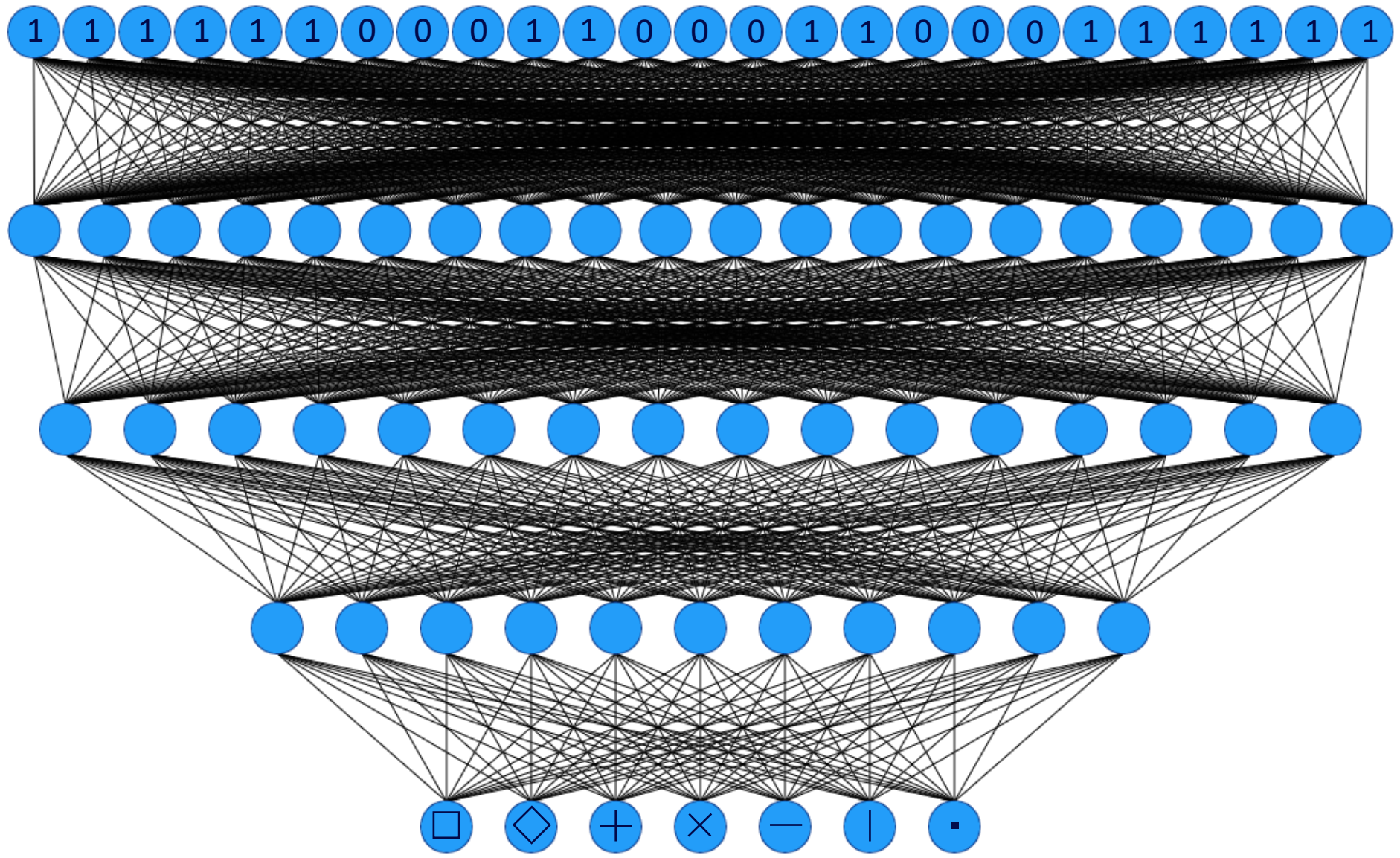




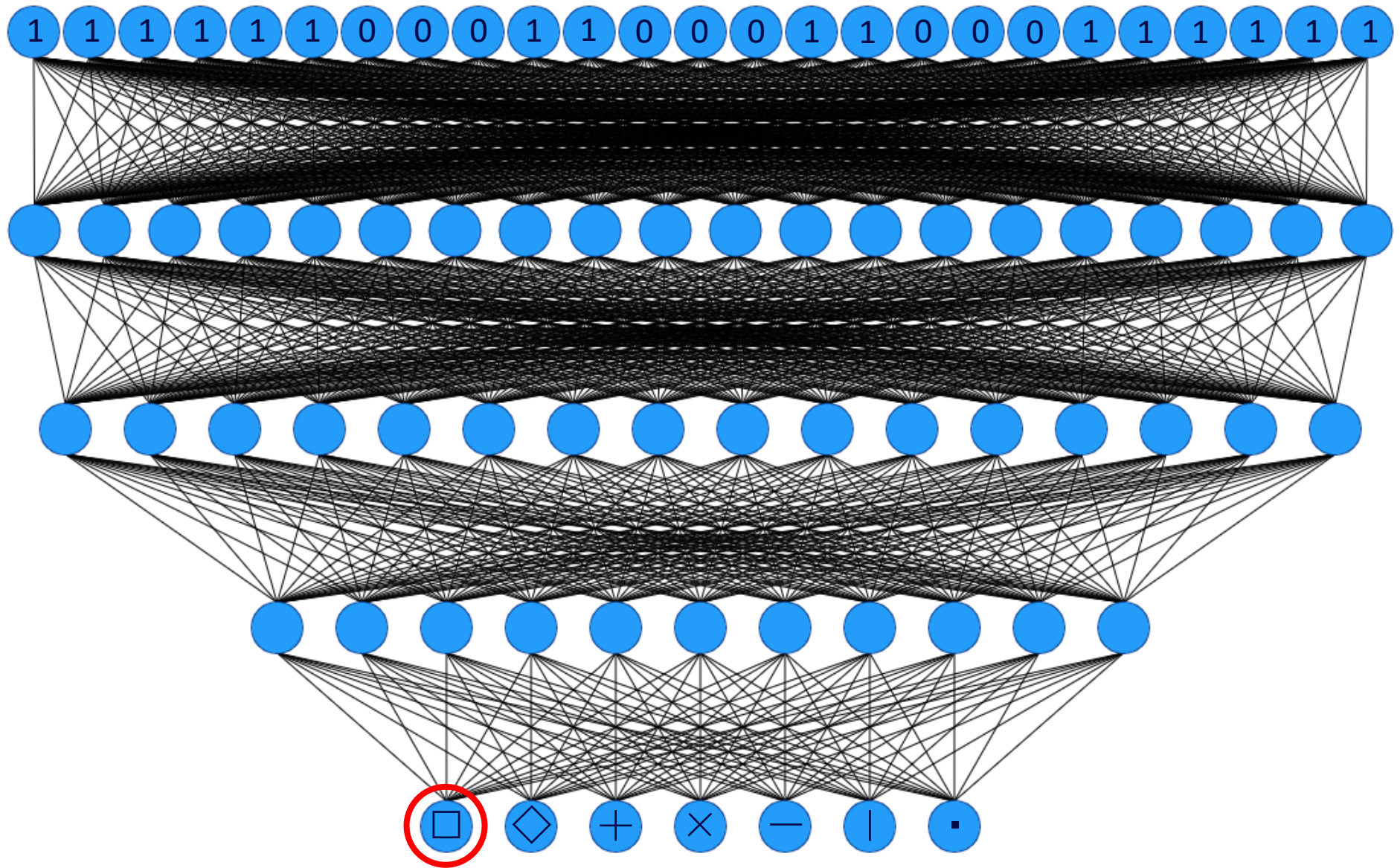


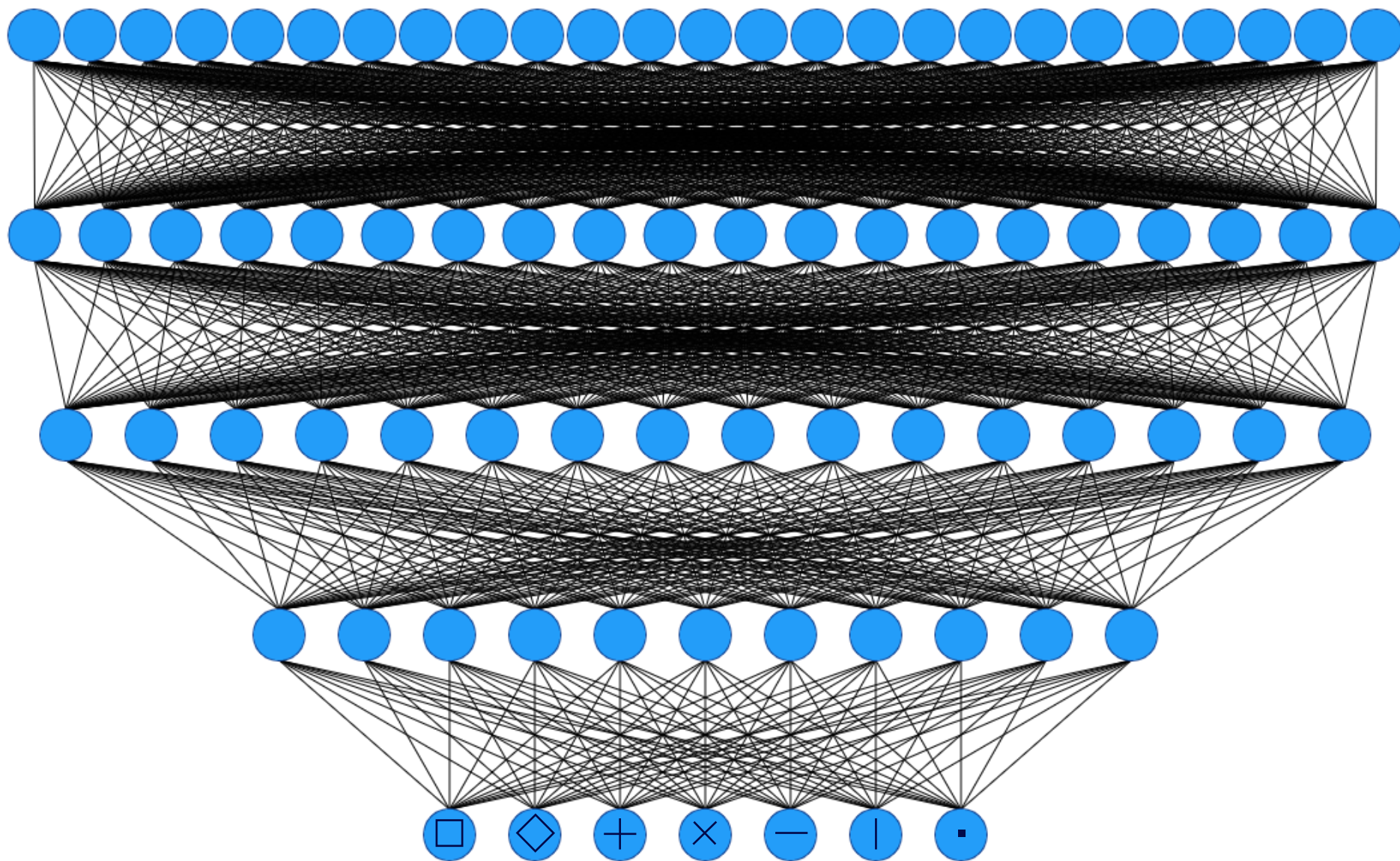
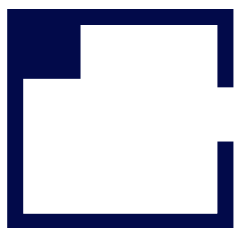
1 1 1 1 1  
1 0 0 0 1  
1 0 0 0 1  
1 0 0 0 1  
1 1 1 1 1





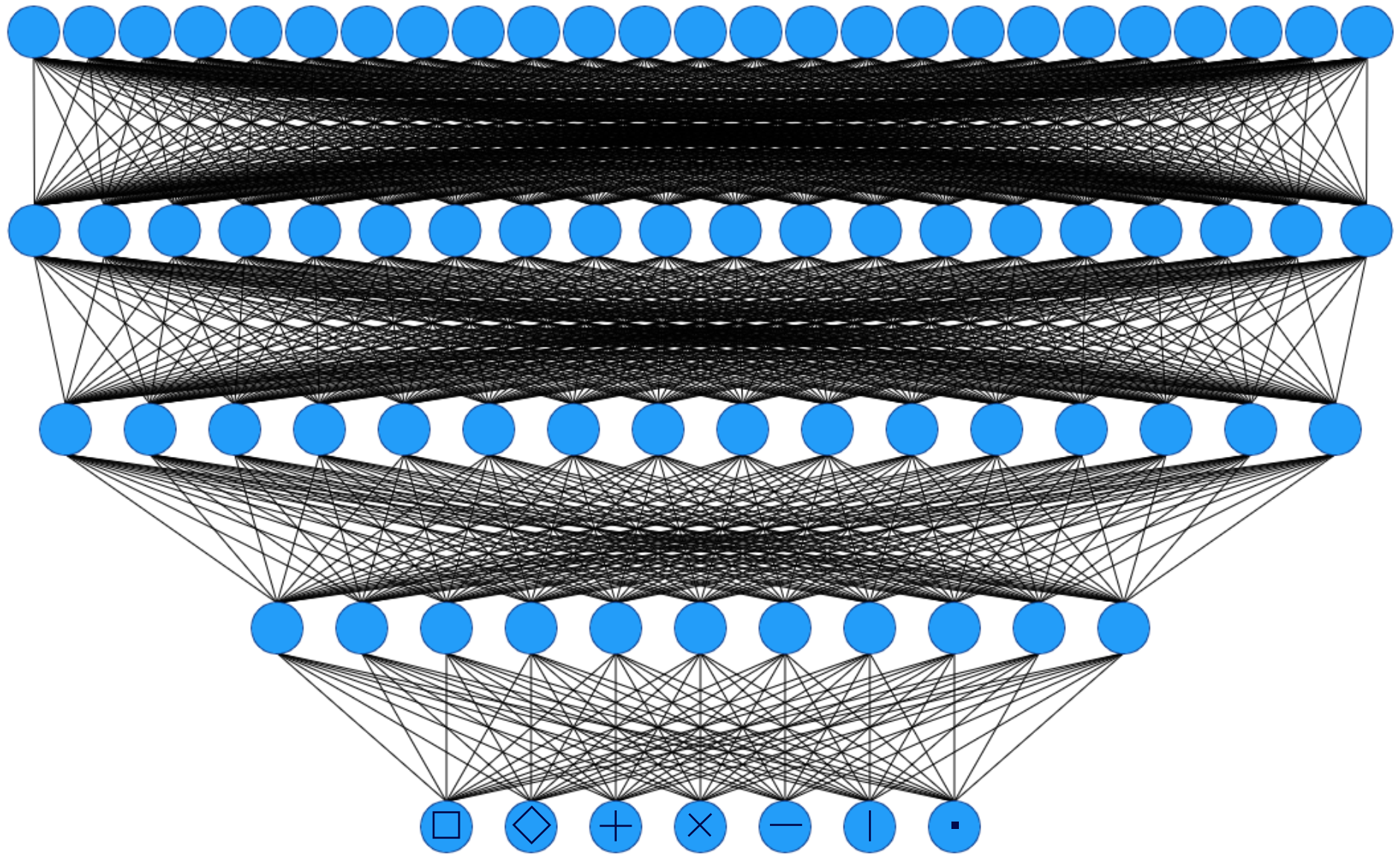


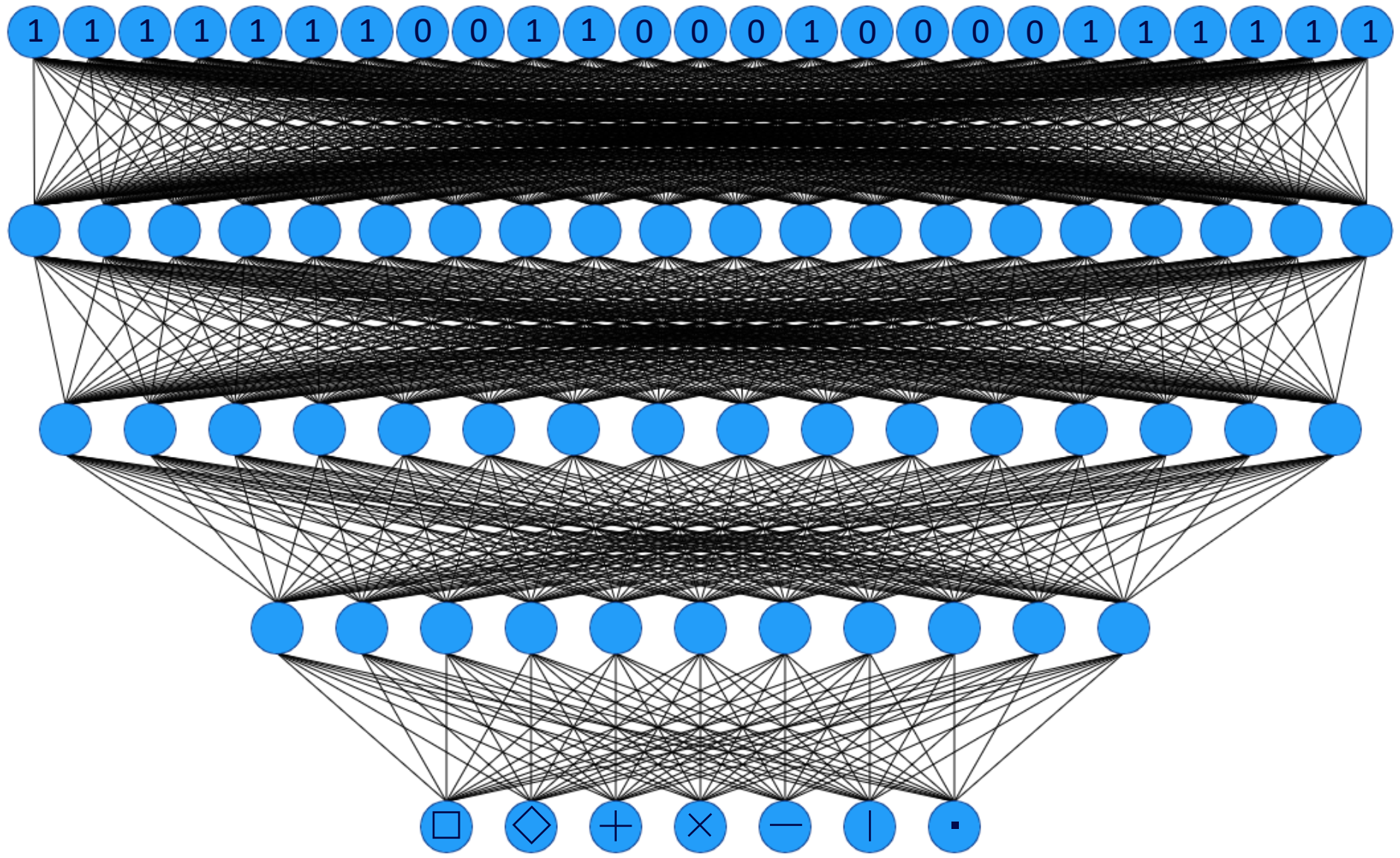




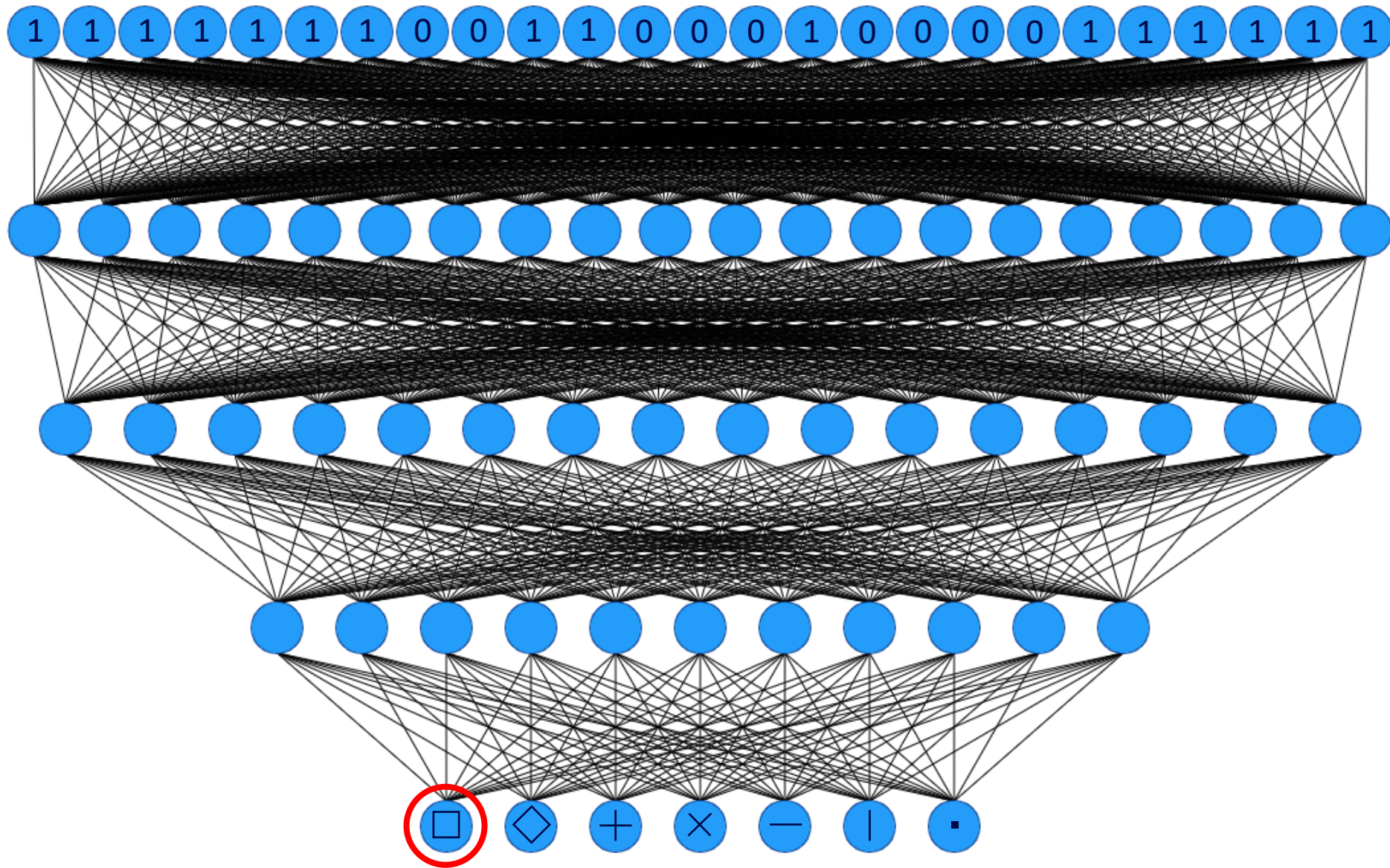


1 1 1 1 1  
1 1 0 0 1  
1 0 0 0 0  
1 0 0 0 1  
1 1 1 1 1

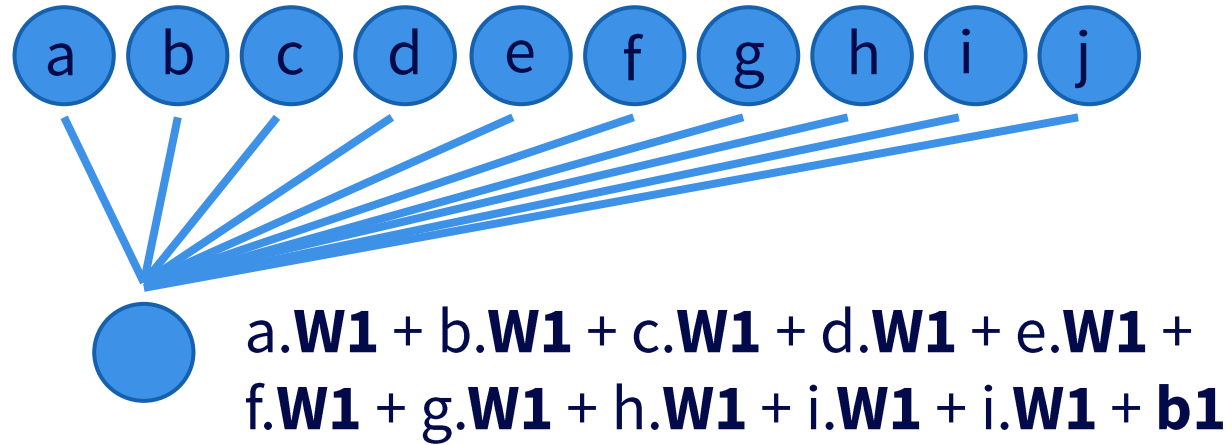








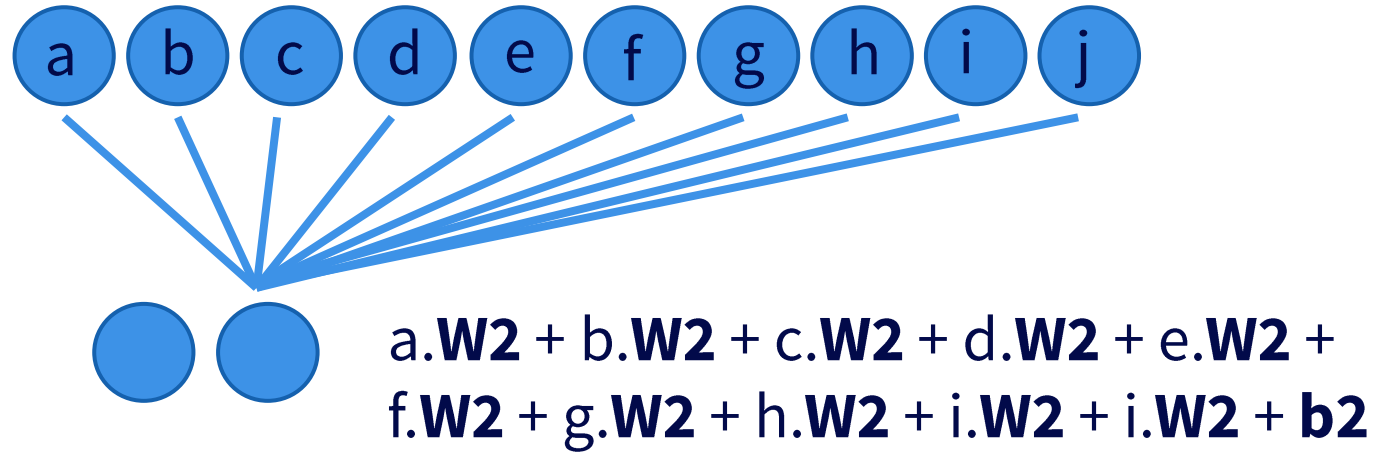
## Training



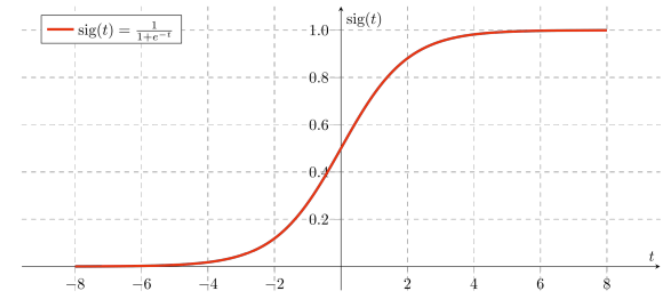
Degrees of freedom: **W1** and **b1**



# Training



Degrees of freedom: **W2** and **b2**



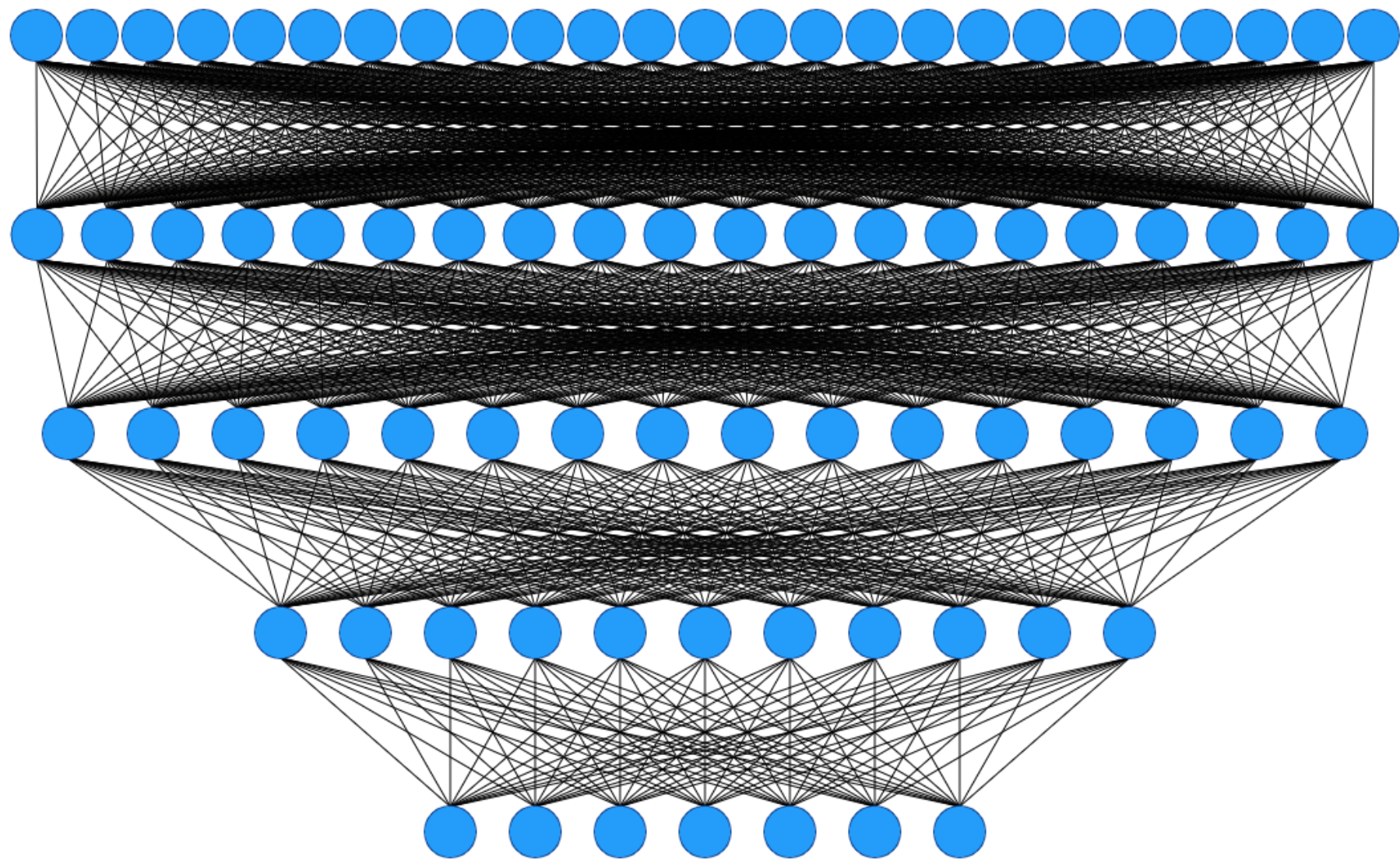
Activation function

## Training

One neural network level:

$$L = \text{activation}(X.W + b)$$





# Training

1 1 1 1 1 1 0 0 0 1 1 0 0 0 1 1 0 0 0 1 1 1 1 1 1	1 0 0 0 0 0 0 0	□
0 0 1 0 0 0 1 0 1 0 1 0 0 0 1 0 1 0 1 0 0 0 1 0 0	0 1 0 0 0 0 0 0	◇
0 0 1 0 0 0 0 1 0 0 1 1 1 1 1 0 0 1 0 0 0 0 1 0 0	0 0 1 0 0 0 0 0	+
1 0 0 0 1 0 1 0 1 0 0 0 1 0 0 0 1 0 1 0 1 0 0 0 1	0 0 0 1 0 0 0 0	×
0 0 0 0 0 0 0 0 0 0 0 1 1 1 1 1 0 0 0 0 0 0 0 0 0 0	0 0 0 0 1 0 0 0	—
0 0 1 0 0 0 0 1 0 0 0 0 1 0 0 0 0 1 0 0 0 0 1 0 0	0 0 0 0 0 1 0 0	
0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 1 0 0 0 0 0 0 0 0	0 0 0 0 0 0 0 1	■

Input data

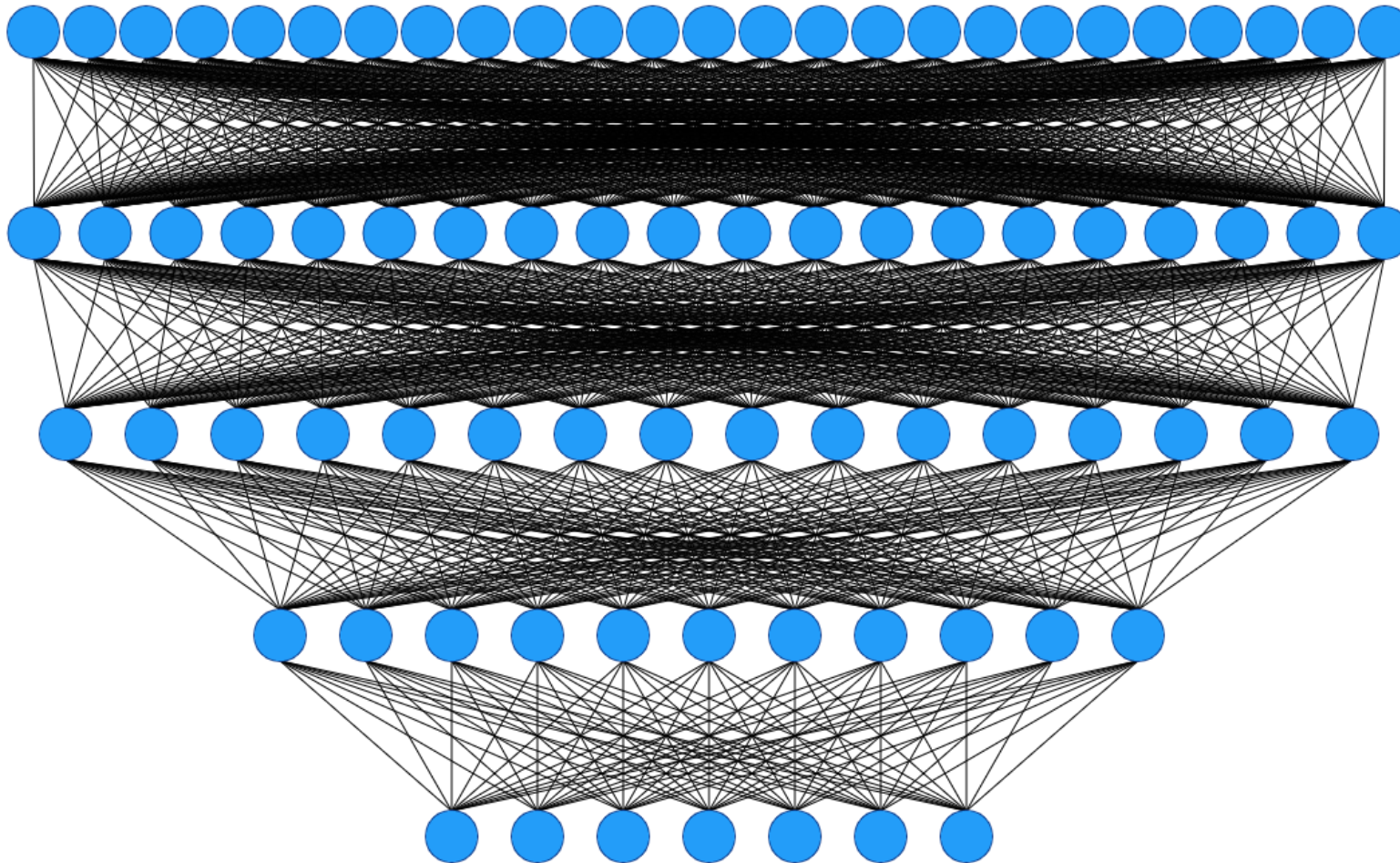
Output data  
(one-hot encoding)



Demo Time!

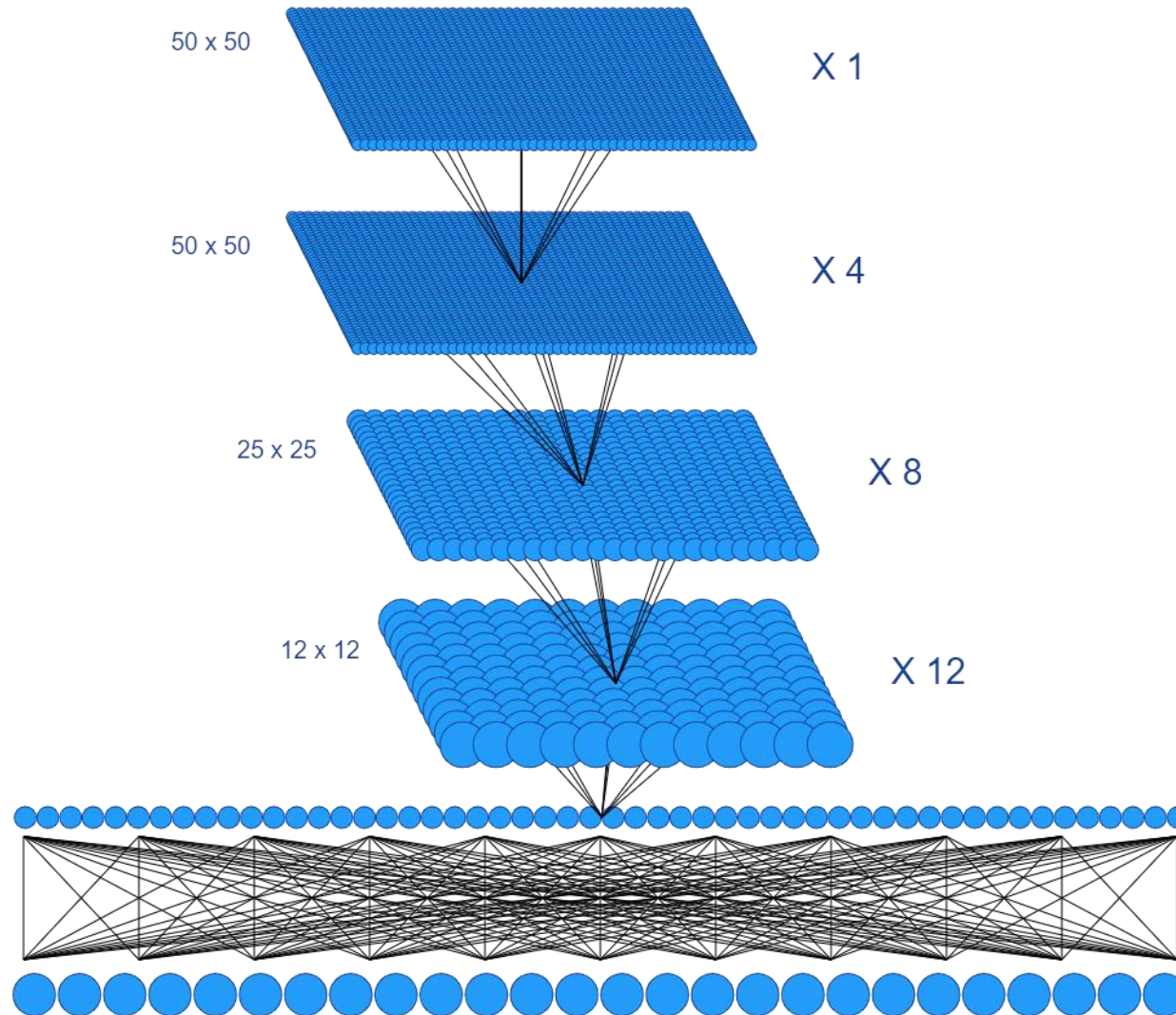


# Multilayer Perceptron (MLP)

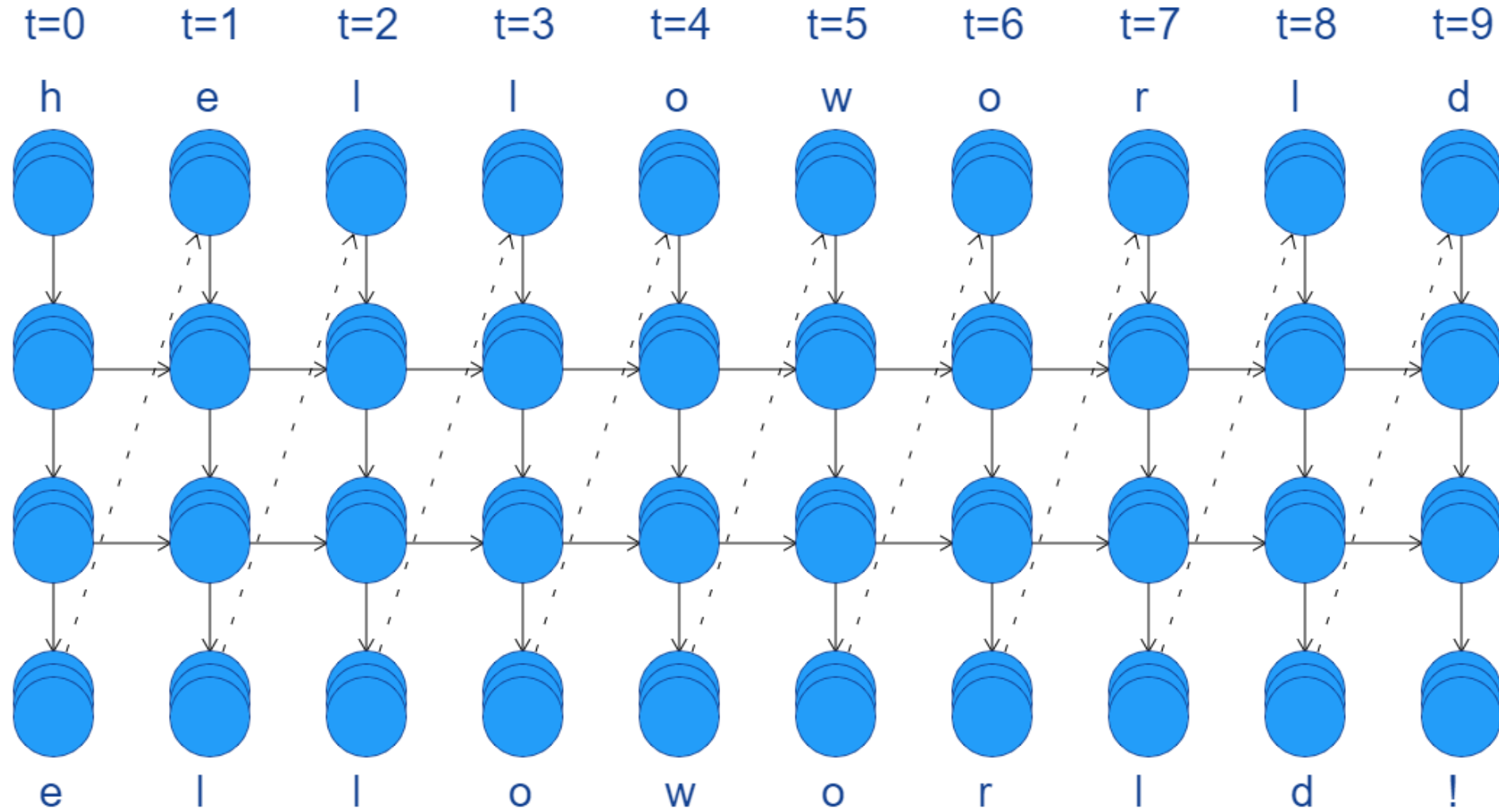




# Convolutional Neural Network (CNN)



# Recurrent Neural Network (RNN)





## Try it yourself!

Web studio:

<https://sebferrer.fr/deep-learning/>

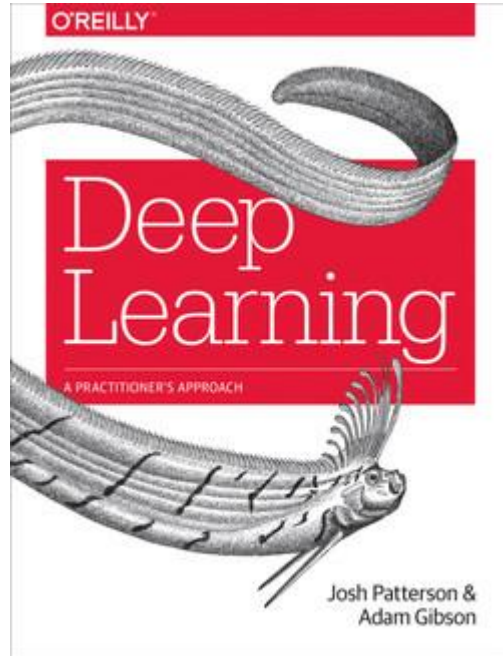
Graphic library:

<https://github.com/nokia/BYONND>

Python templates (Keras/Tensorflow):

<https://github.com/sebferrer/keras-template>

## References



Deep Learning  
by **Josh Patterson, Adam Gibson**  
Released August 2017  
Publisher(s): O'Reilly Media, Inc.  
ISBN: 9781491914250



**Tensorflow and deep learning -  
without a PhD by Martin Görner**

EN: <https://www.youtube.com/watch?v=qyvlt7kiQoI>

FR: <https://www.youtube.com/watch?v=BtAVBeLuigl>



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