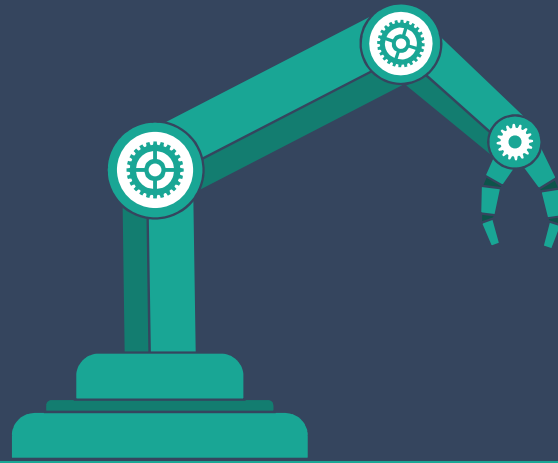


# Master Thesis

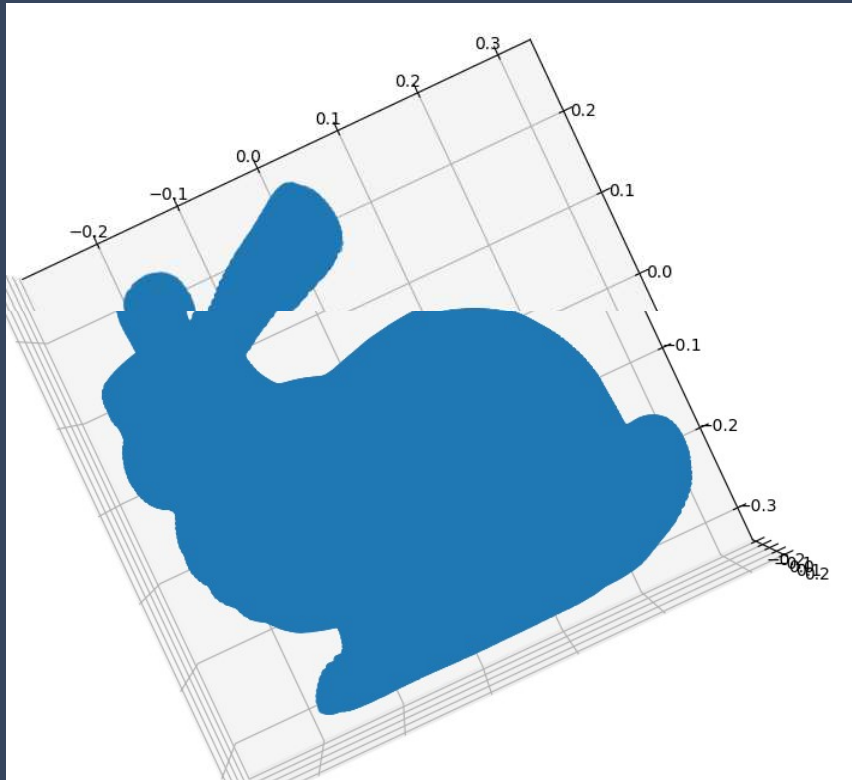
Yannick Kees

10.04.2022



# Effectiveness of different Network sizes for the Ambrosio - Tortorelli loss

# Point Cloud



Number of points : 35947

# Hyperparameters of the Ambrosio- Tortorelli Loss functional

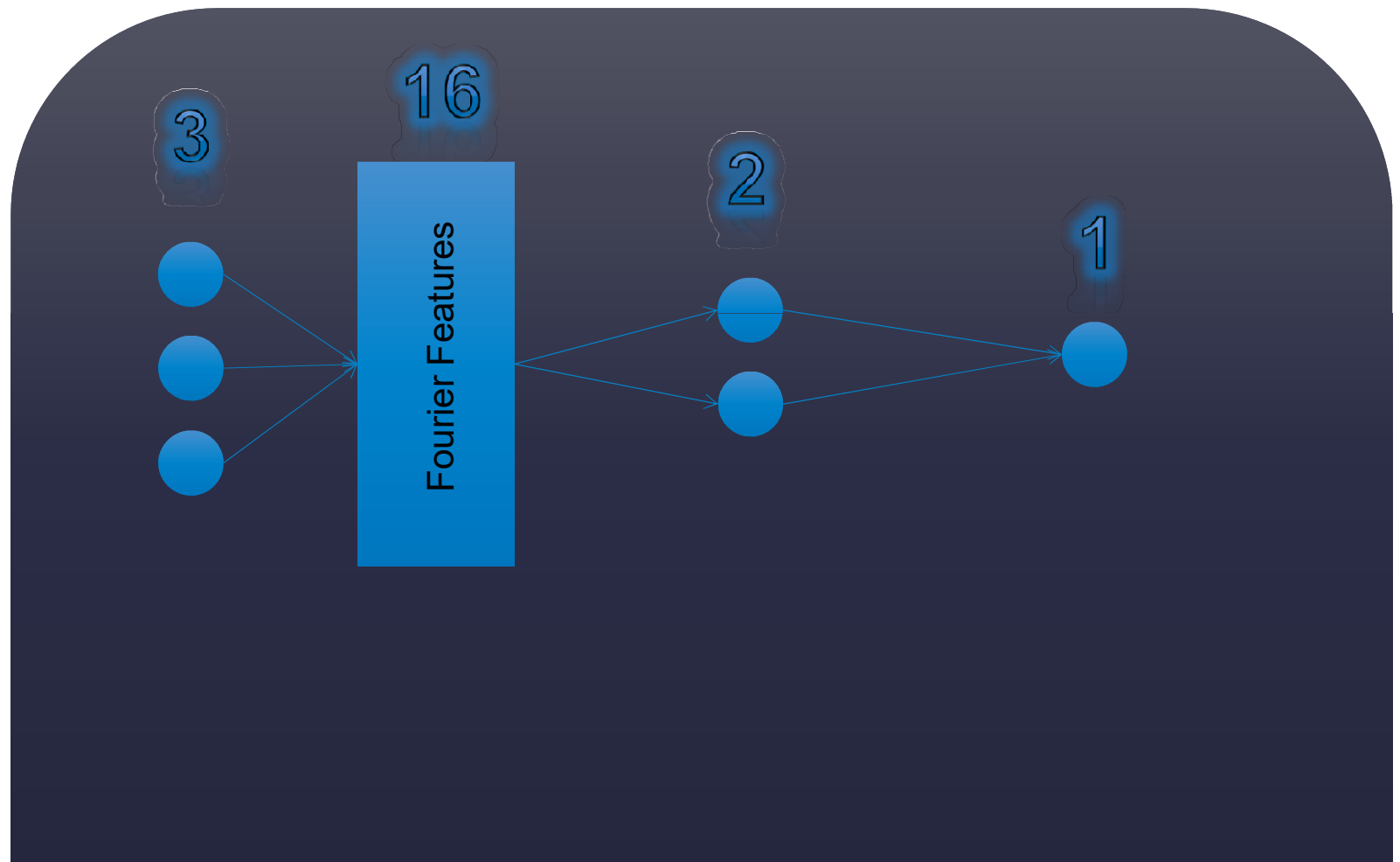
C = 40  
Eps = 0,001  
Batchsize (pc) = 10000  
Sigma (Fourier Features) = 1,3  
Number of FF = 16  
Initial Learning rate = 0,01

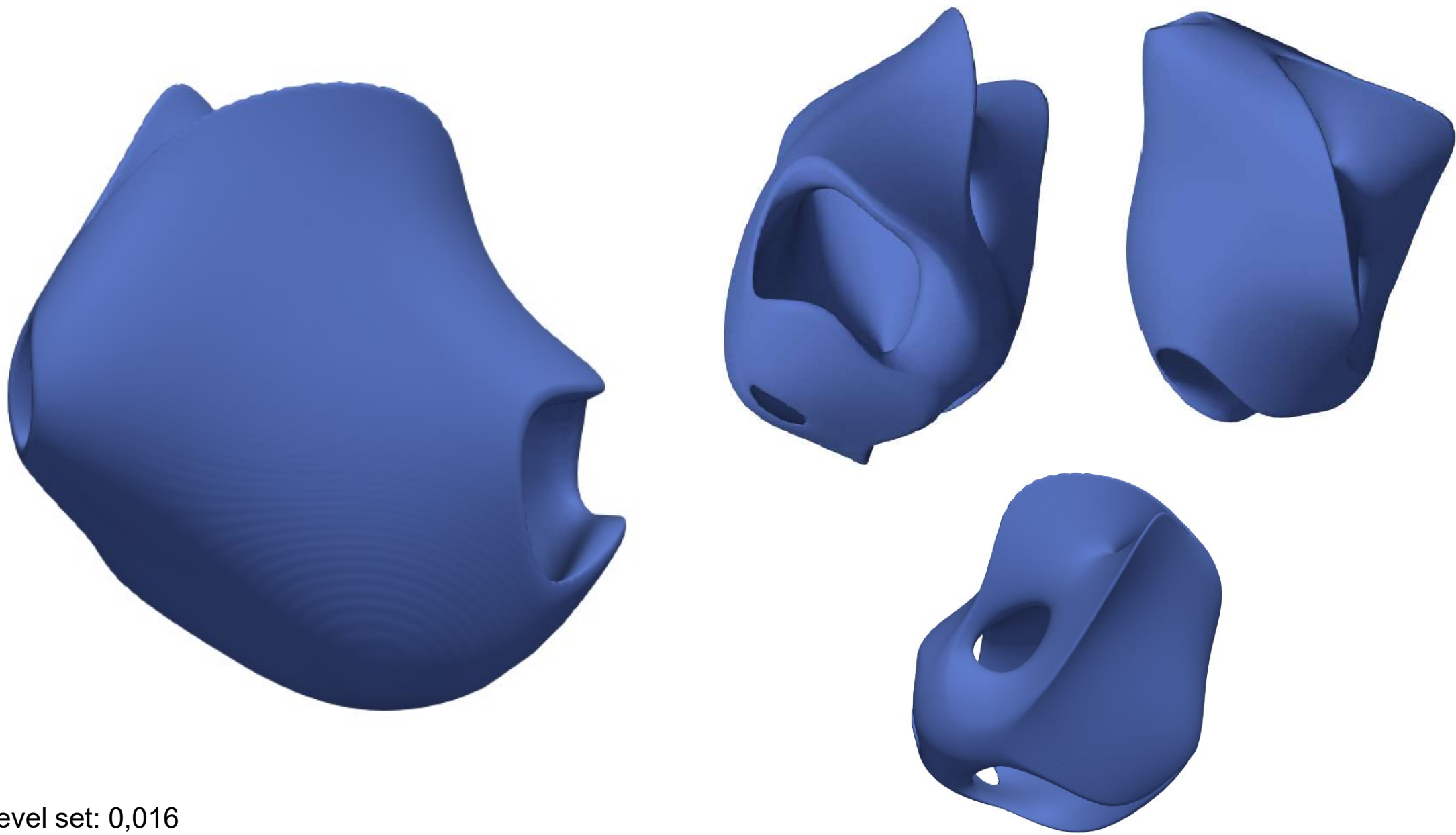
$$\int \frac{1}{4\varepsilon} (u(x) - 1)^2 + \varepsilon \|\nabla u(x)\|^2 dx + C\varepsilon^{-\frac{1}{3}} \sum_{p \in P} |u(p)|^2$$

# Layout of the Neuronal Network

Total Number of  
Learnable Parameters

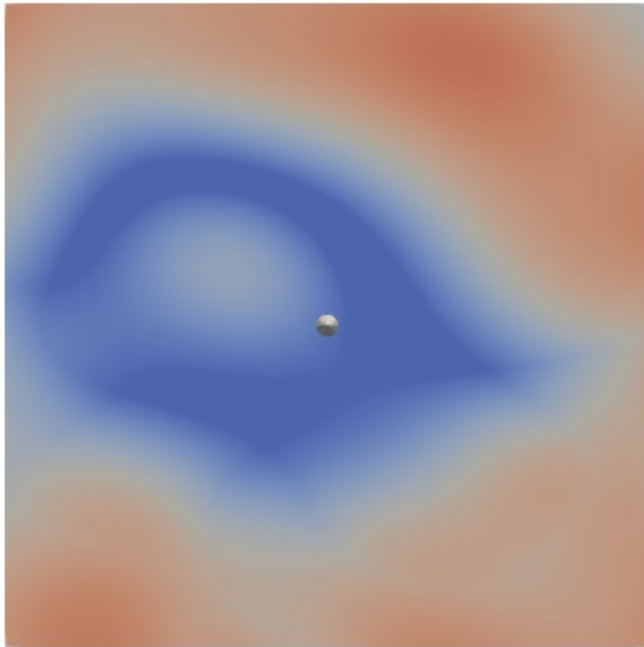
$$(16+1) * 2 + (2+1) * 1 \\ = 37$$



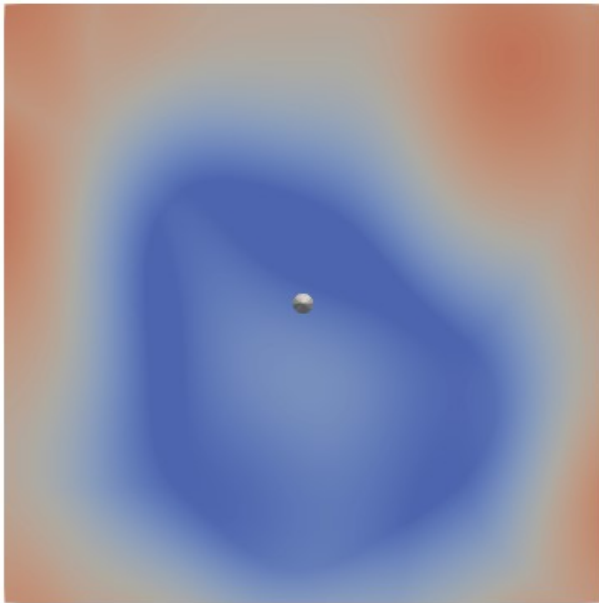


Level set: 0,016

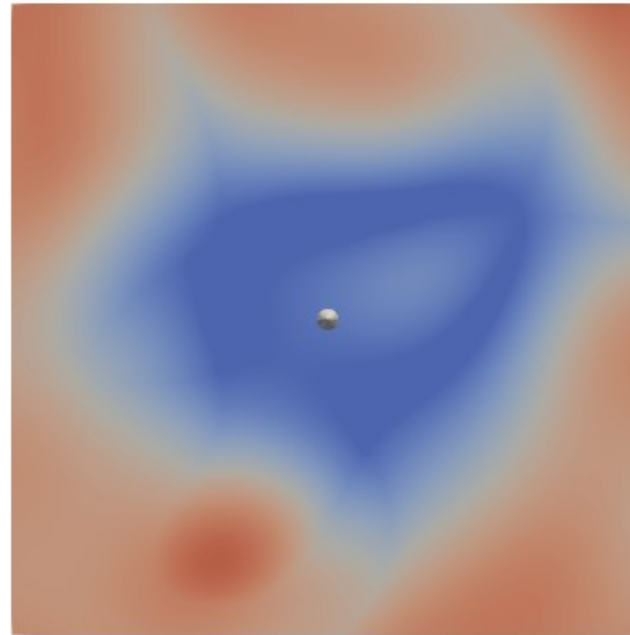
Normal:  
(1,0,0)



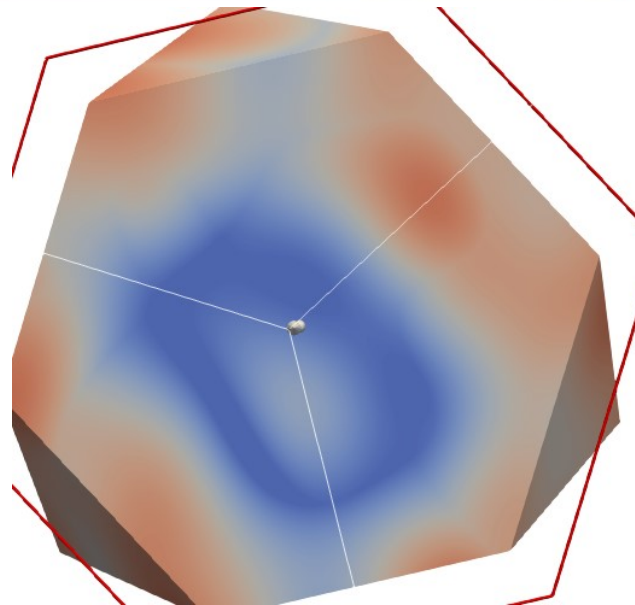
Normal:  
(0,0,1)



Normal:  
(0,1,0)



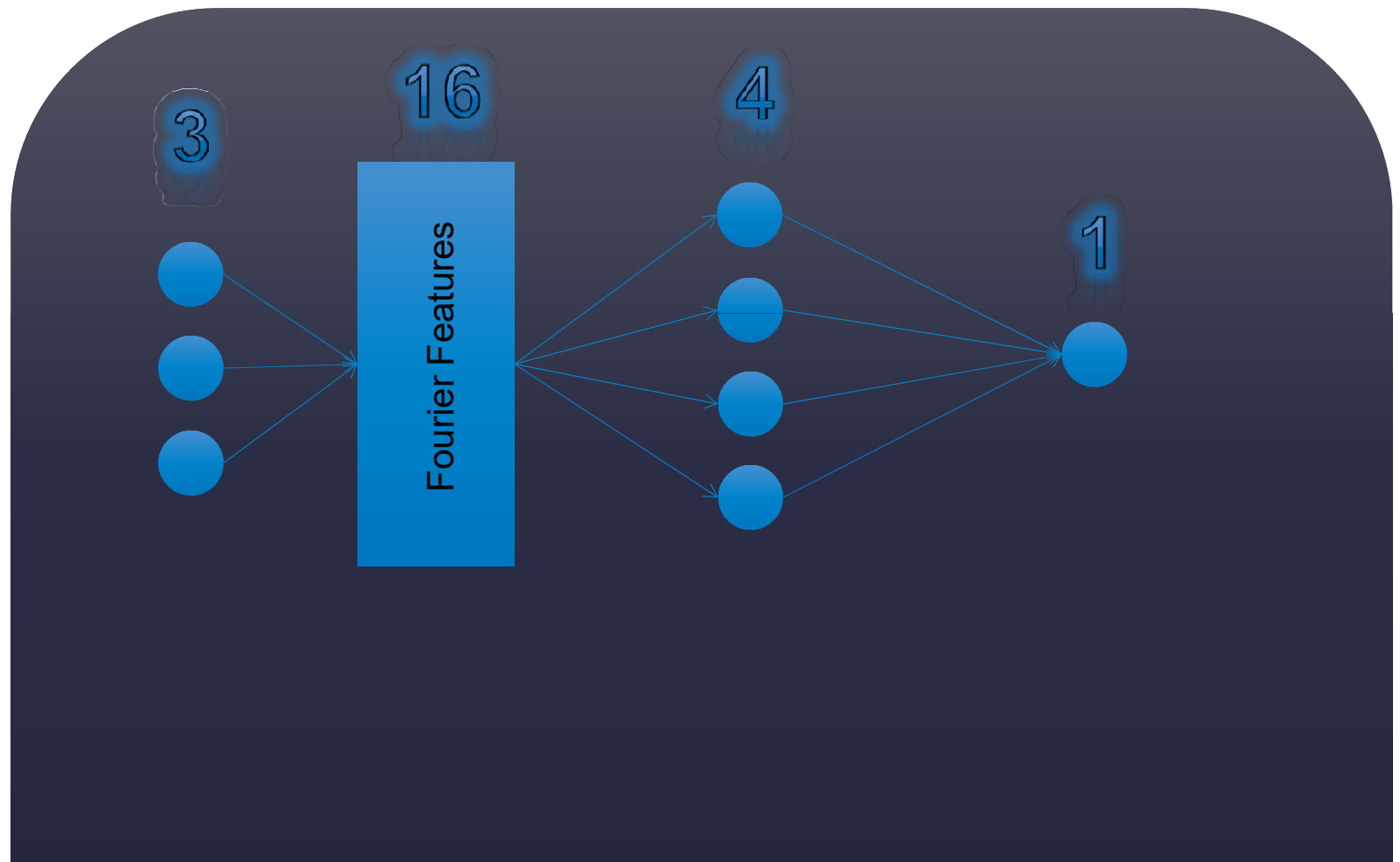
Normal:  
(1,1,1)



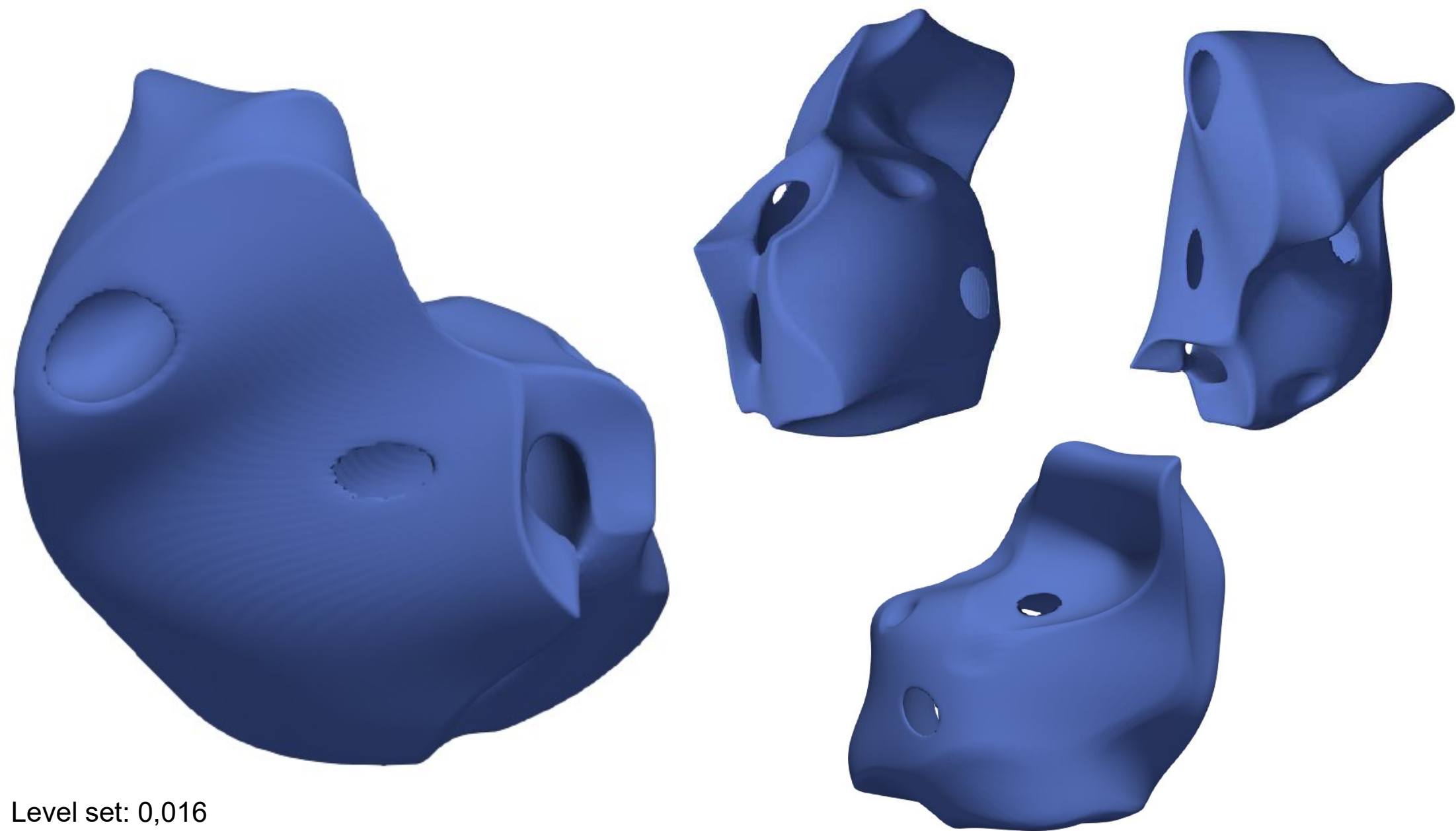
# Layout of the Neuronal Network

Total Number of  
Learnable Parameters

$$(16+1) * 4 + (4+1) * 1 = 73$$

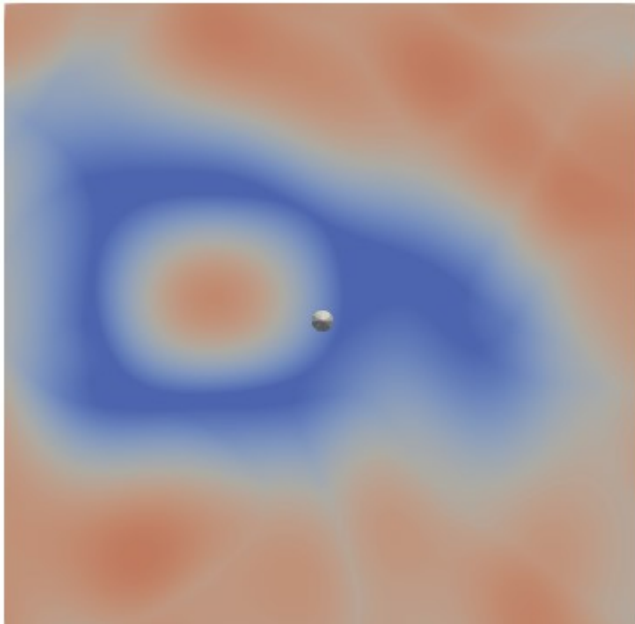




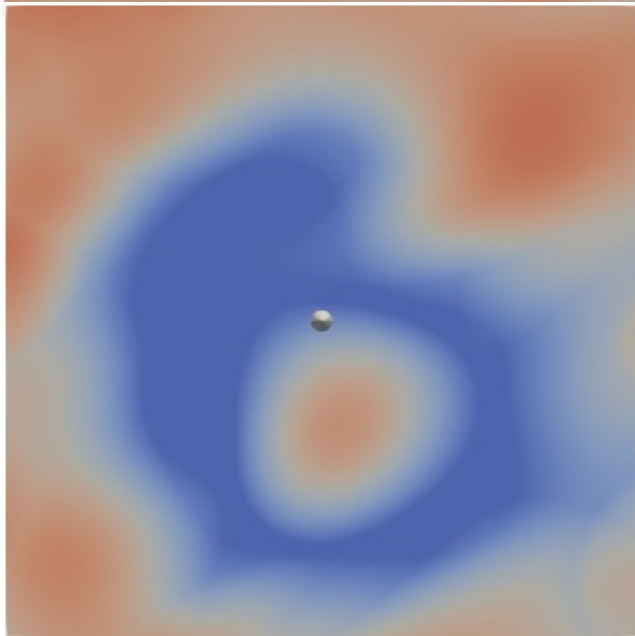


Level set: 0,016

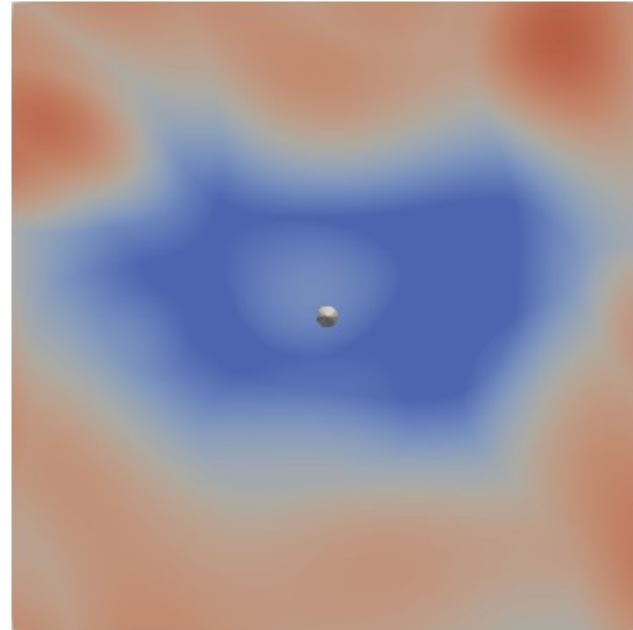
Normal:  
(1,0,0)



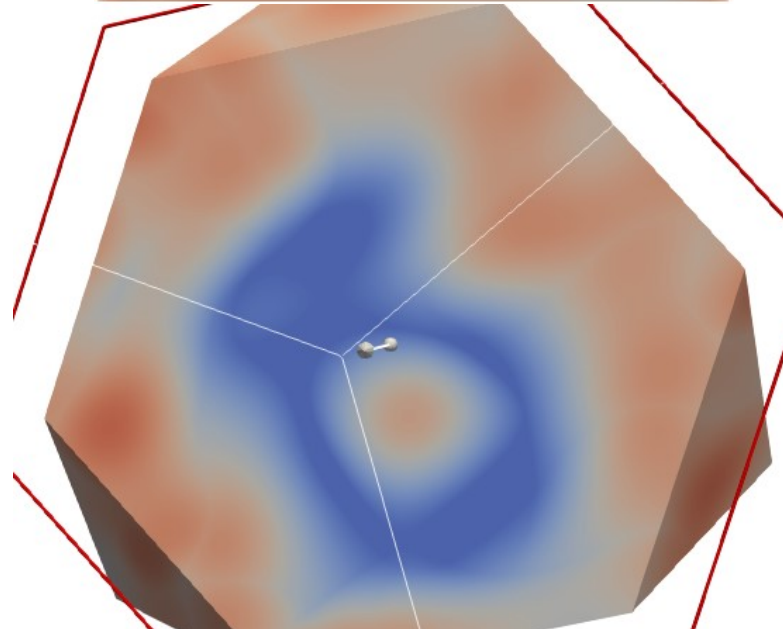
Normal:  
(0,0,1)



Normal:  
(0,1,0)



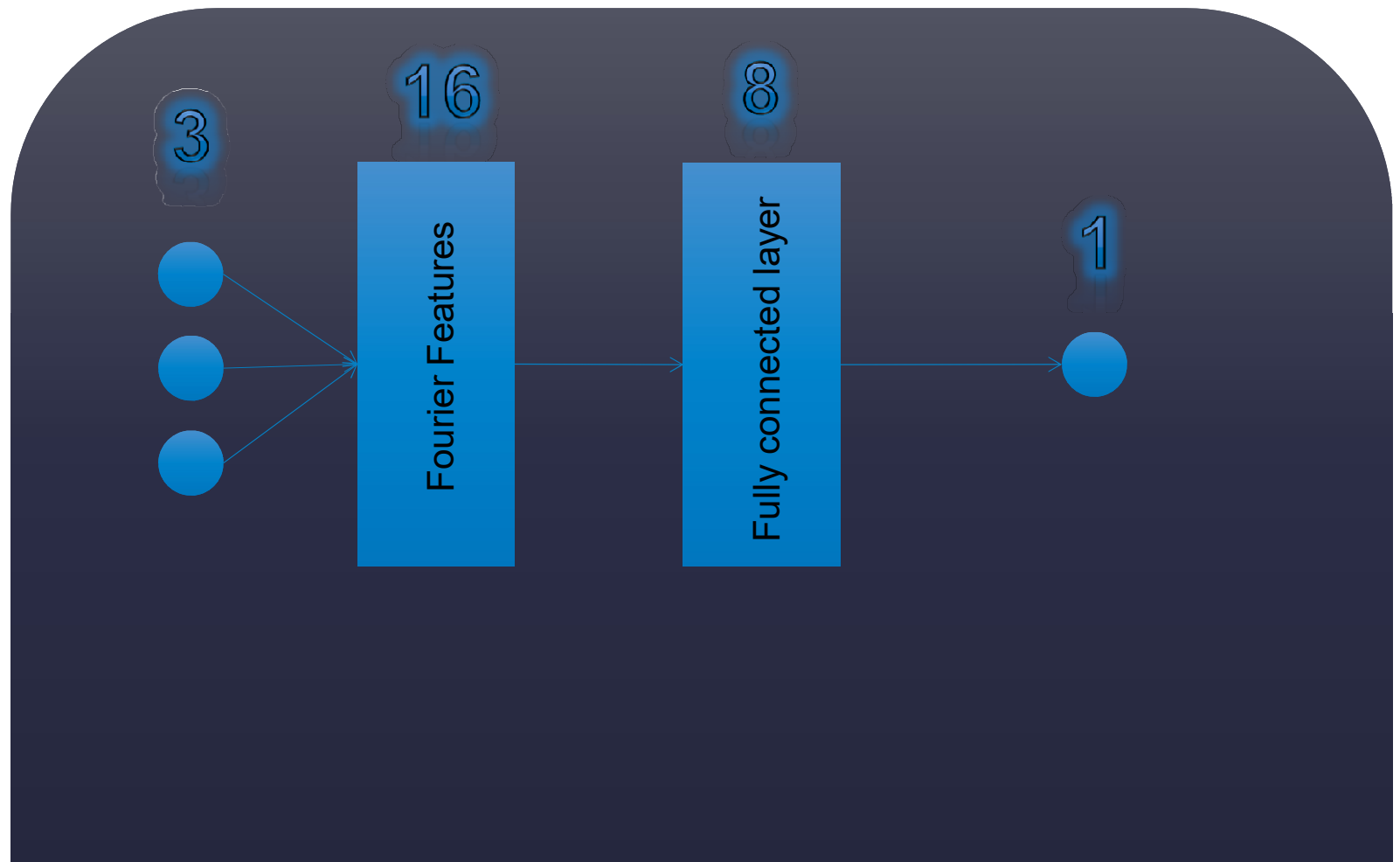
Normal:  
(1,1,1)

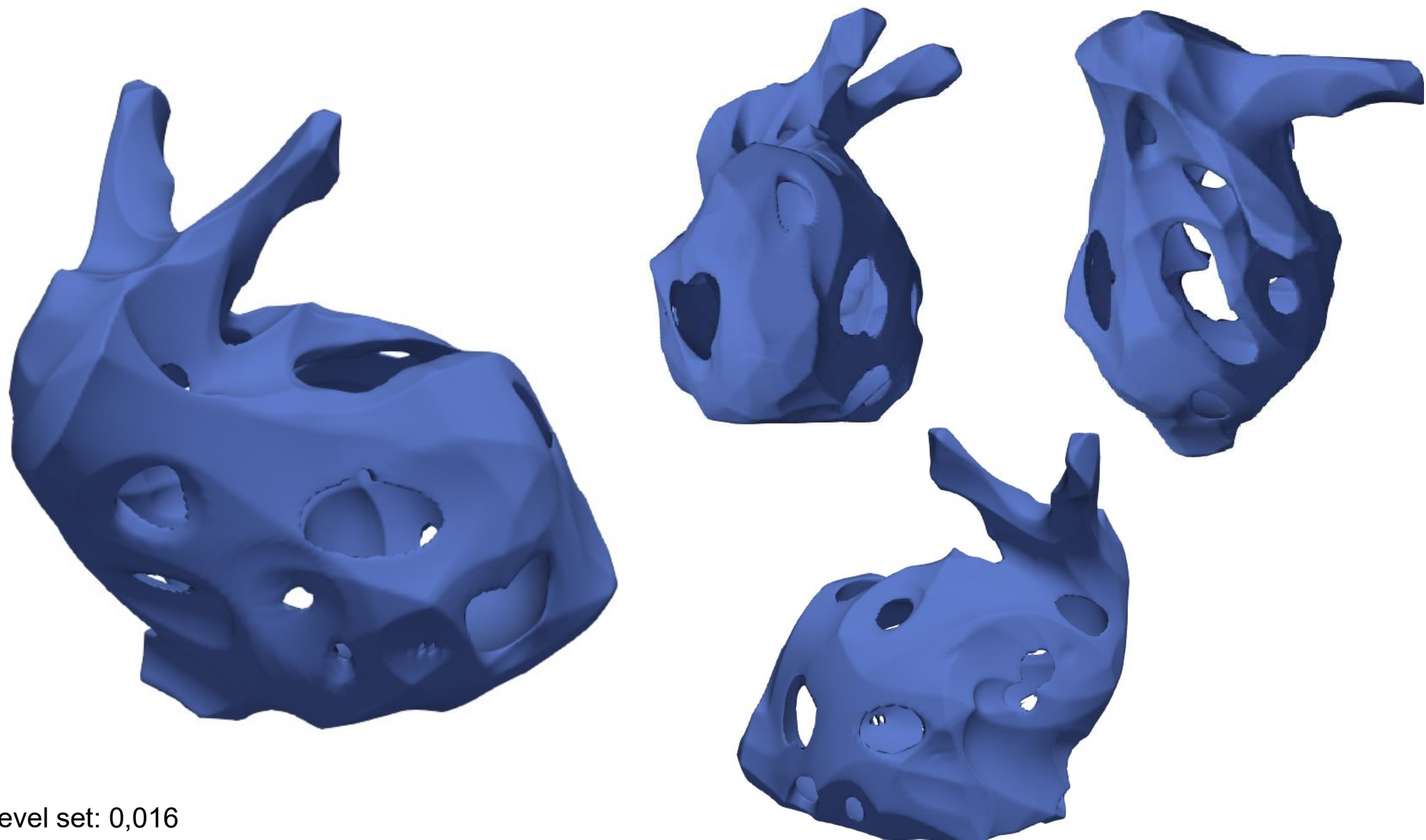


# Layout of the Neuronal Network

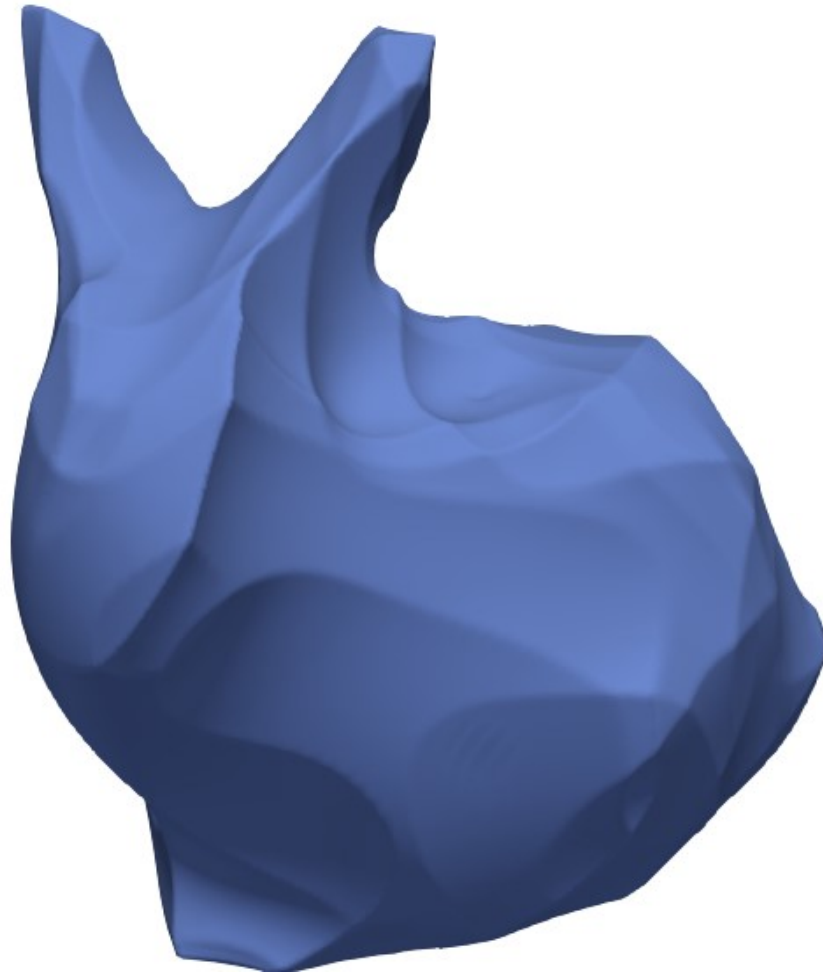
Total Number of  
Learnable Parameters

$$(16+1) * 8 + (8+1) * 1 \\ = 145$$



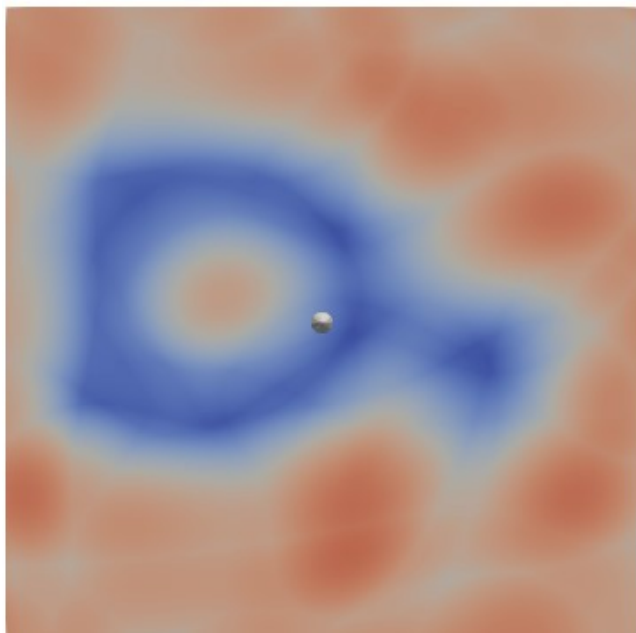


Level set: 0,016

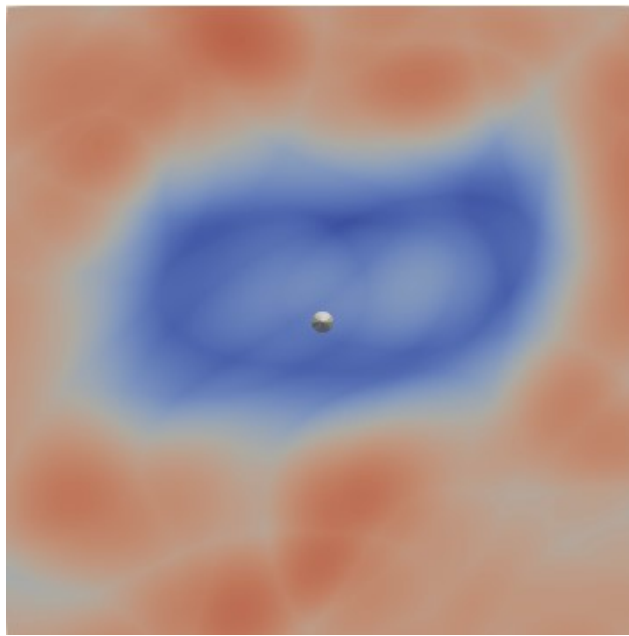


Level set: 0,1

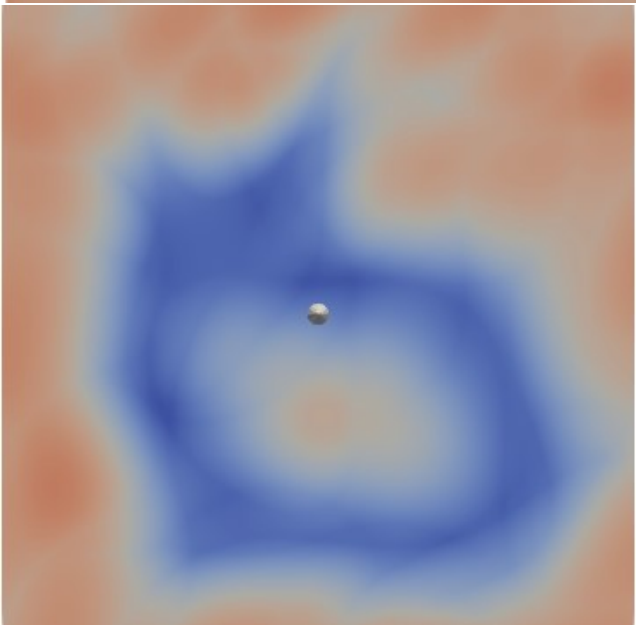
Normal:  
(1,0,0)



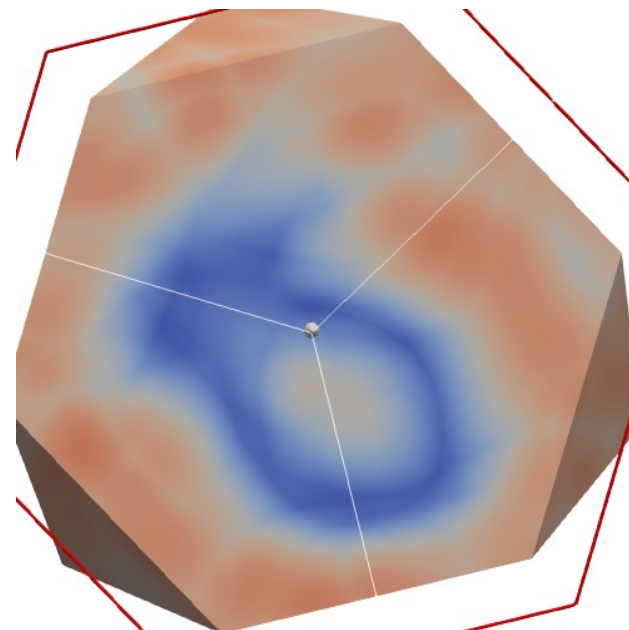
Normal:  
(0,1,0)



Normal:  
(0,0,1)



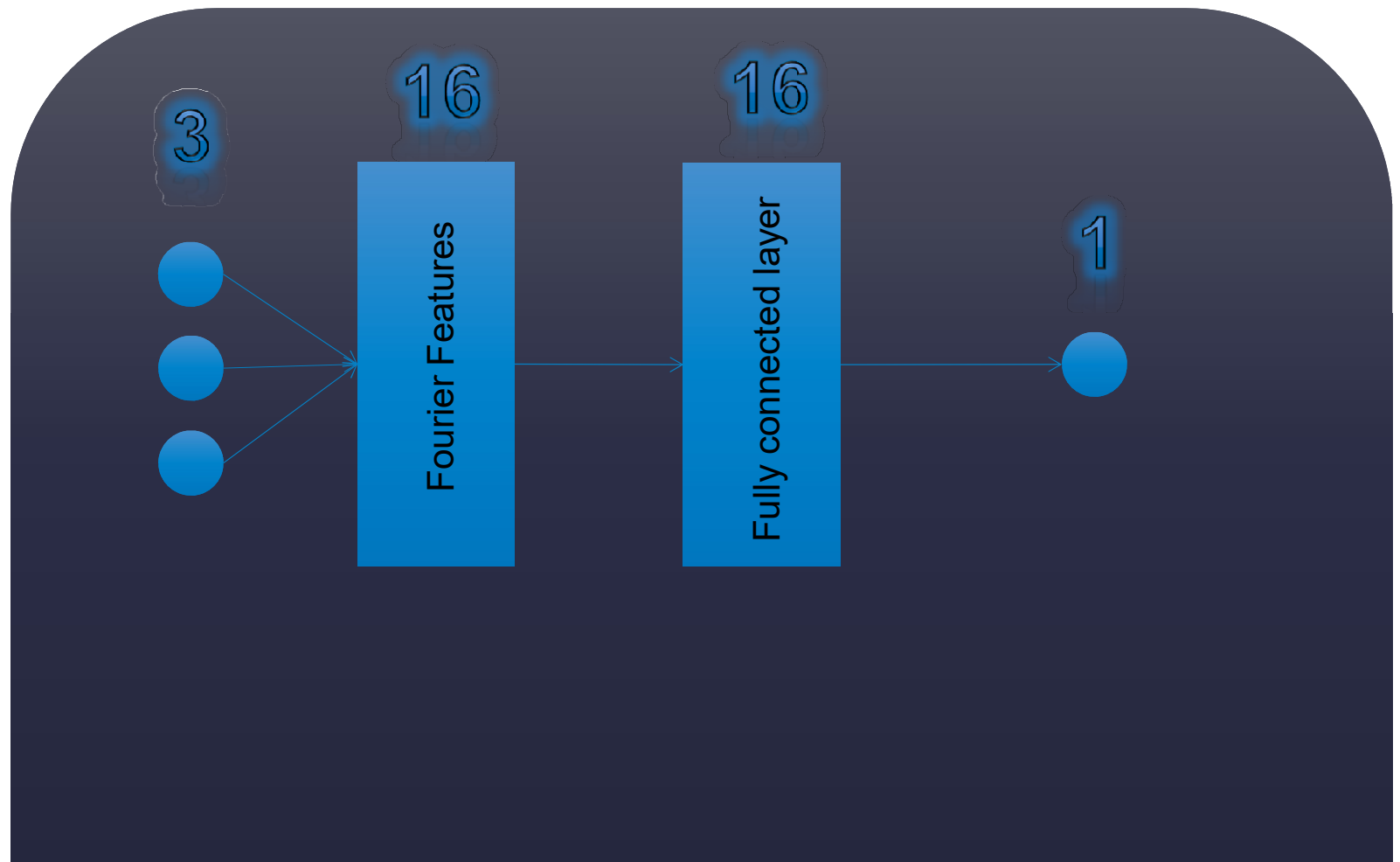
Normal:  
(1,1,1)



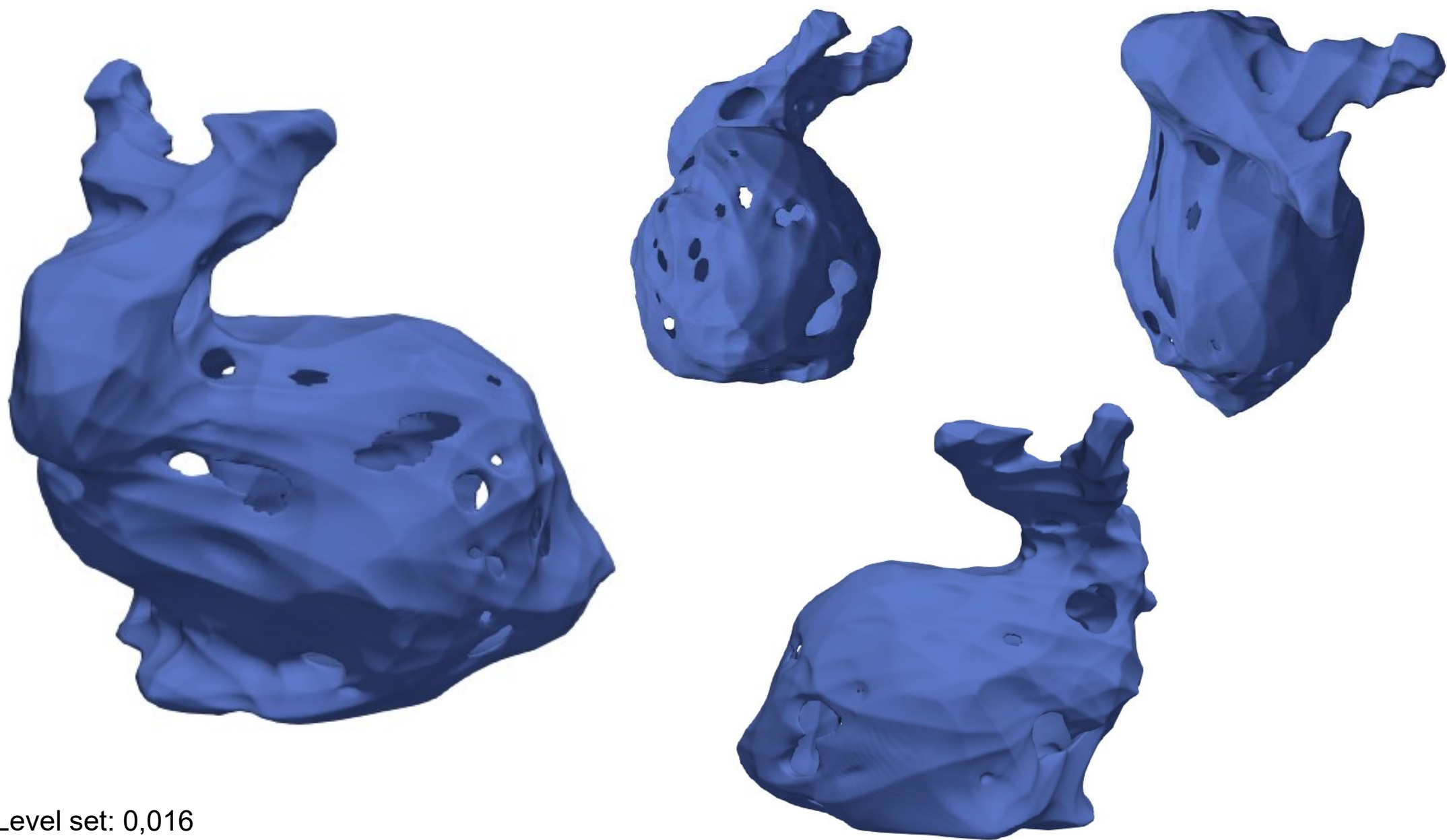
# Layout of the Neuronal Network

Total Number of  
Learnable Parameters

$$(16+1) * 16 + (16+1) * 1 \\ = 289$$



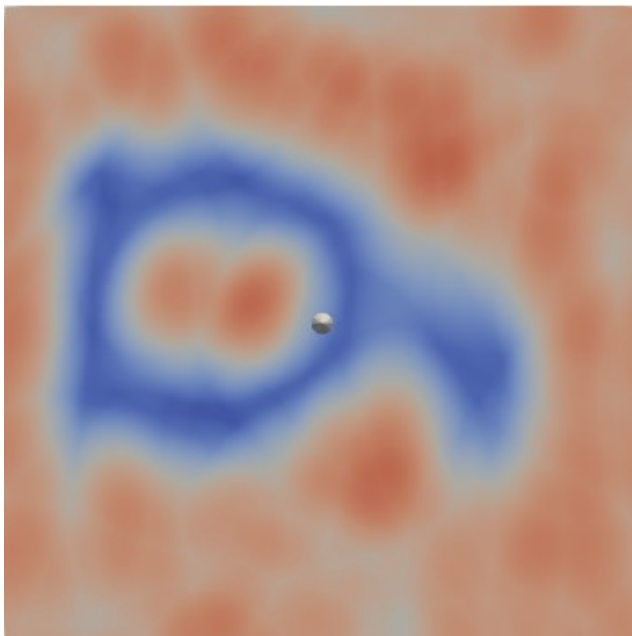




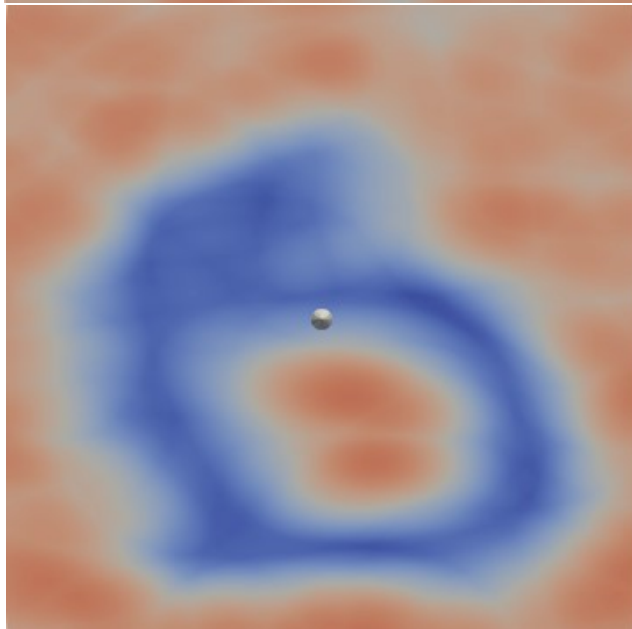
Level set: 0,016



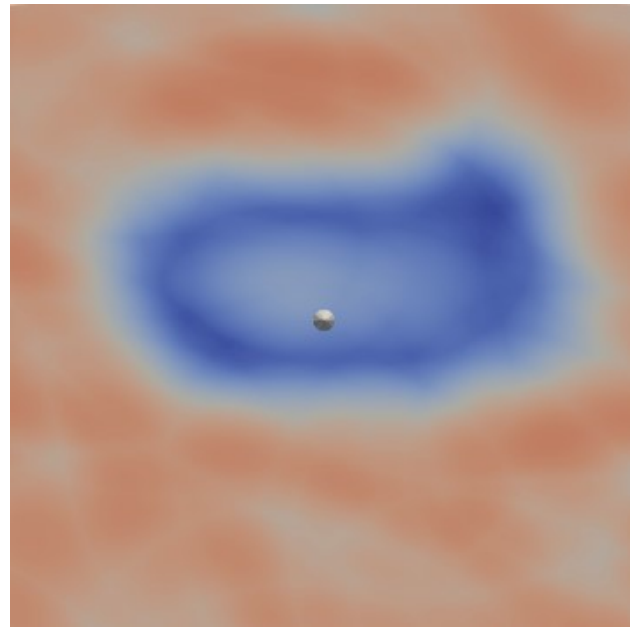
Normal:  
(1,0,0)



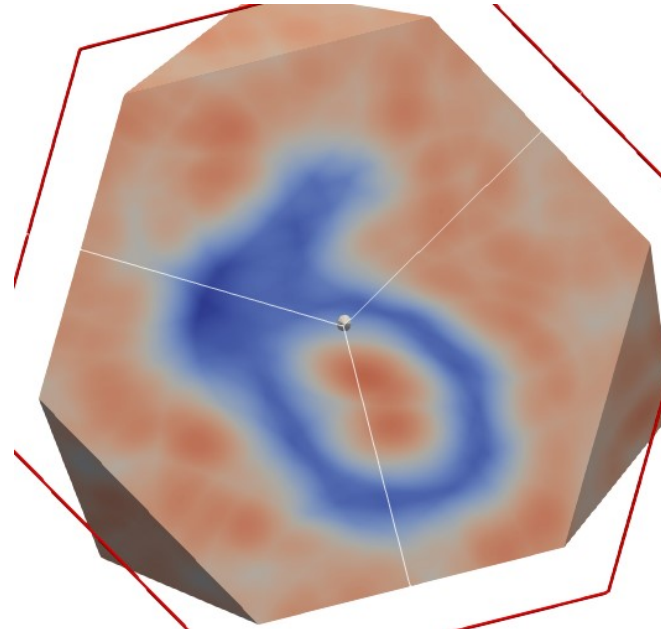
Normal:  
(0,0,1)



Normal:  
(0,1,0)



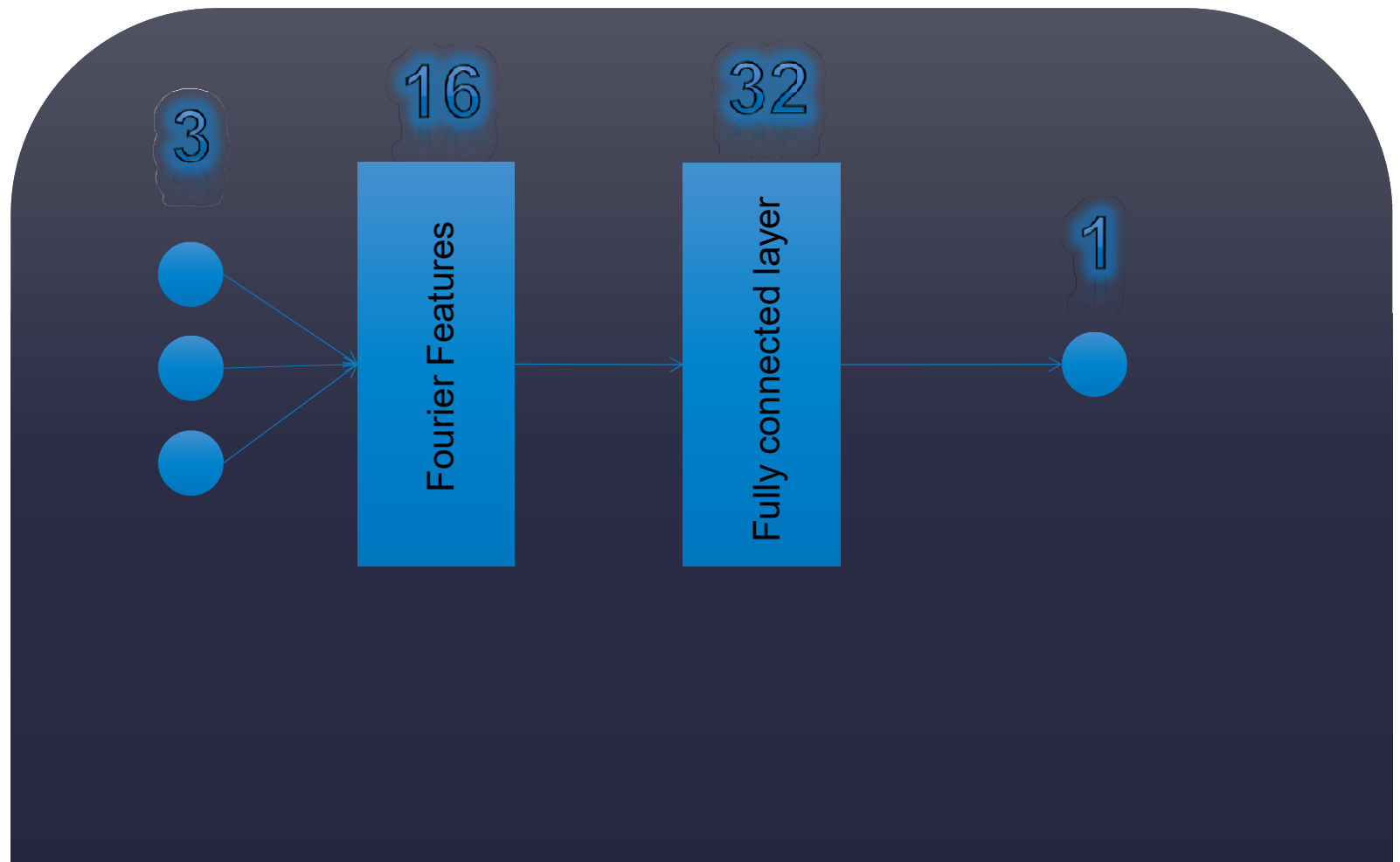
Normal:  
(1,1,1)

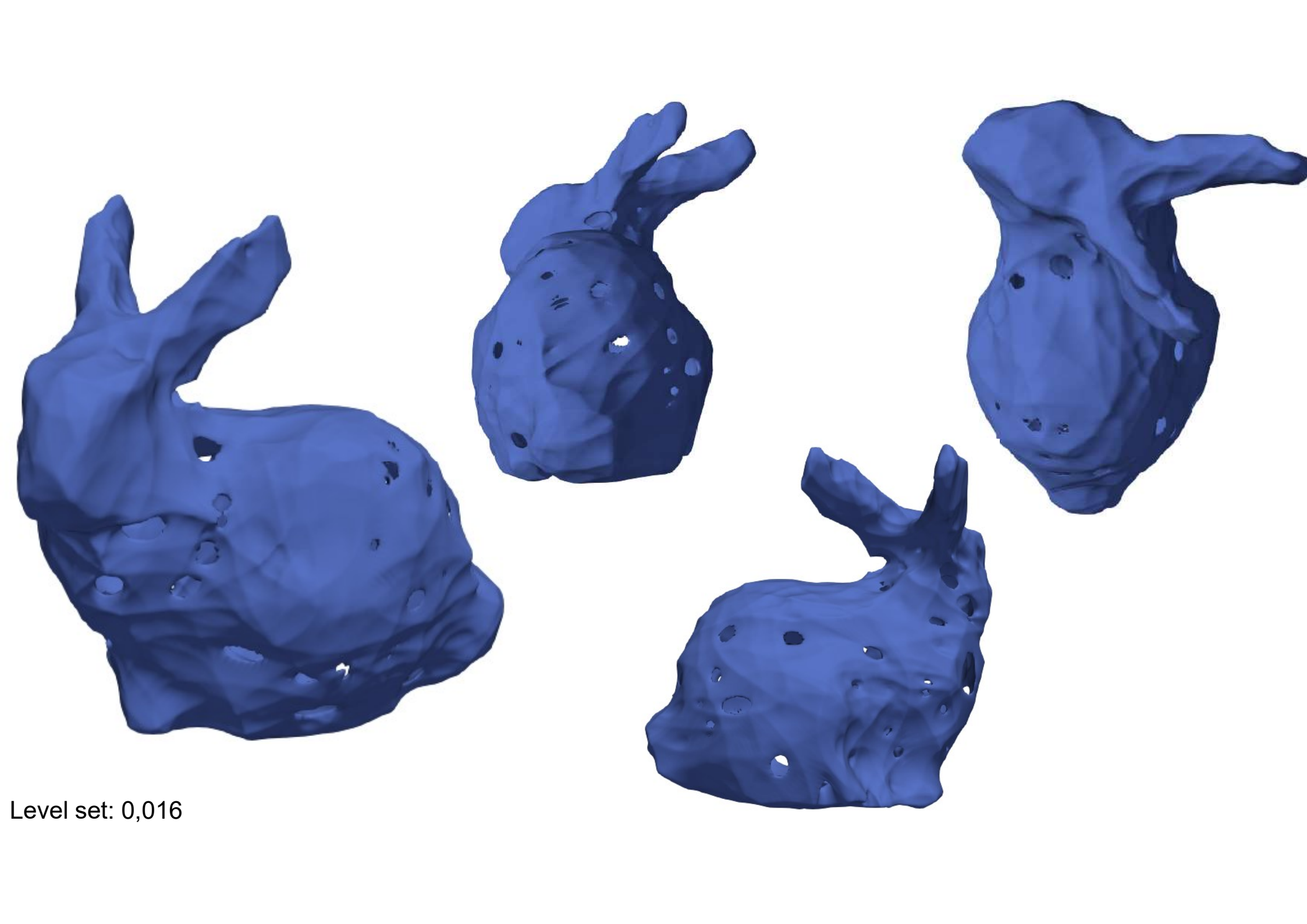


# Layout of the Neuronal Network

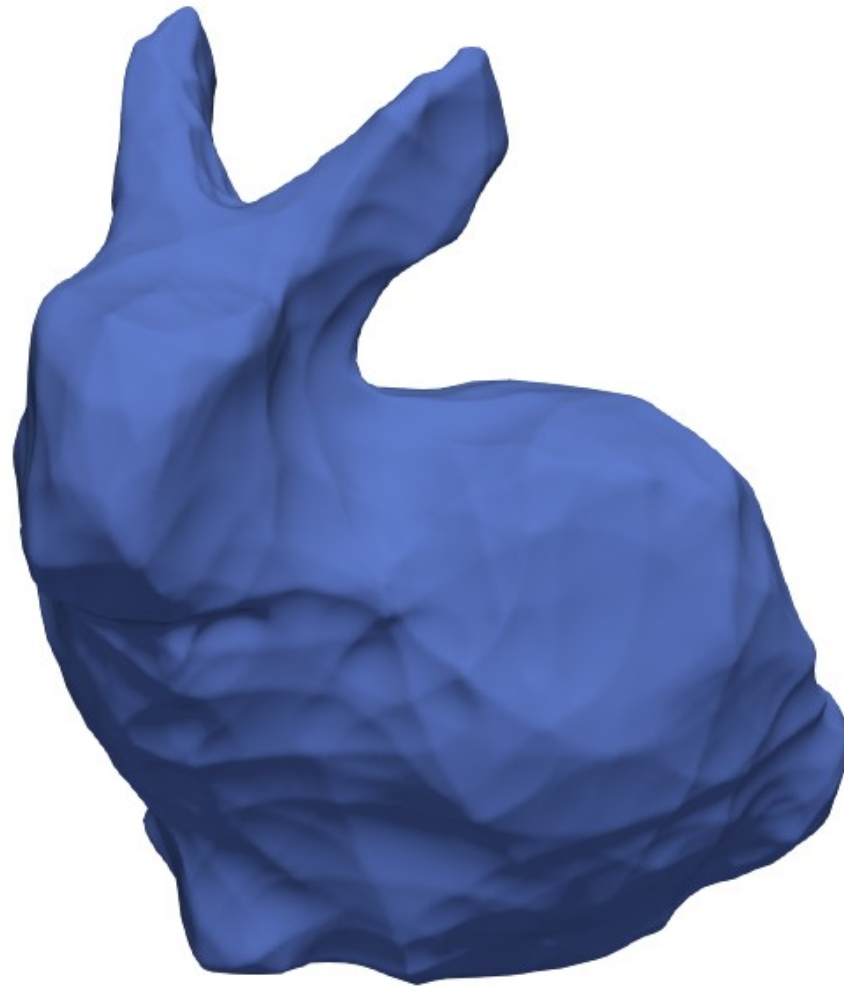
Total Number of  
Learnable Parameters

$$(16+1) * 32 + (32+1) * 1 \\ = 577$$



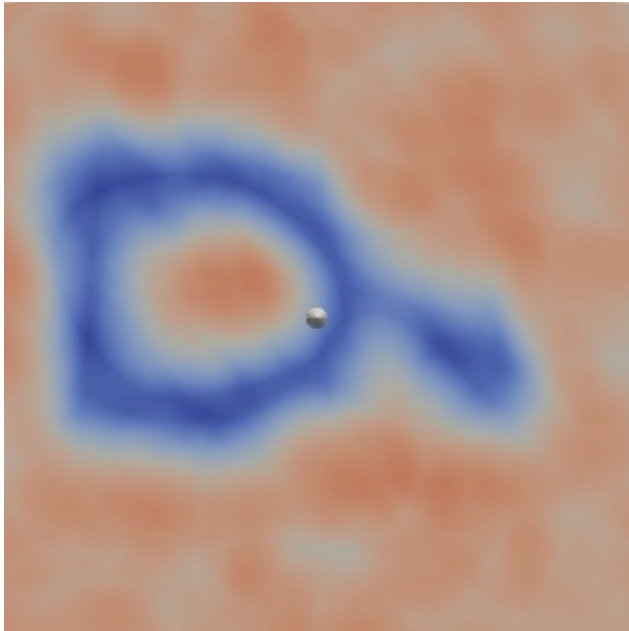


Level set: 0,016

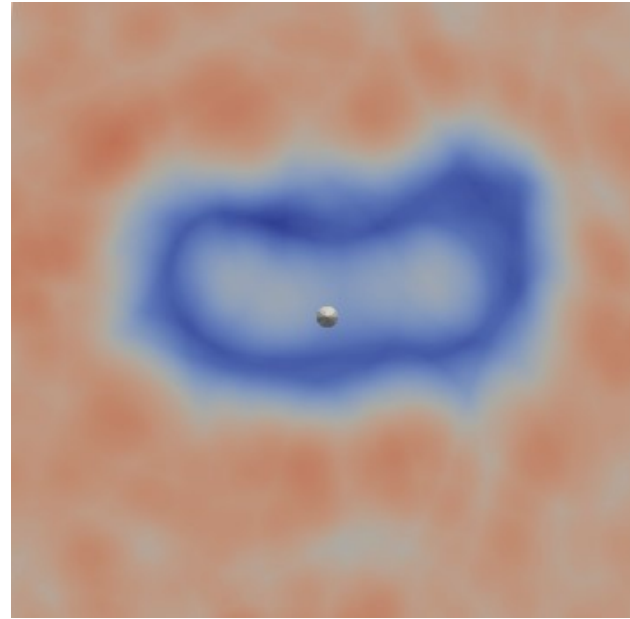


Level set: 0,05

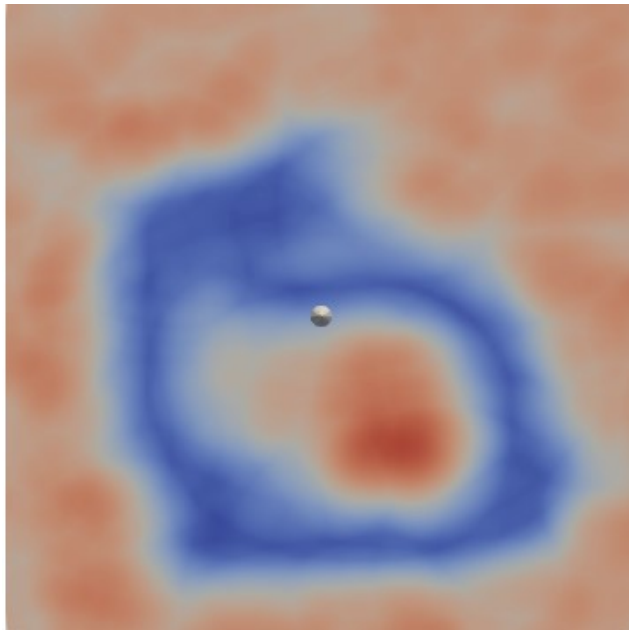
Normal:  
(1,0,0)



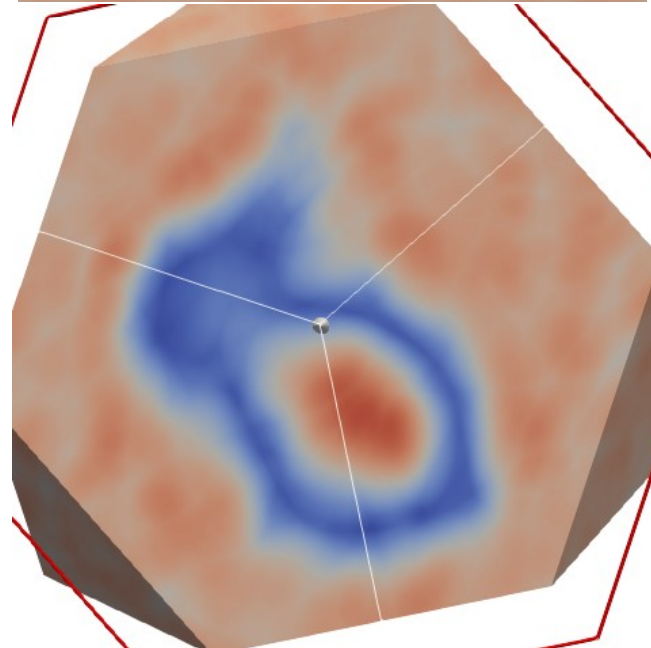
Normal:  
(0,1,0)



Normal:  
(0,0,1)



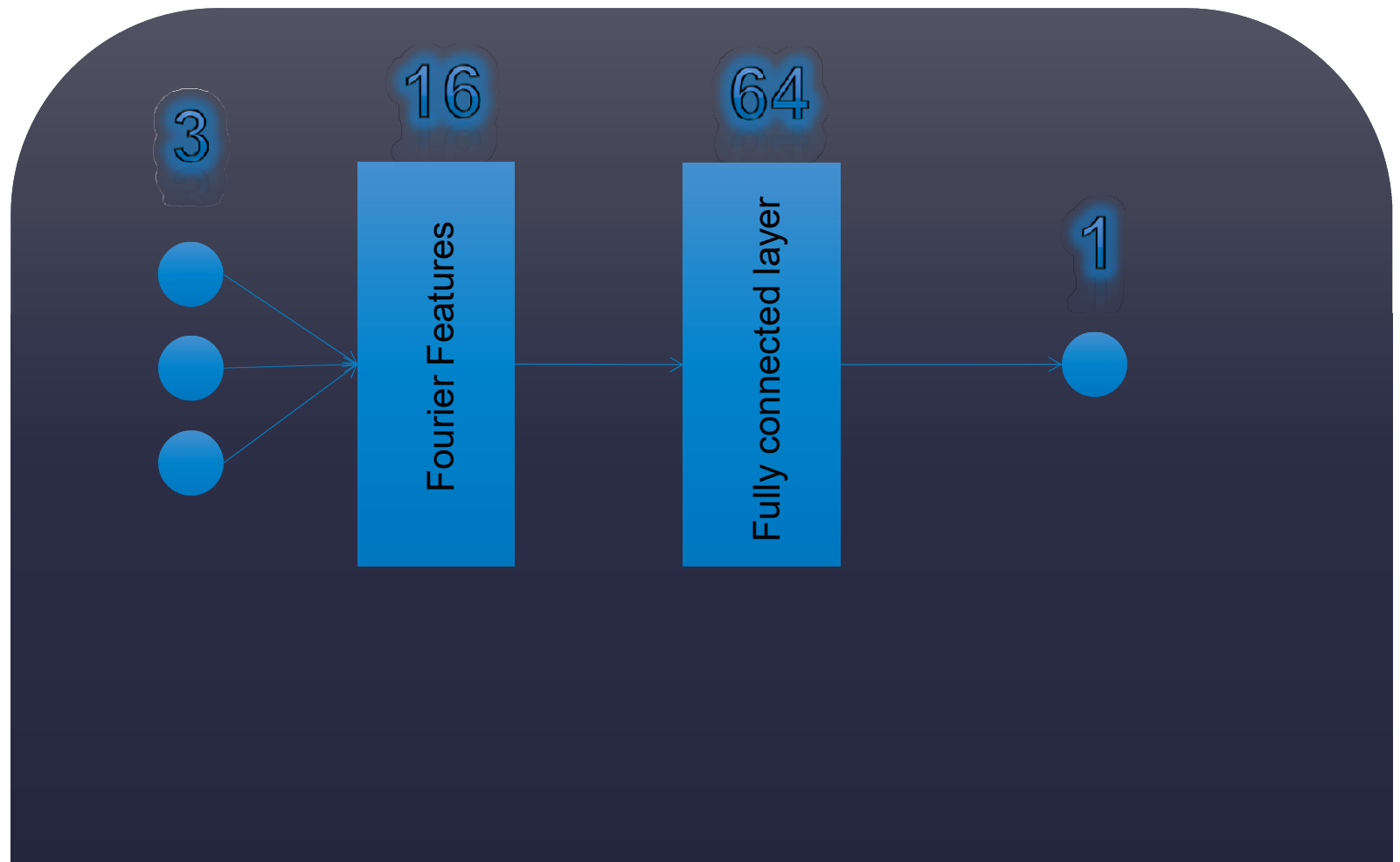
Normal:  
(1,1,1)



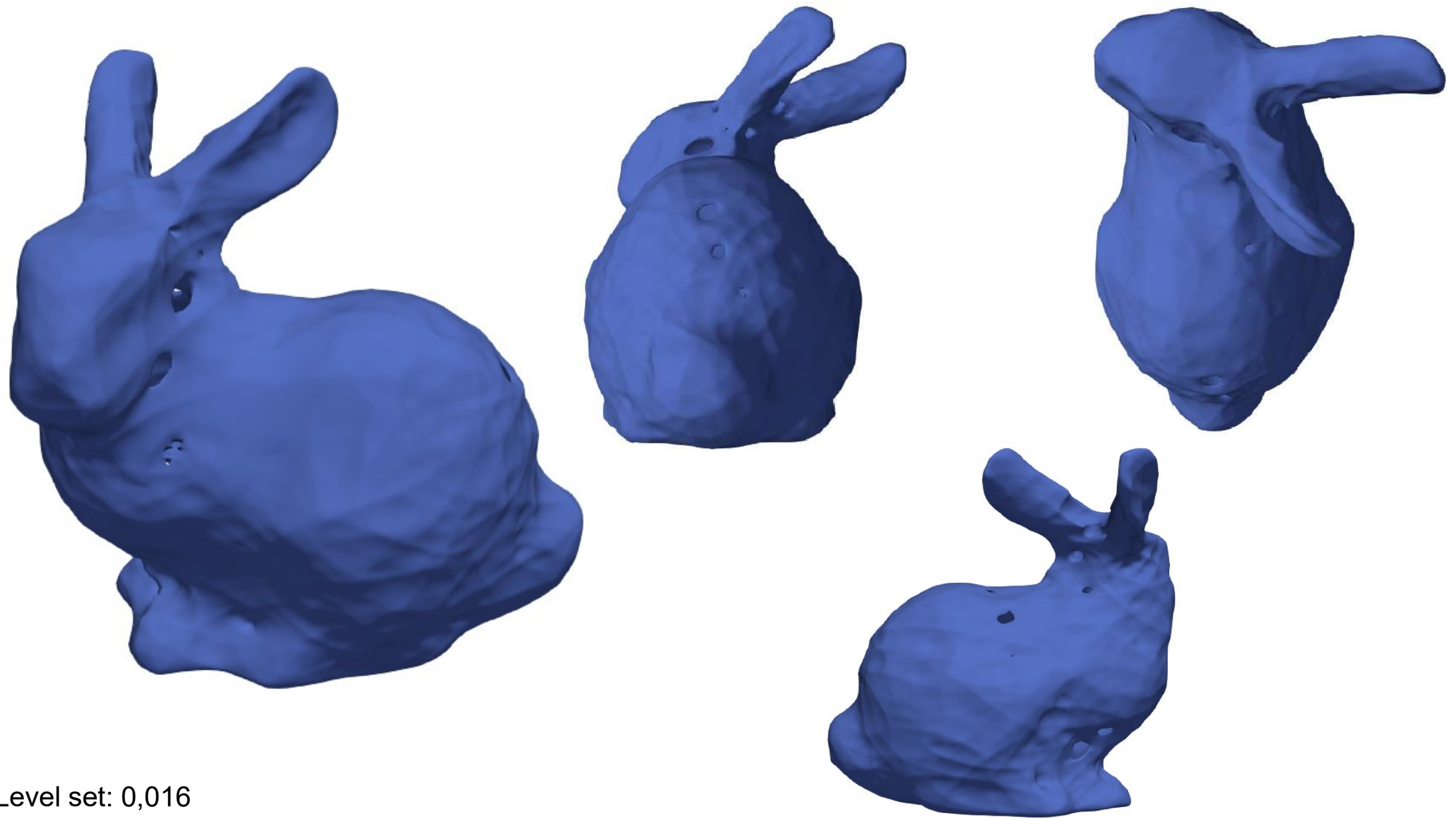
# Layout of the Neuronal Network

Total Number of  
Learnable Parameters

$$(16+1) * 64 + (64+1) * 1 \\ = 1153$$

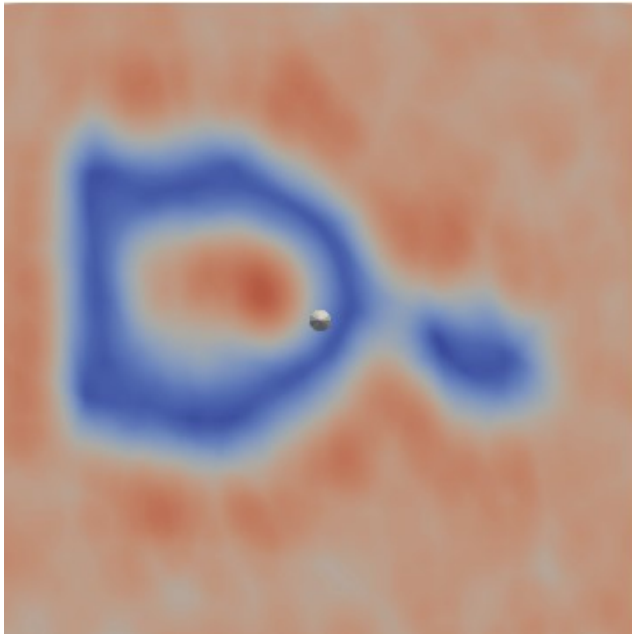




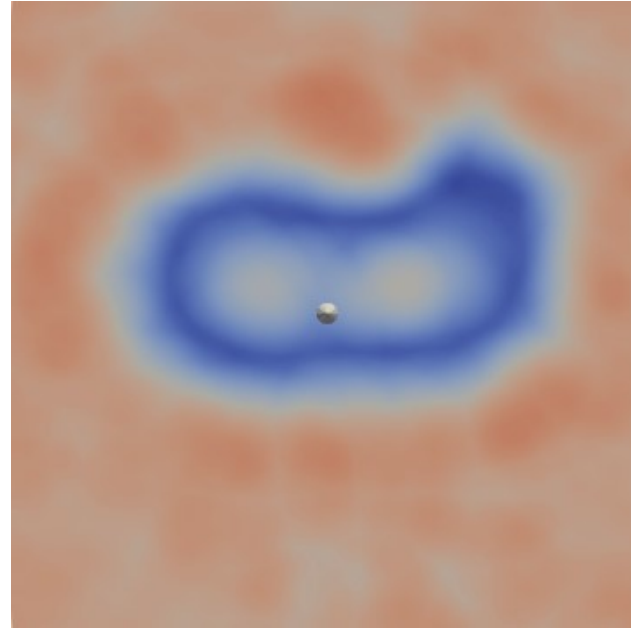


Level set: 0,016

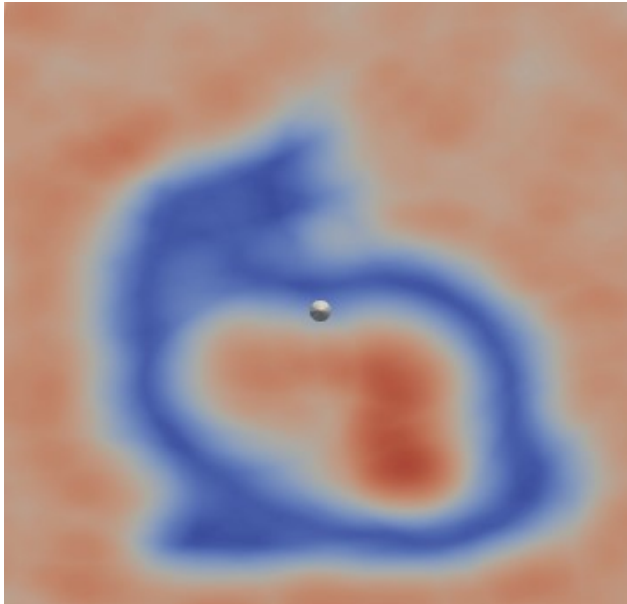
Normal:  
(1,0,0)



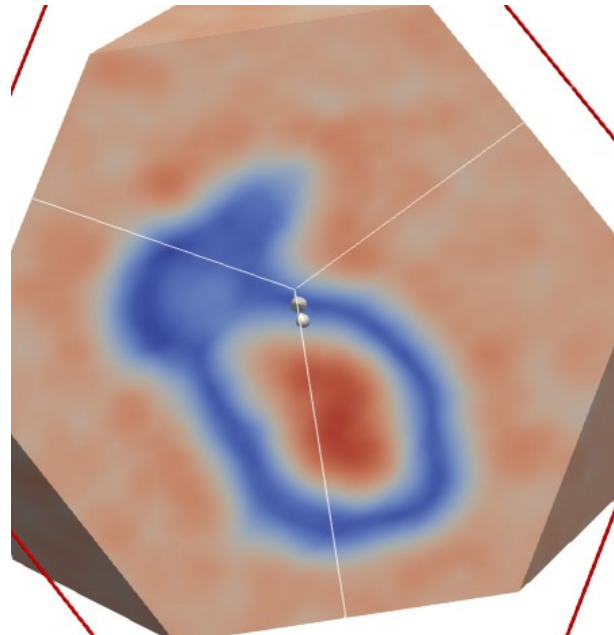
Normal:  
(0,1,0)



Normal:  
(0,0,1)



Normal:  
(1,1,1)

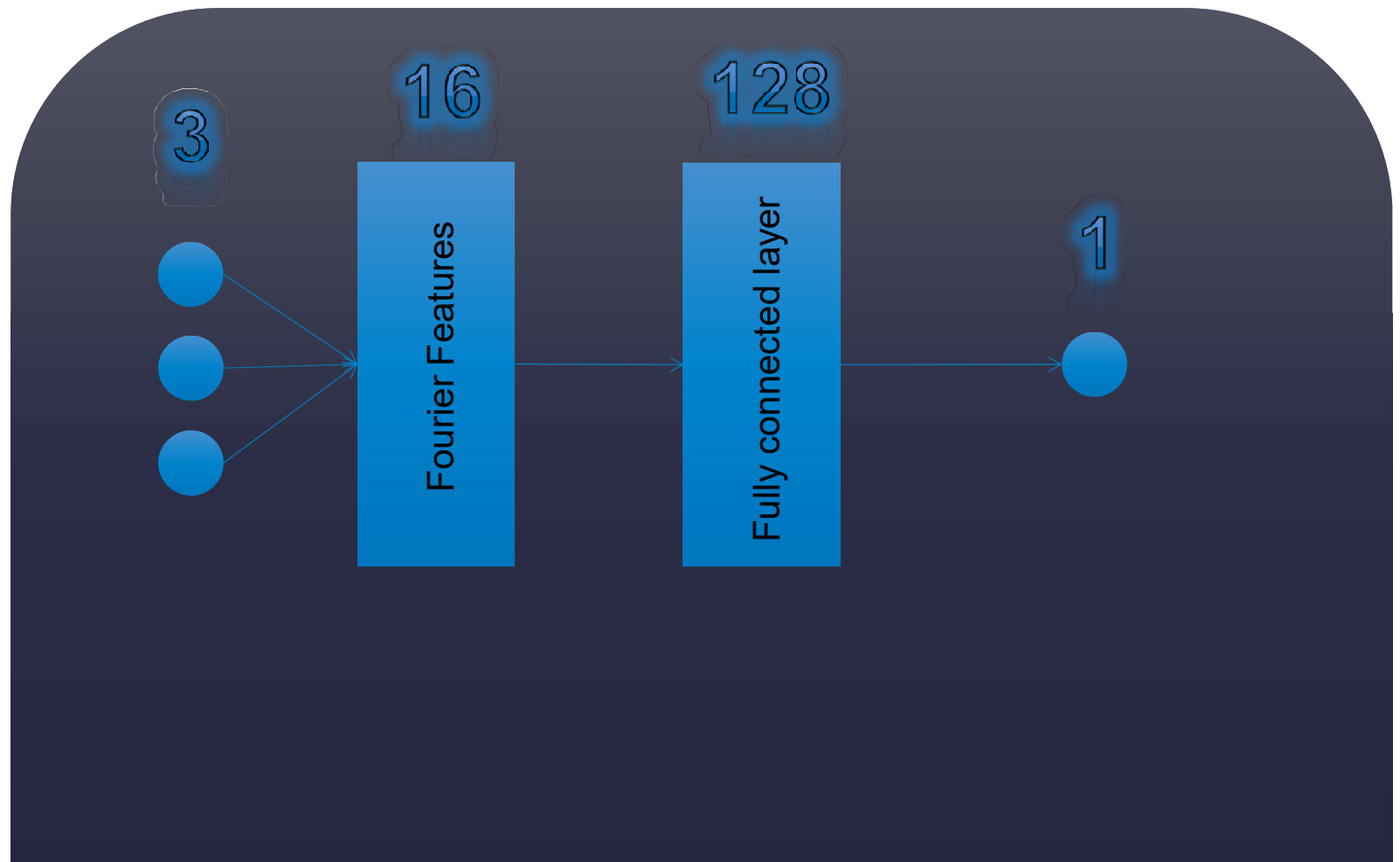


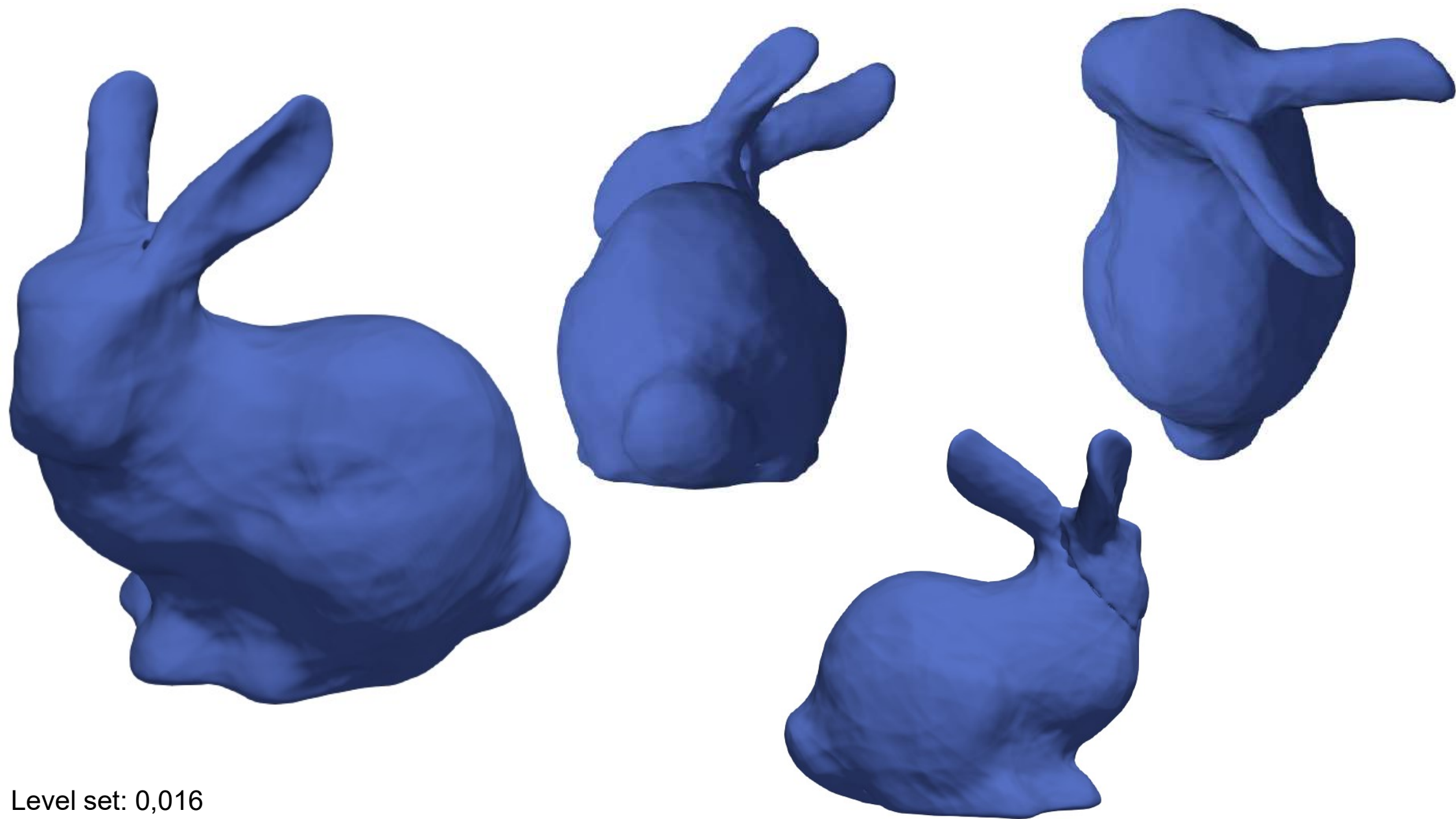


# Layout of the Neuronal Network

**Total Number of  
Learnable Parameters**

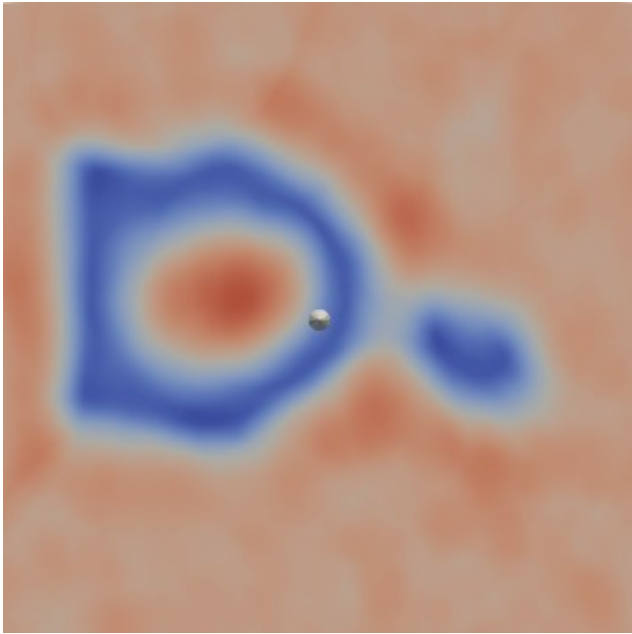
$(16+1) * 128 + (128+1) * 1$   
 $= 2305$



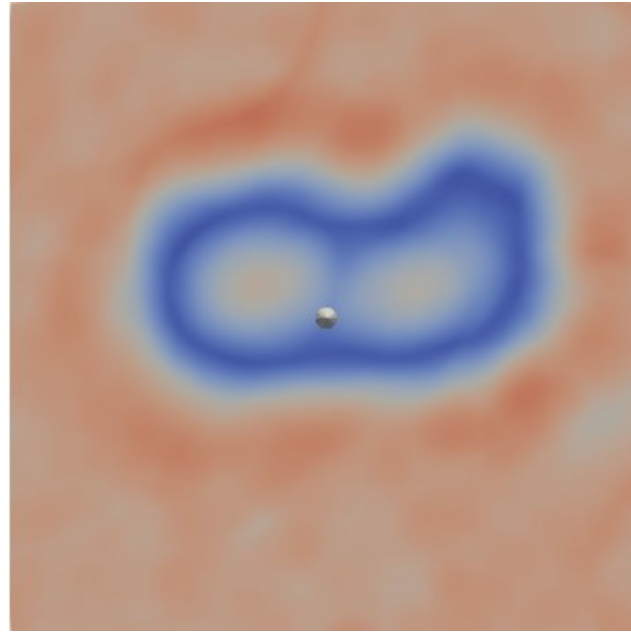


Level set: 0,016

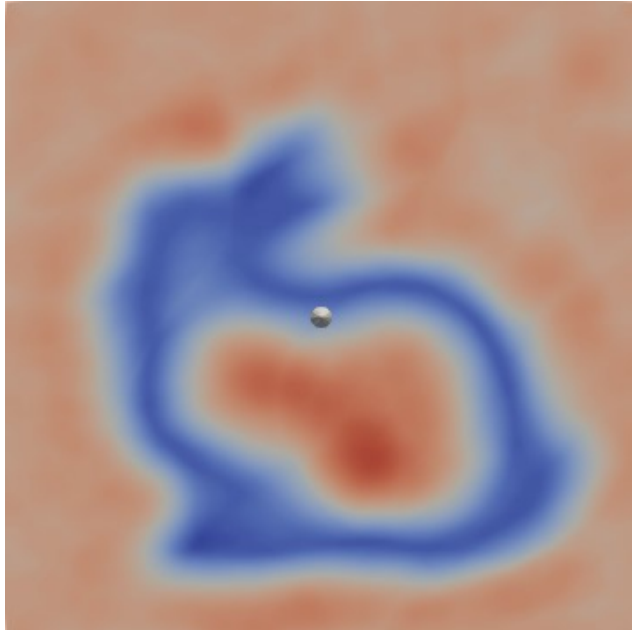
Normal:  
(1,0,0)



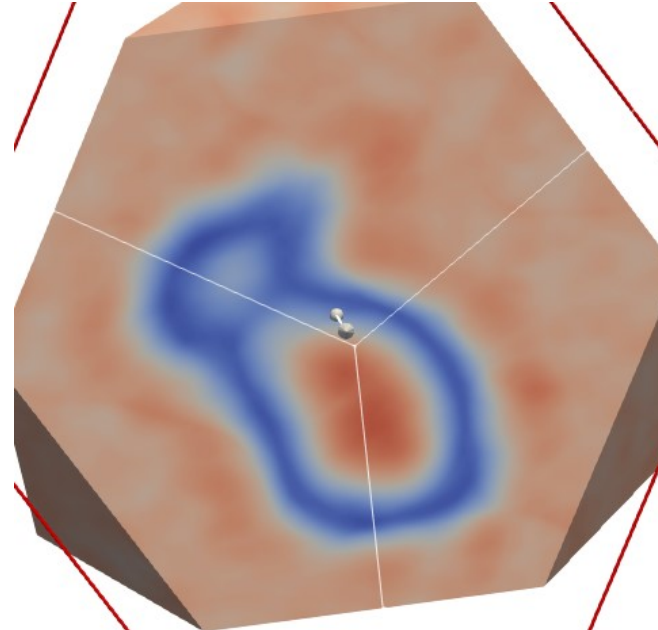
Normal:  
(0,1,0)



Normal:  
(0,0,1)



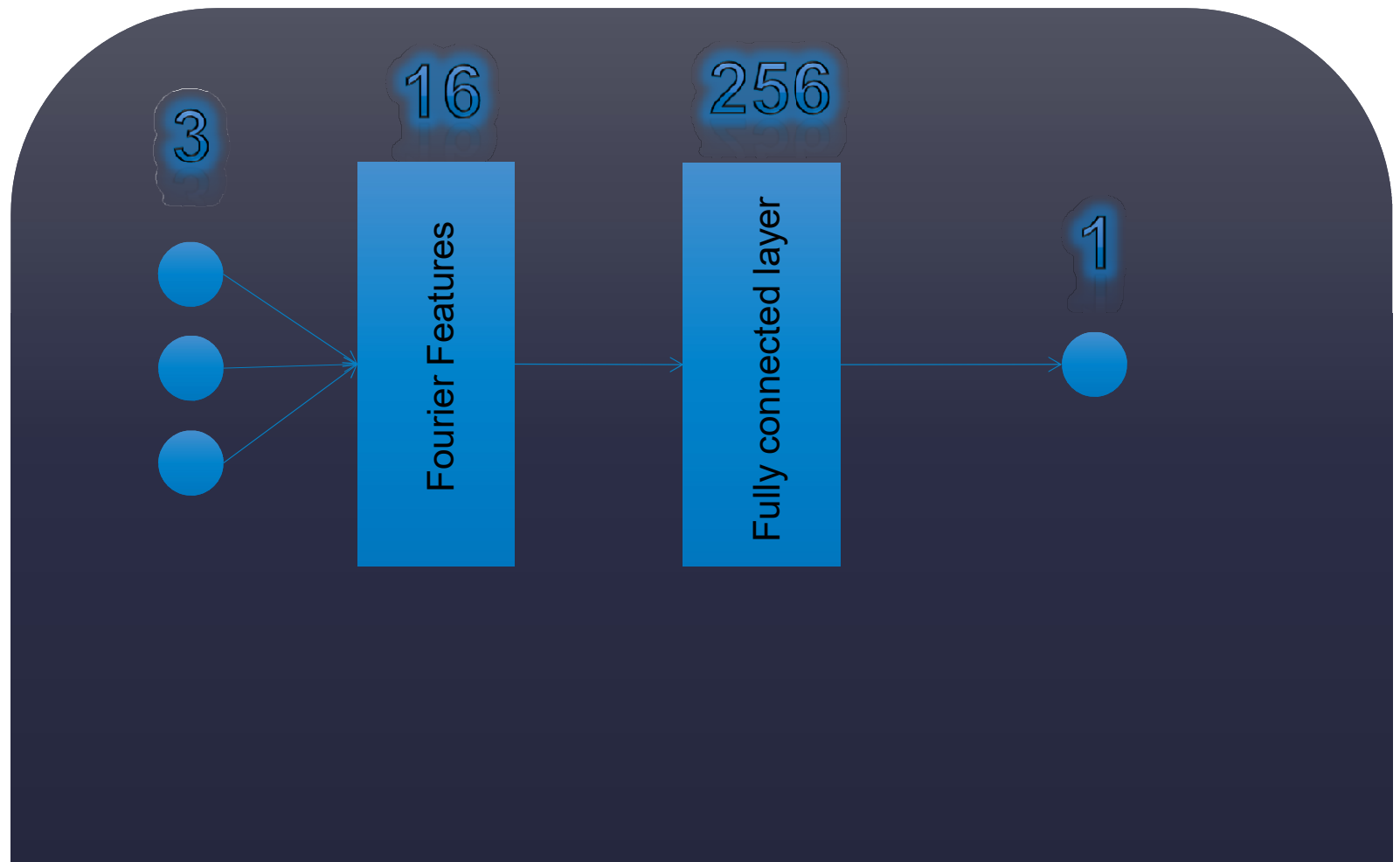

Normal:  
(1,1,1)

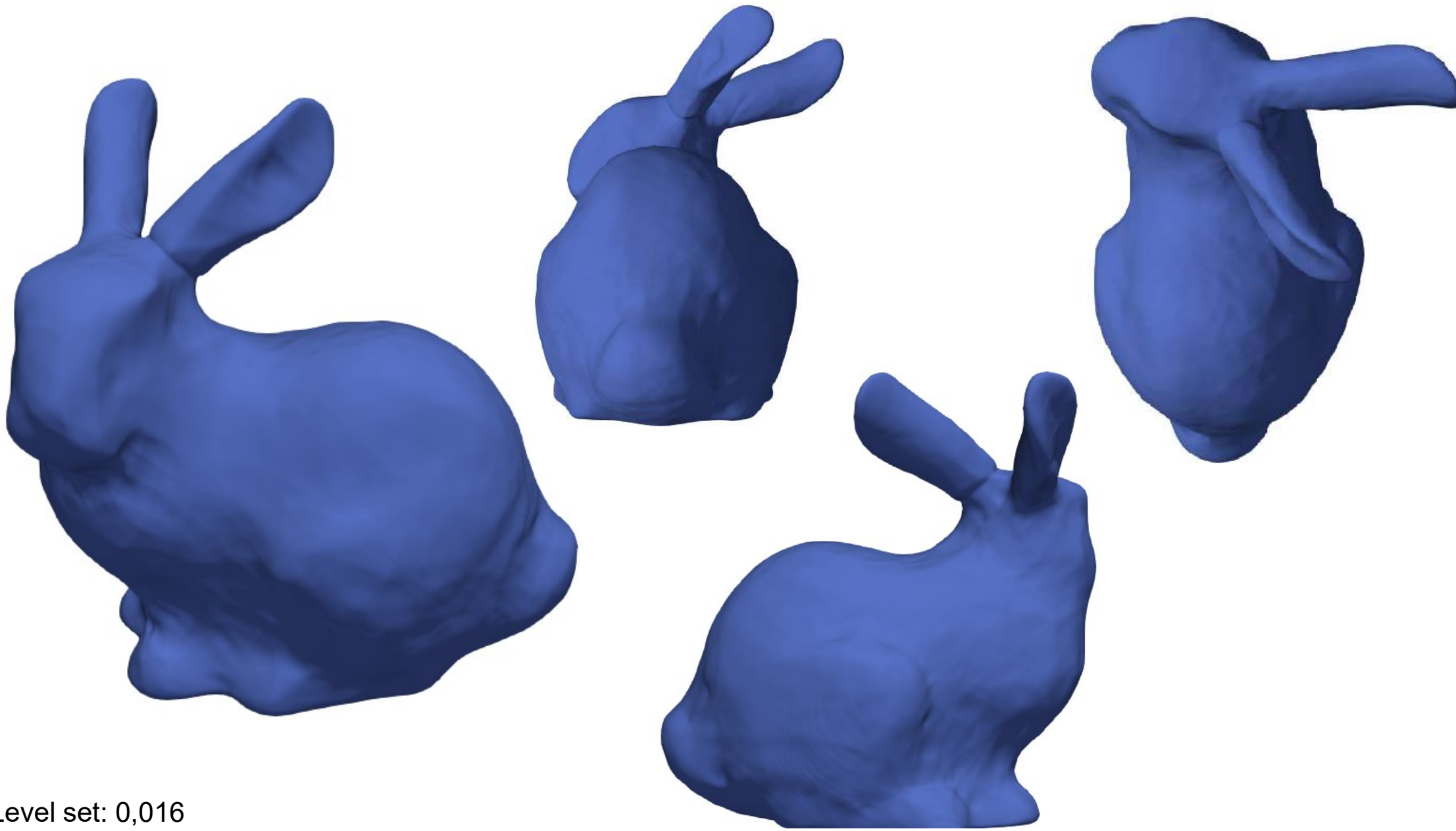


# Layout of the Neuronal Network

**Total Number of  
Learnable Parameters**

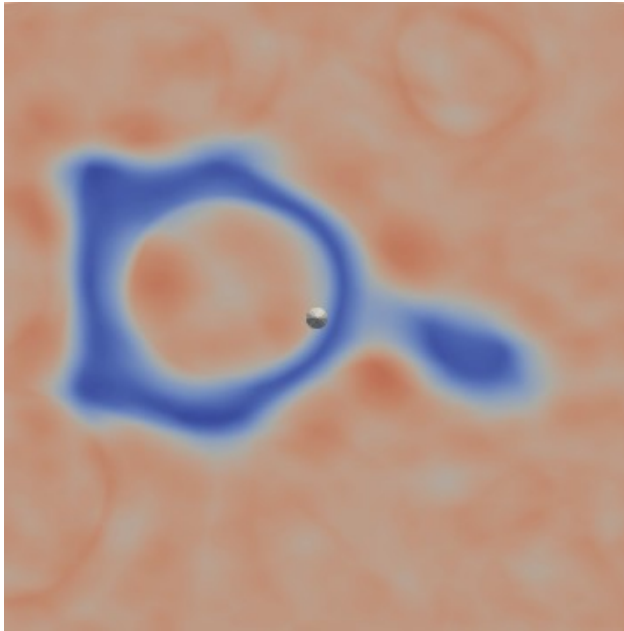
$(16+1) * 256 + (256+1) * 1$   
 $= 4609$



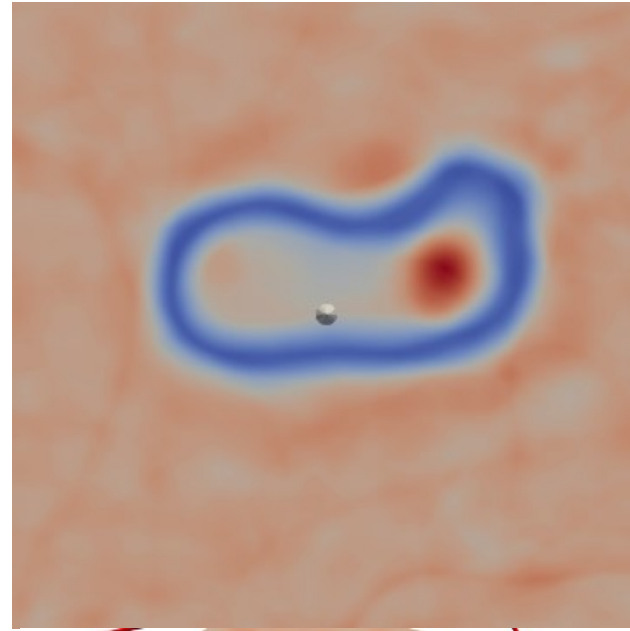


Level set: 0,016

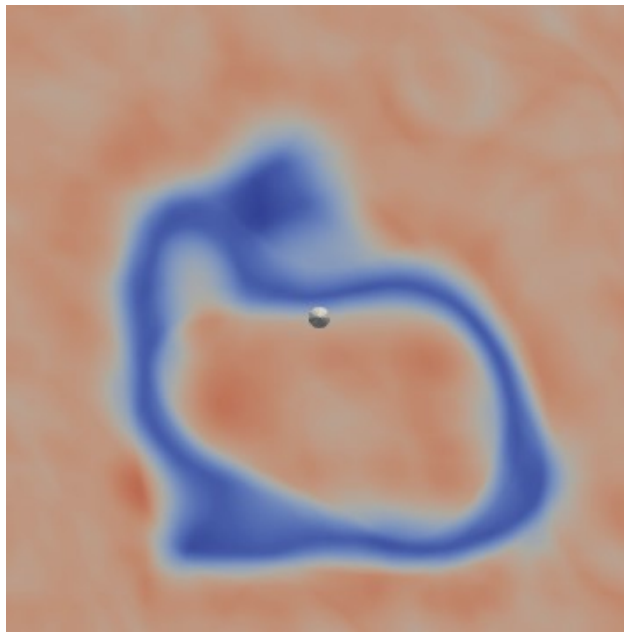
Normal:  
(1,0,0)



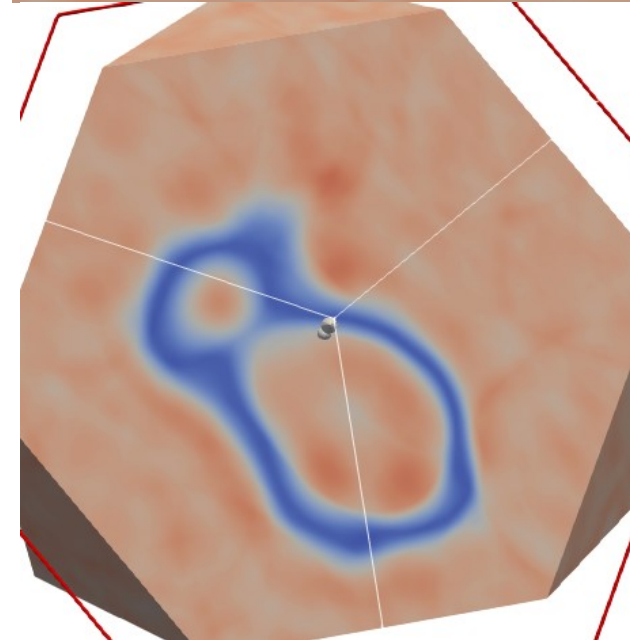
Normal:  
(0,1,0)



Normal:  
(0,0,1)

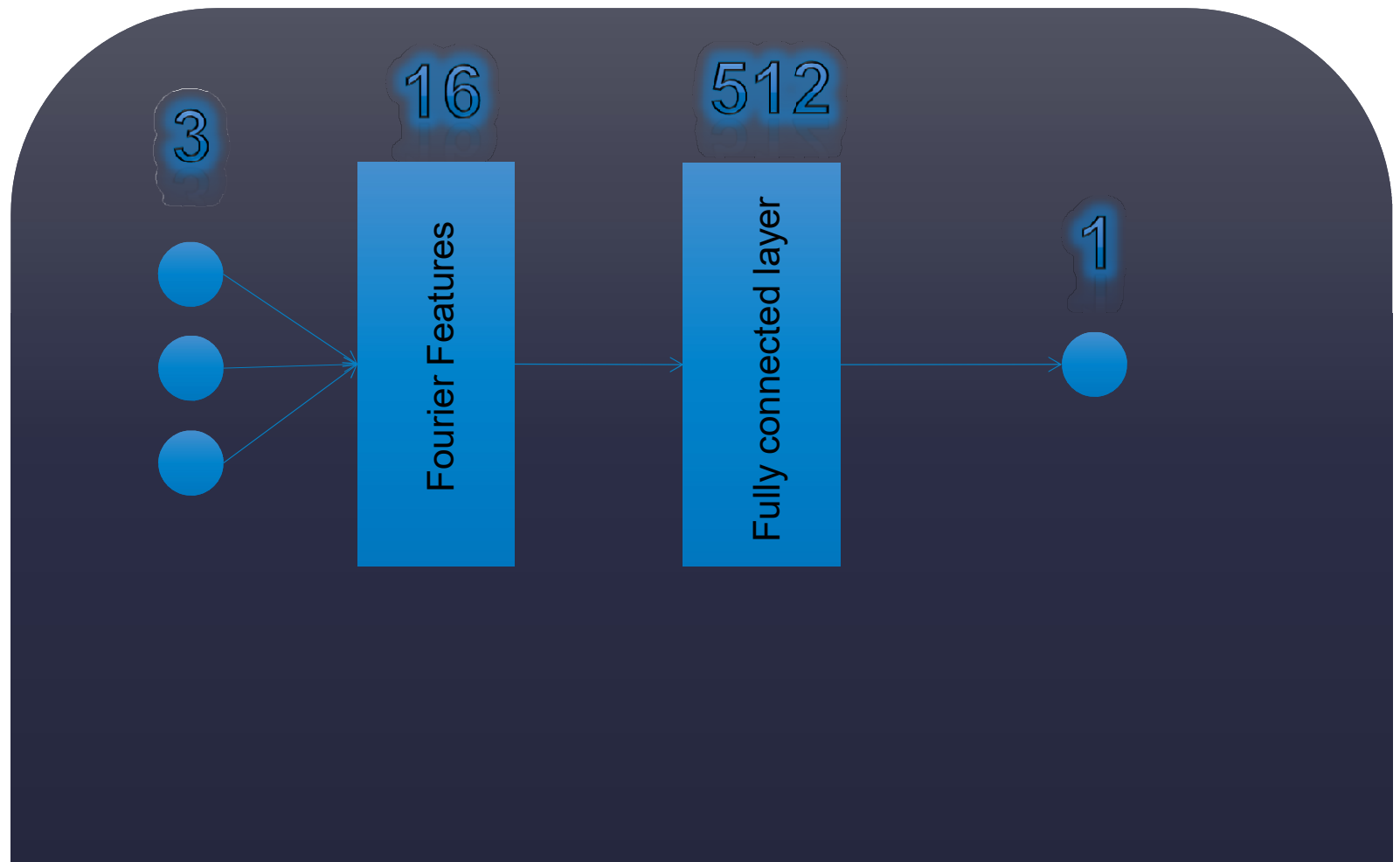


Normal:  
(1,1,1)

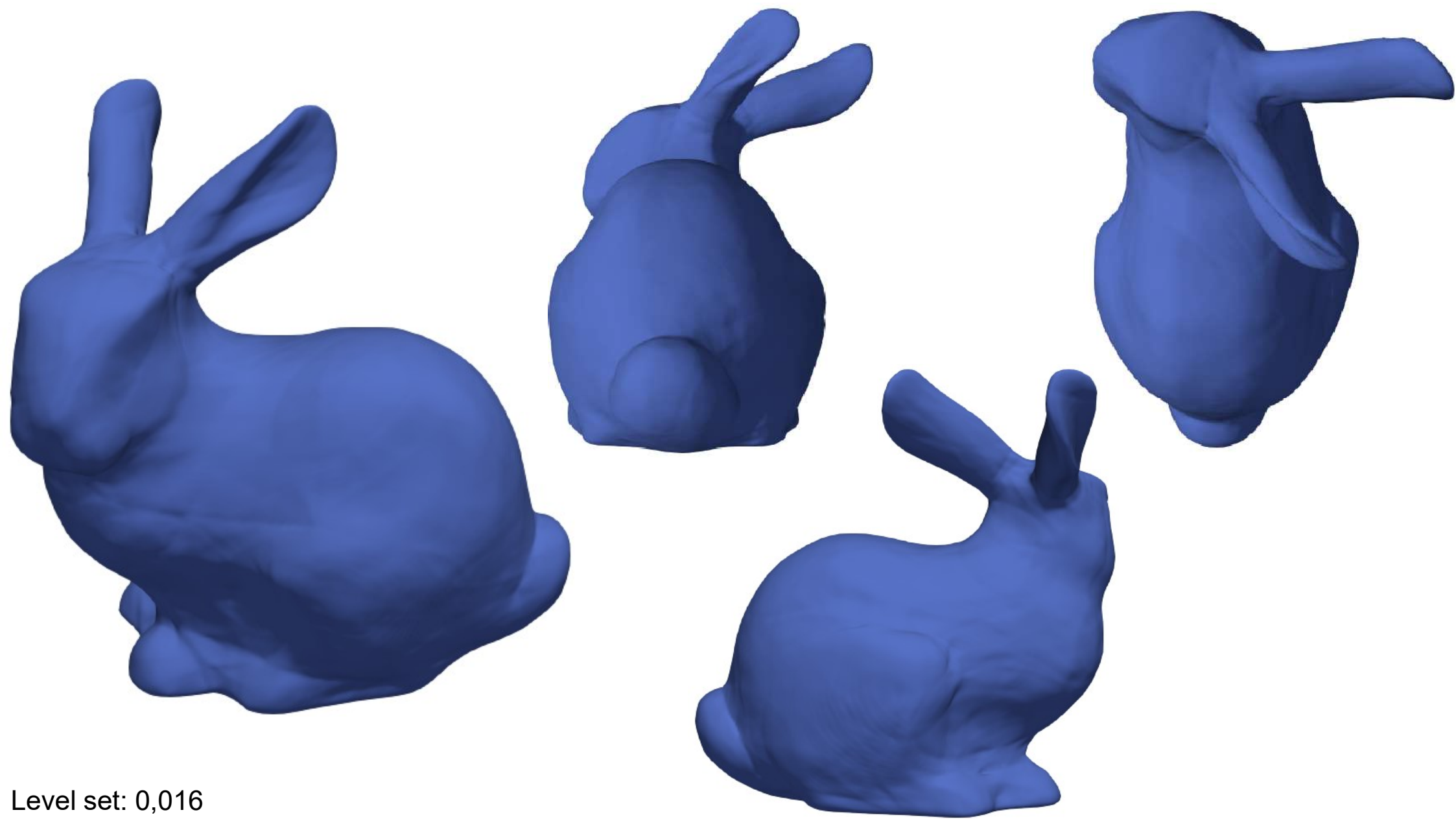


# Layout of the Neuronal Network

**Total Number of  
Learnable Parameters**

$$(16+1) * 512 + (512+1) * 1$$
$$= 9217$$


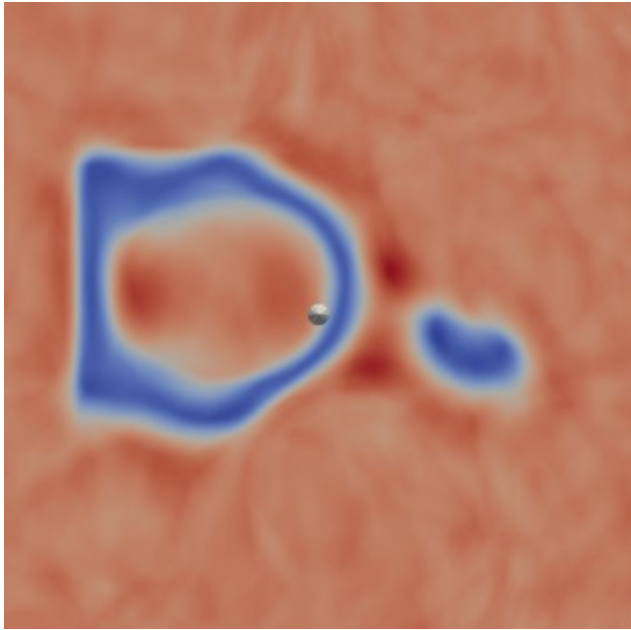




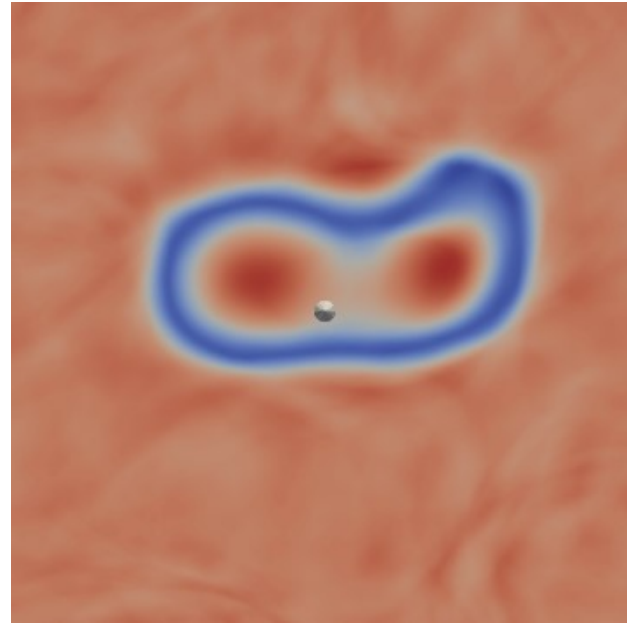
Level set: 0,016



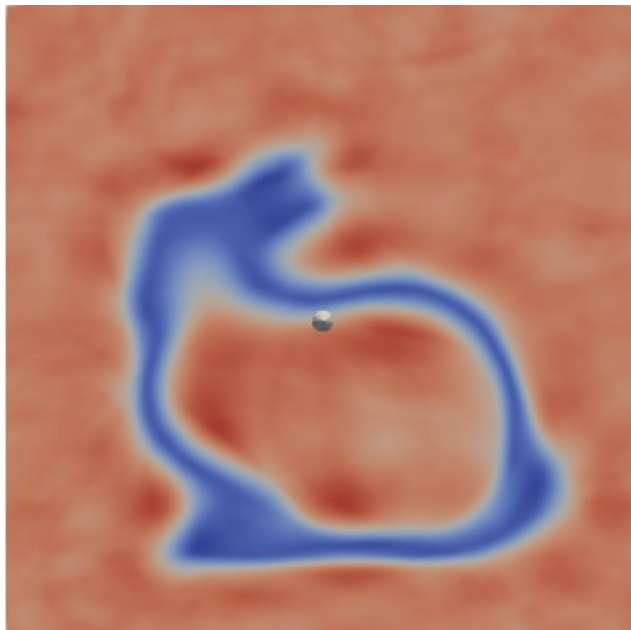
Normal:  
(1,0,0)



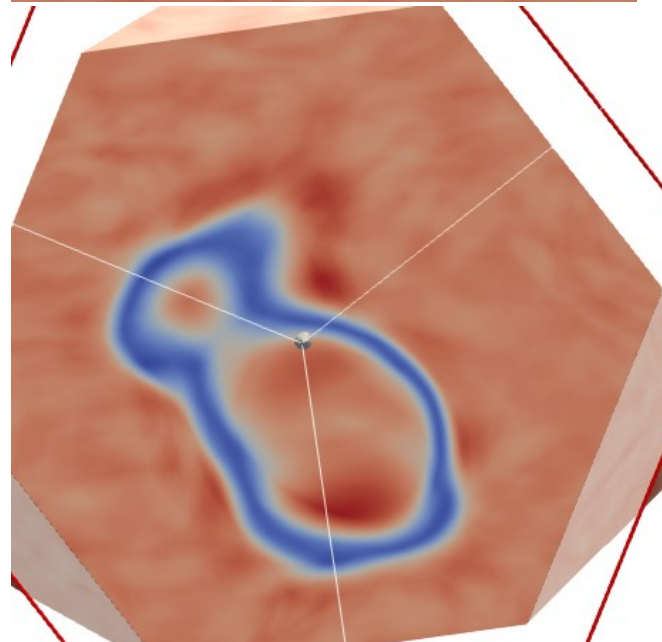
Normal:  
(0,1,0)



Normal:  
(0,0,1)



Normal:  
(1,1,1)

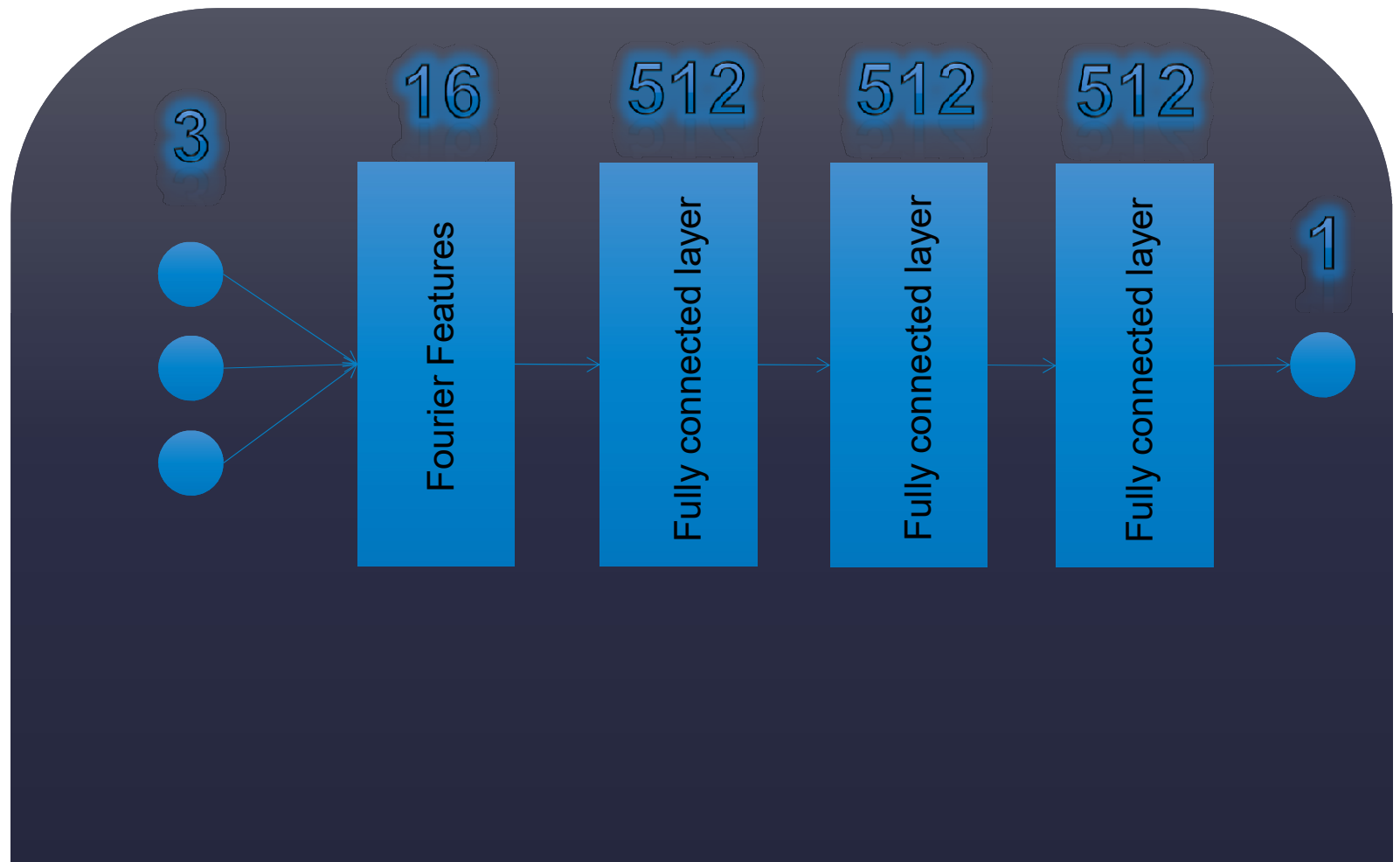


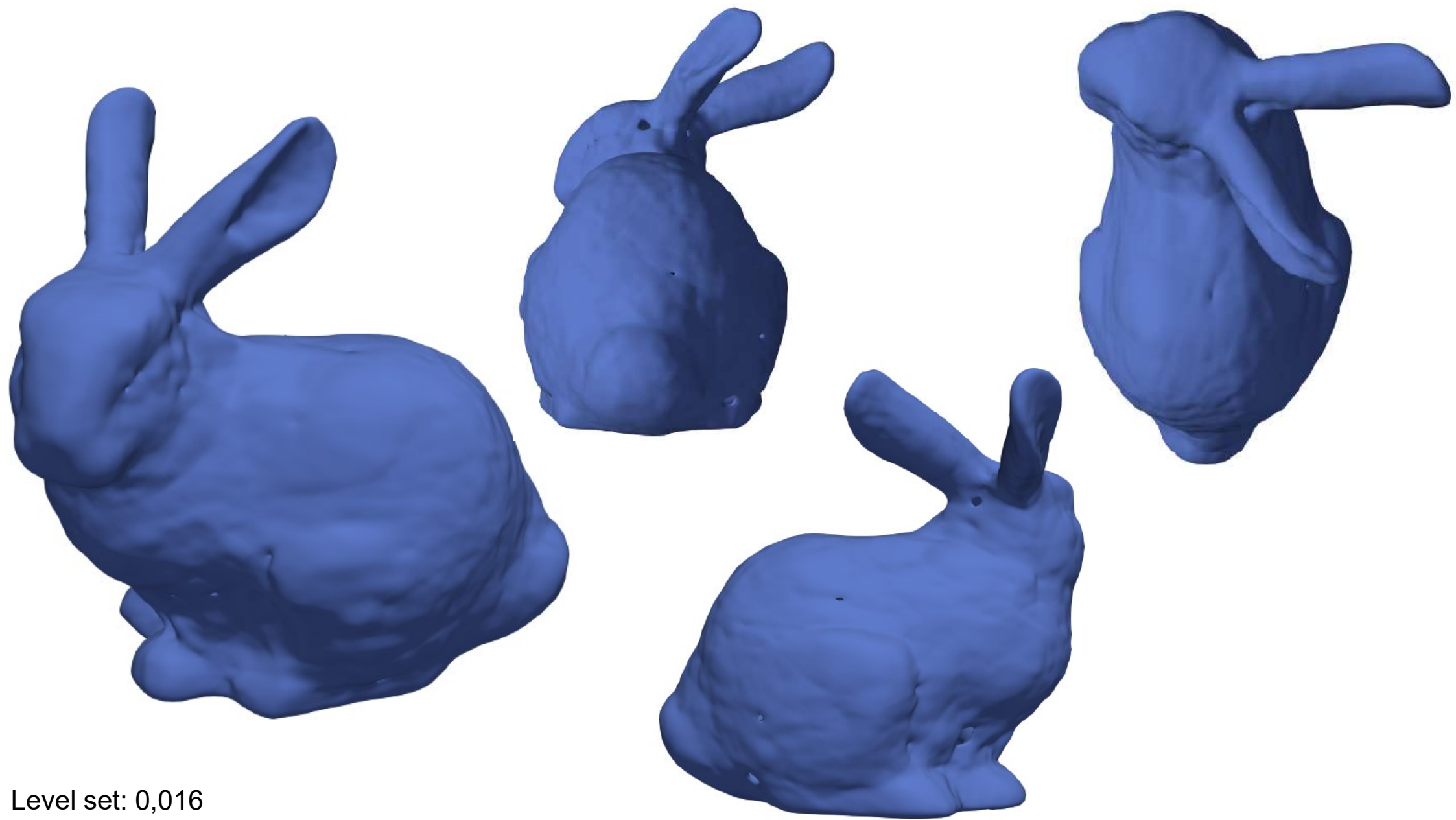
# Layout of the Neuronal Network

**Total Number of  
Learnable Parameters**



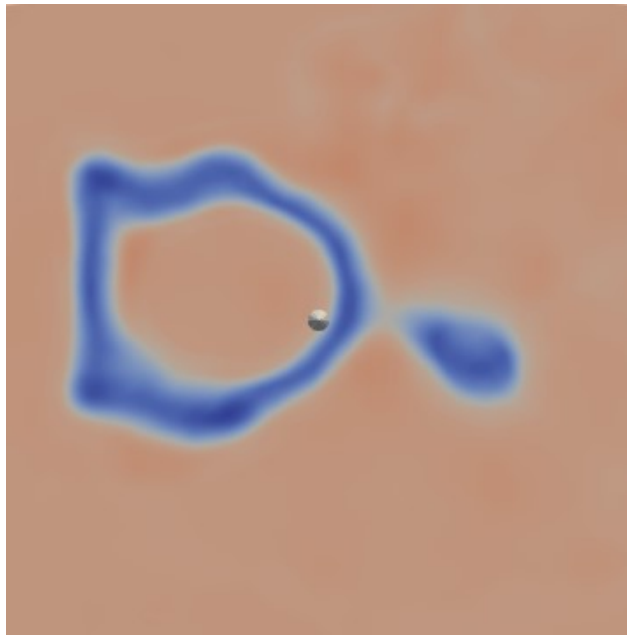
$$\begin{aligned} &(16+1) * 512 + 2 * (512+1)*512 \\ &\quad + (512+1) * 1 \\ &= 534529 \end{aligned}$$



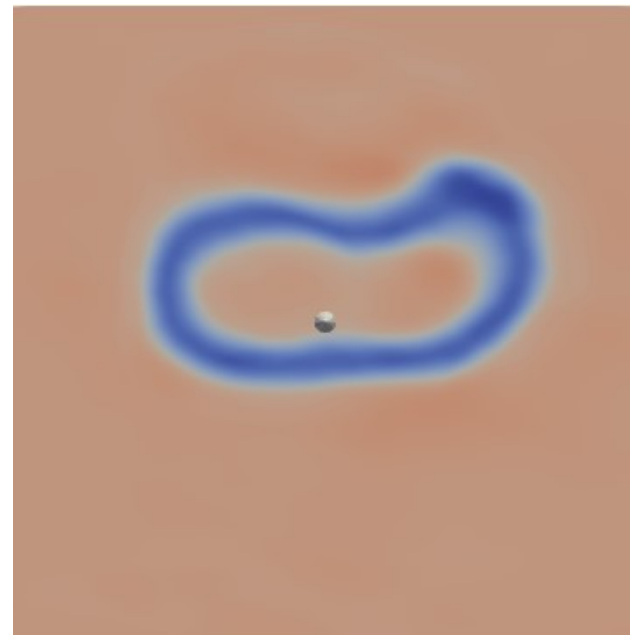


Level set: 0,016

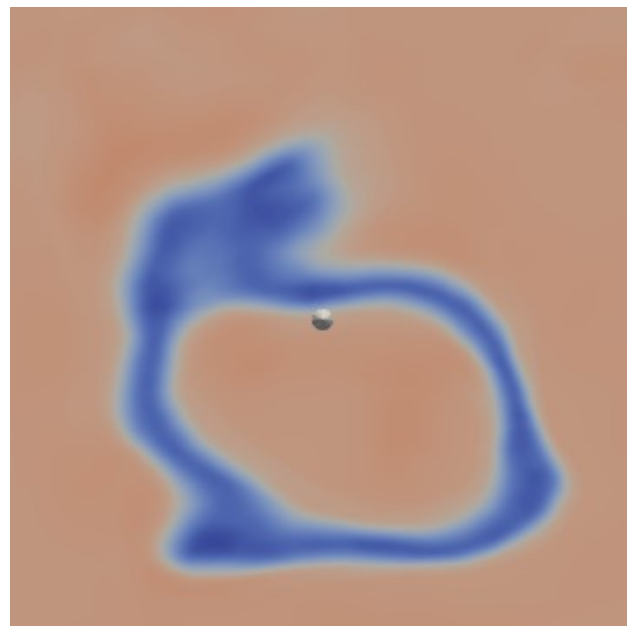
Normal:  
(1,0,0)



Normal:  
(0,1,0)



Normal:  
(0,0,1)



Normal:  
(1,1,1)

