



Bioimage Informatics

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Workshop

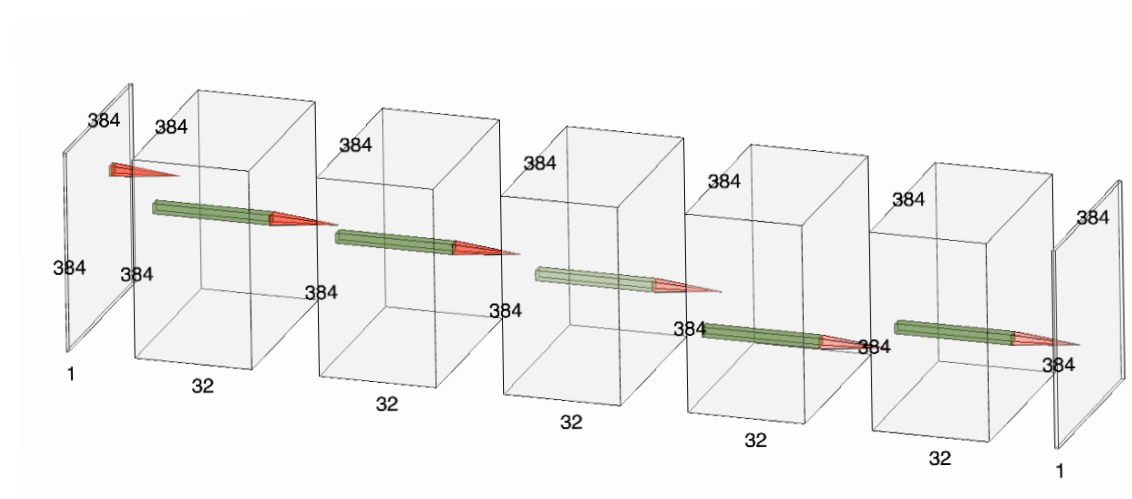
Experiences Convolution Neural Network

 Convolutional Neural Network U-Net

SUPERVISED LEARNING



Ground-Truth



Resnet (200E)



Ground-Truth



Median filter, radius = 3



Unet (100E)

Layer	Shape	Params
Input	384 x 384 x 1	0
Conv2D 3x3	384 x 384 x 32	384 x 384 x 32 x 3 x 3 = 429,888
ReLU	384 x 384 x 32	0
Conv2D 3x3	384 x 384 x 32	384 x 384 x 32 x 3 x 3 = 429,888
ReLU	384 x 384 x 32	0
Conv2D 3x3	384 x 384 x 32	384 x 384 x 32 x 3 x 3 = 429,888
ReLU	384 x 384 x 32	0
Conv2D 3x3	384 x 384 x 32	384 x 384 x 32 x 3 x 3 = 429,888
ReLU	384 x 384 x 32	0
Conv2D 3x3	384 x 384 x 32	384 x 384 x 32 x 3 x 3 = 429,888
ReLU	384 x 384 x 32	0
Conv2D 3x3	384 x 384 x 1	384 x 384 x 1 x 3 x 3 = 13,824
Subtract	384 x 384 x 1	0
Total		2,580,480

Questions?

layers

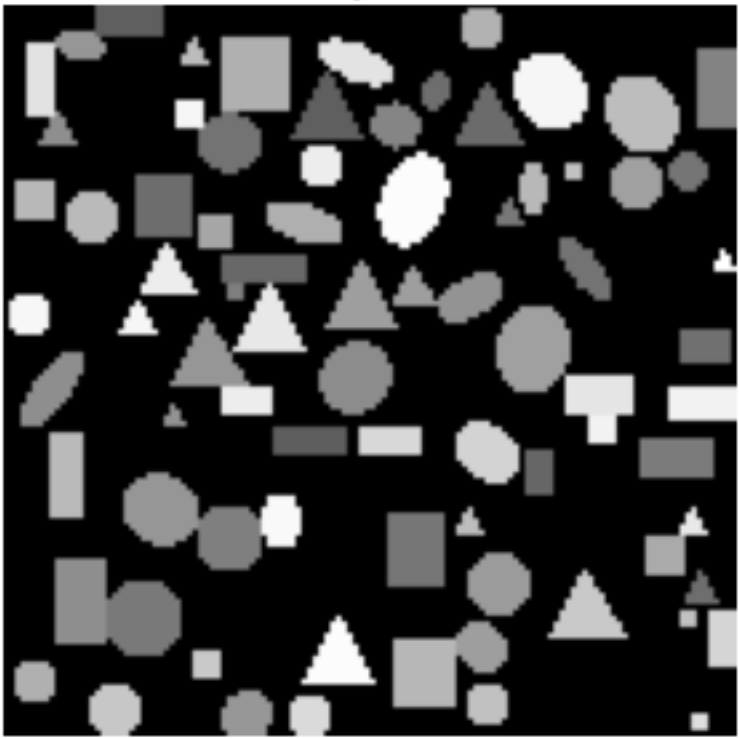
channels

params

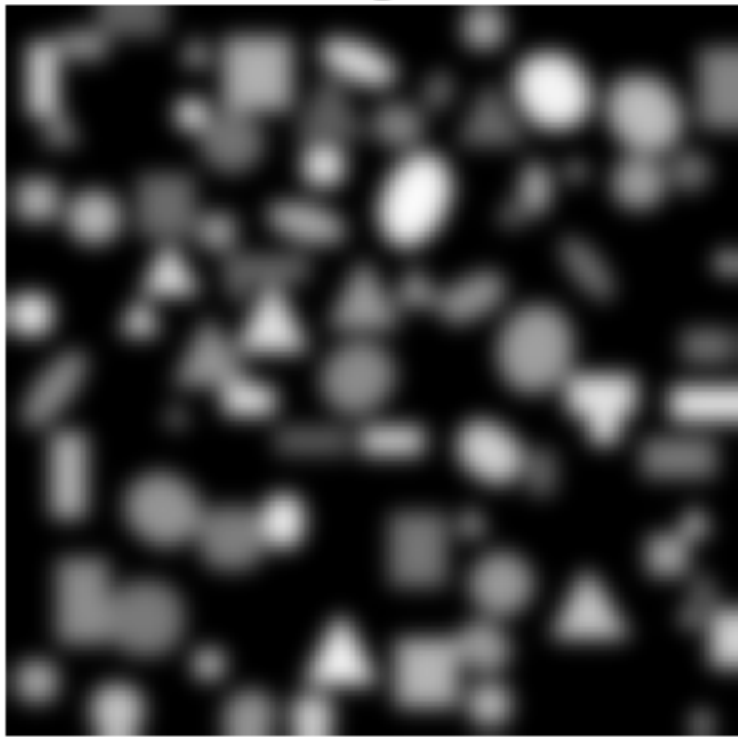
receptive field

Sharp to Blur

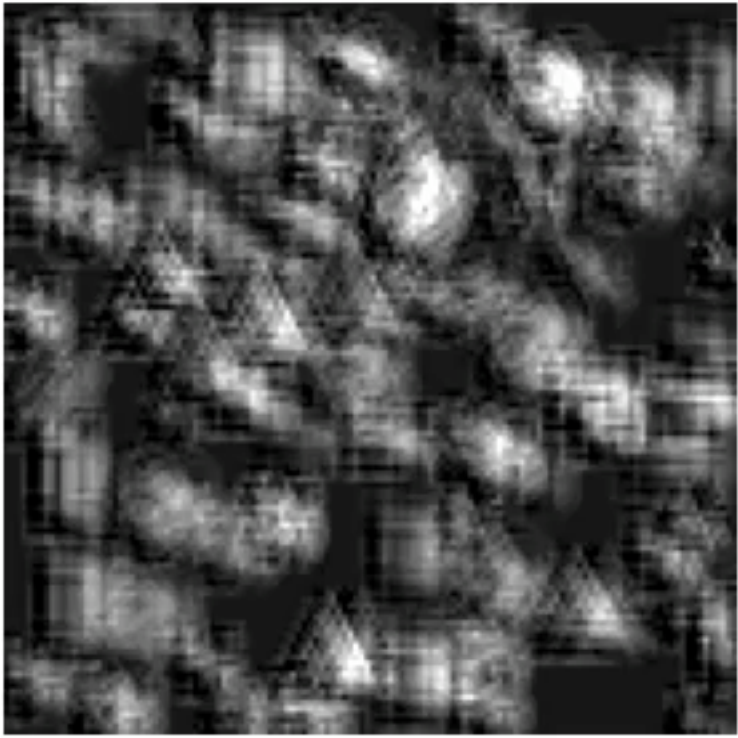
Input



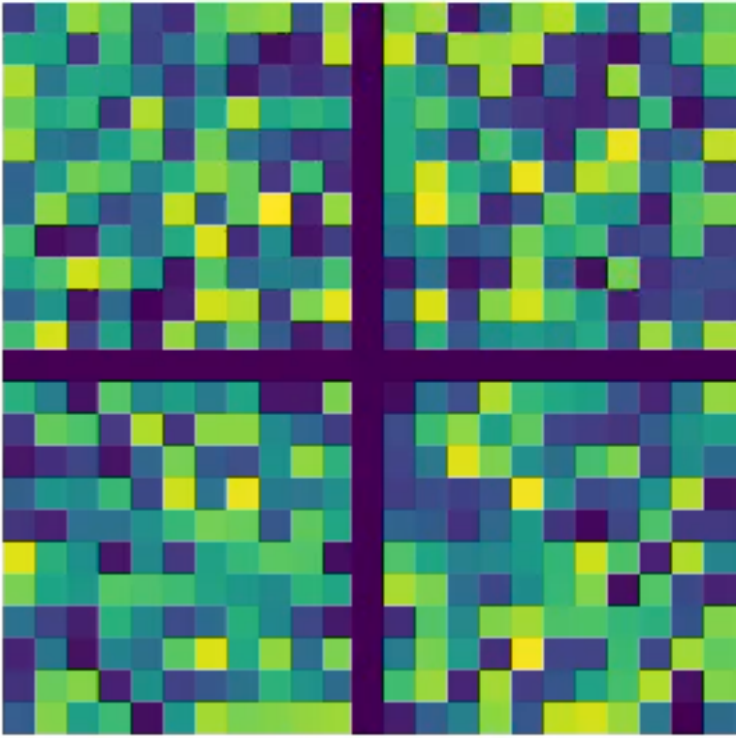
Target



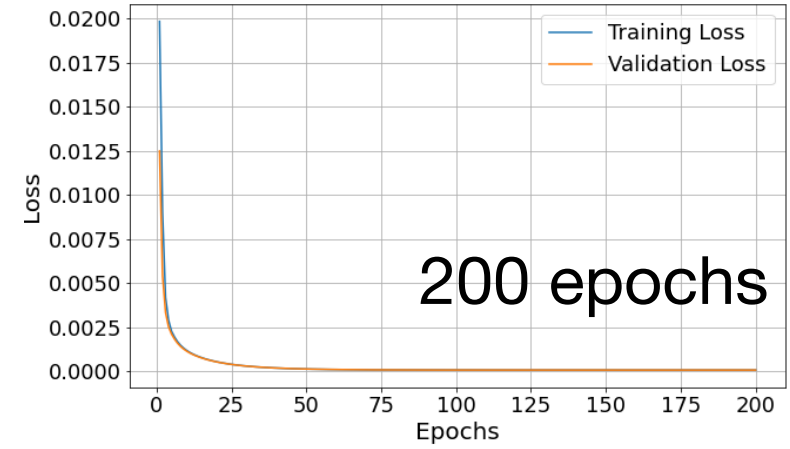
Pred 0.019833



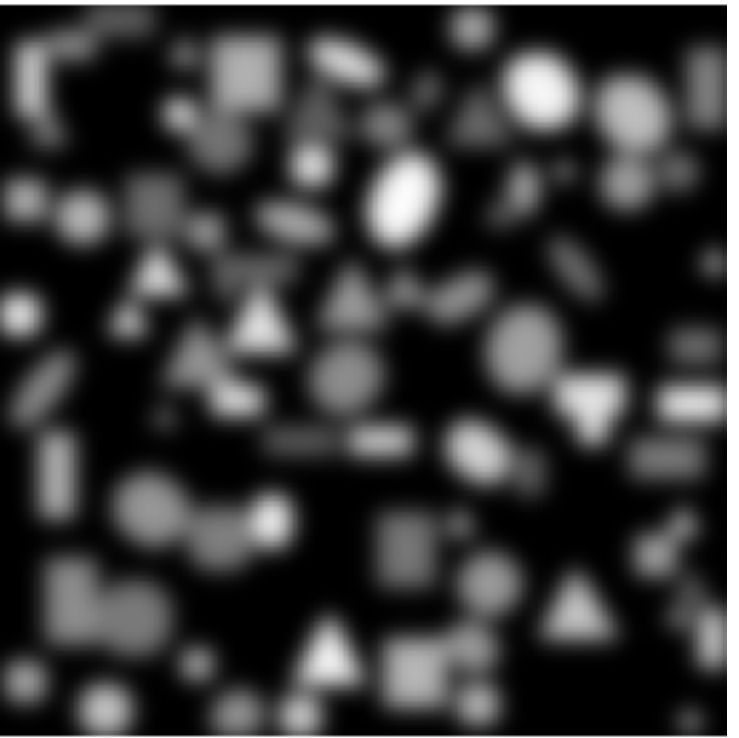
Filters 0



CNN 488 parameters
1 layer, 4 channels, 11x11

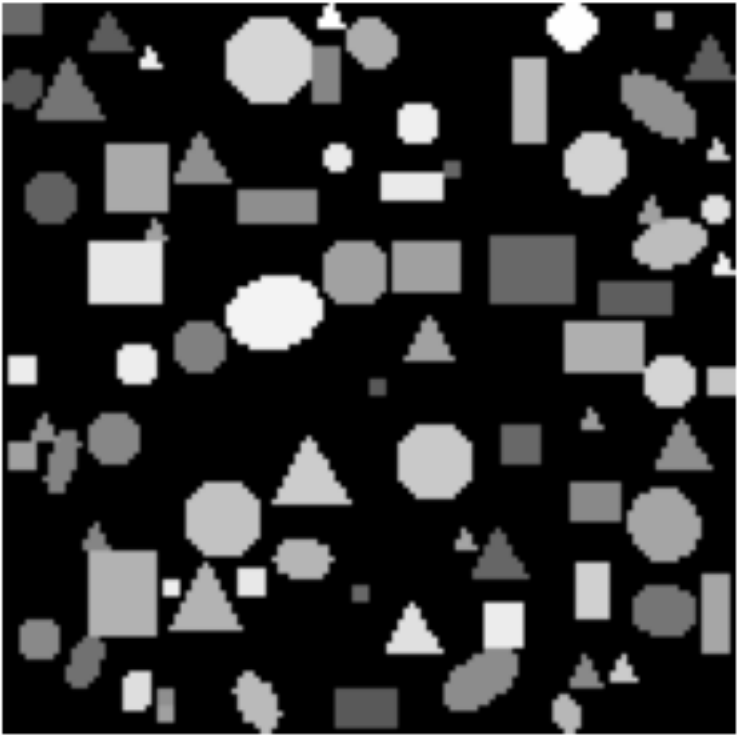


Pred 0.000073

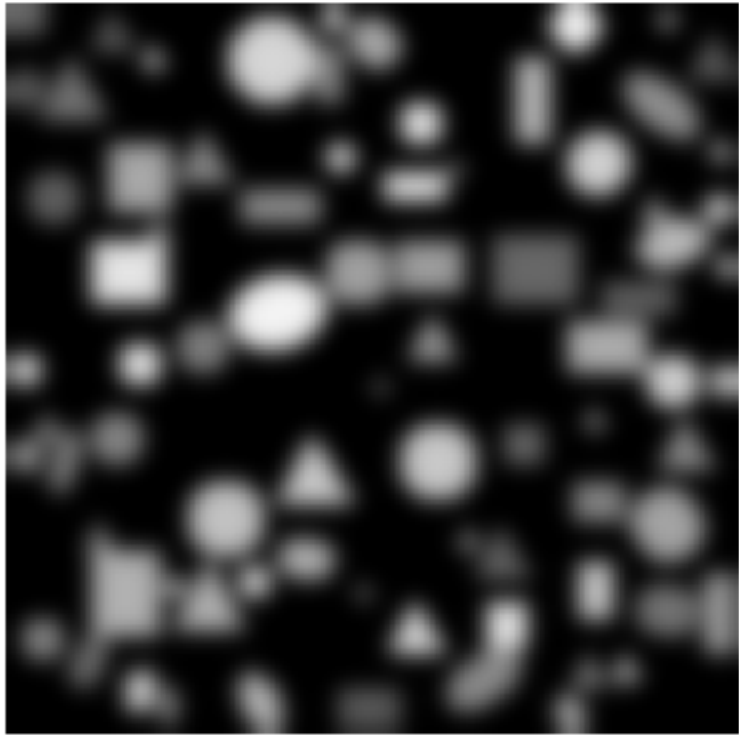


Sharp to Blur

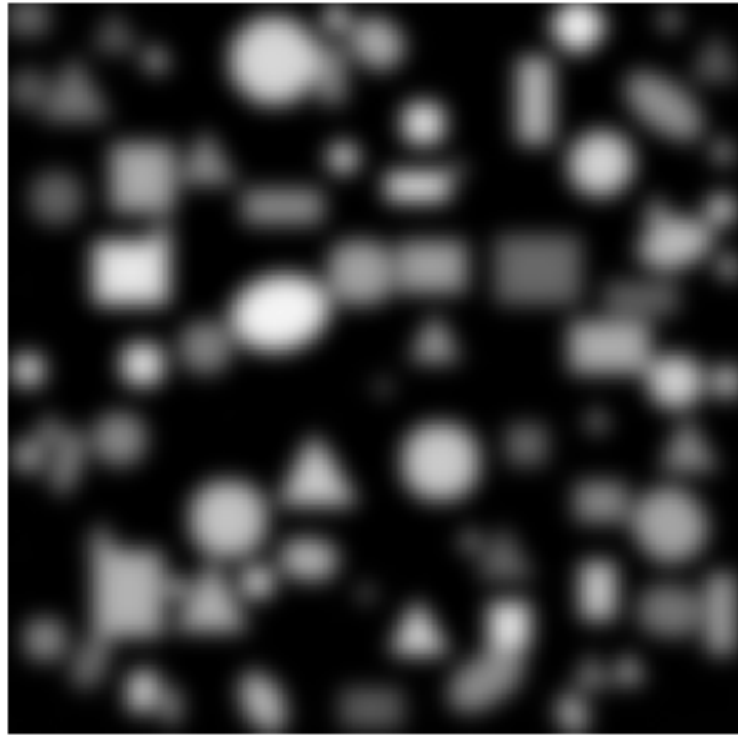
Input



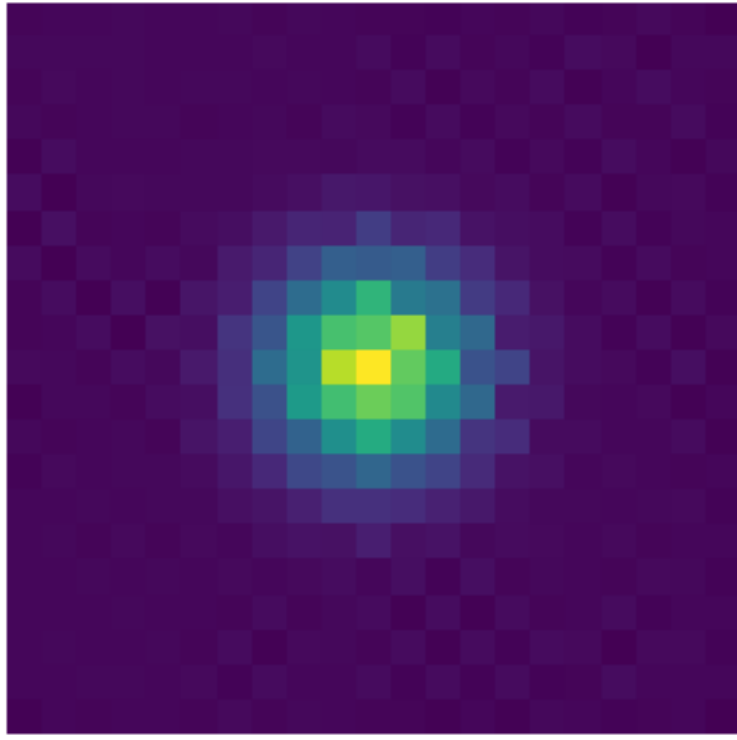
Target



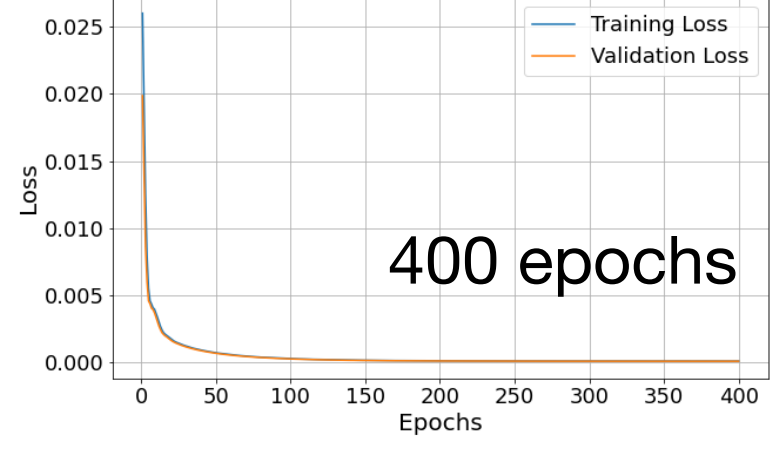
Pred 0.000077



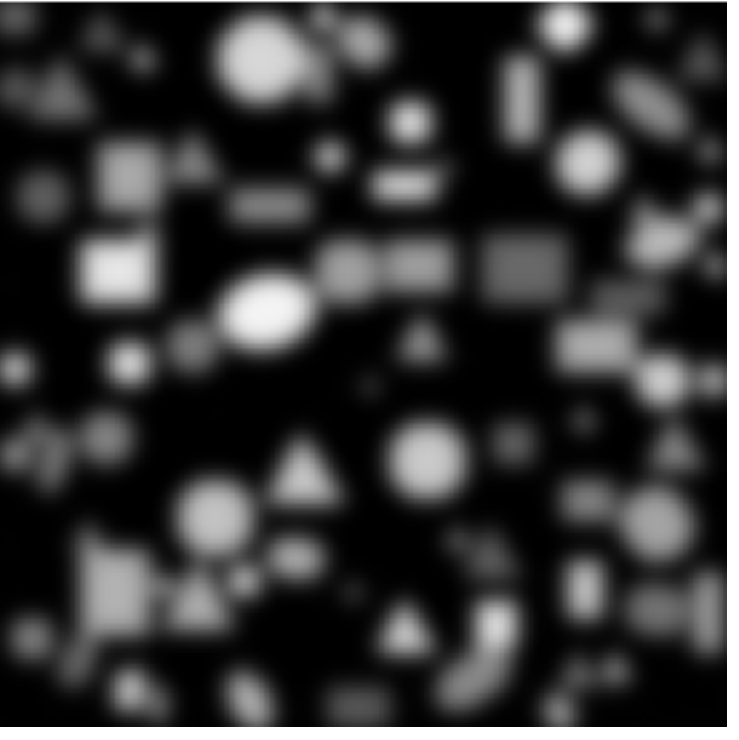
Filters 399



CNN 442 parameters
1 layer, 1 channel, 21x21

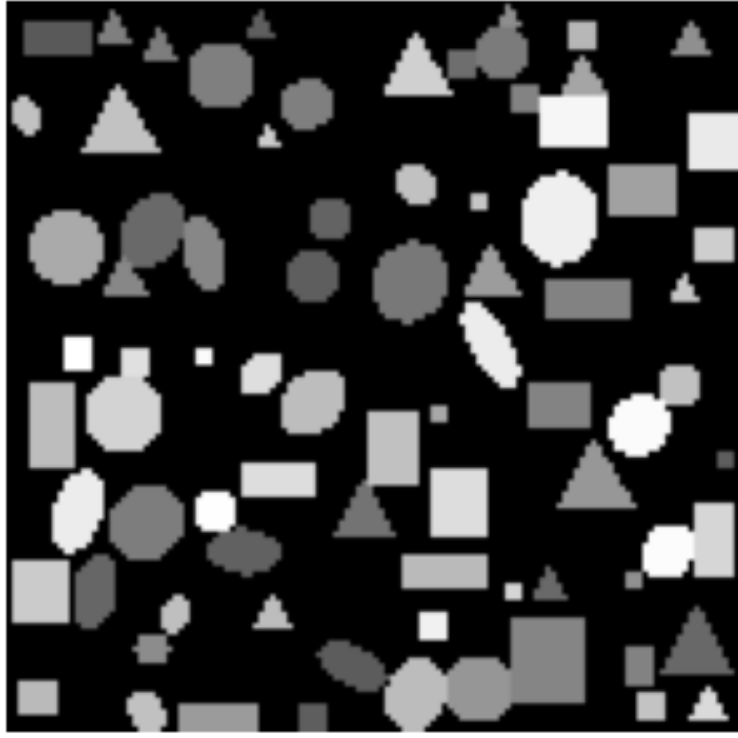


Pred 0.000077

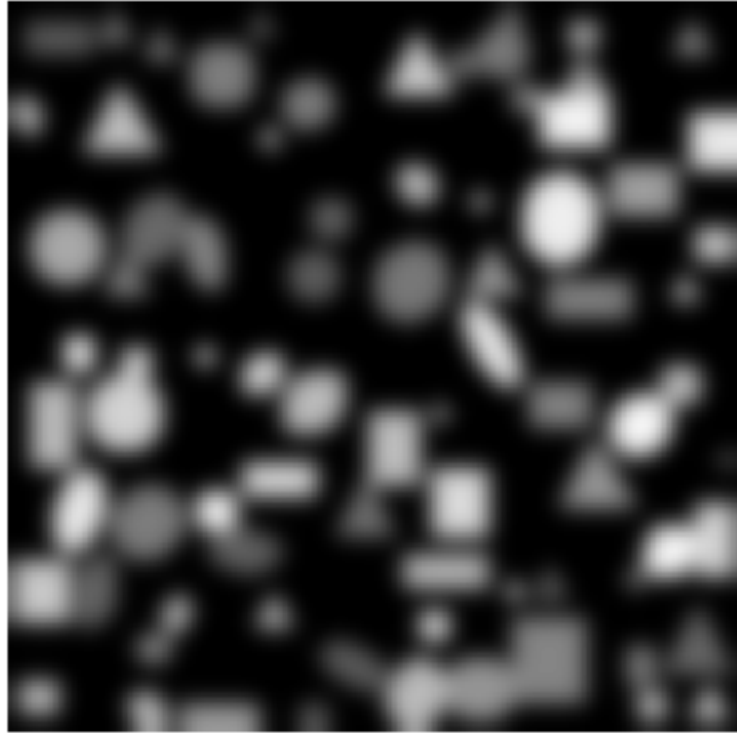


Sharp to Blur

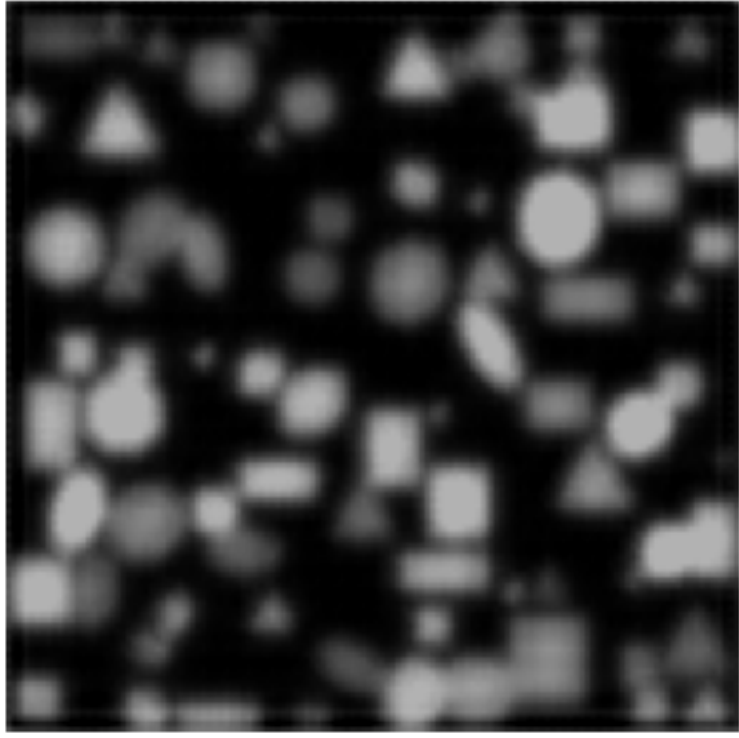
Input



Target



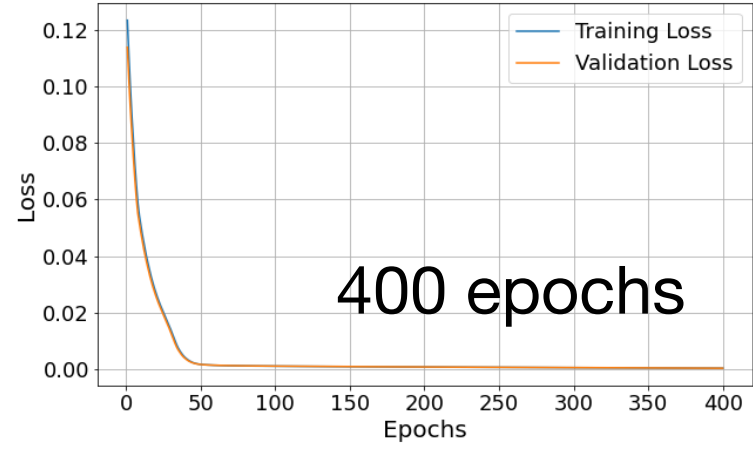
Pred 0.000423



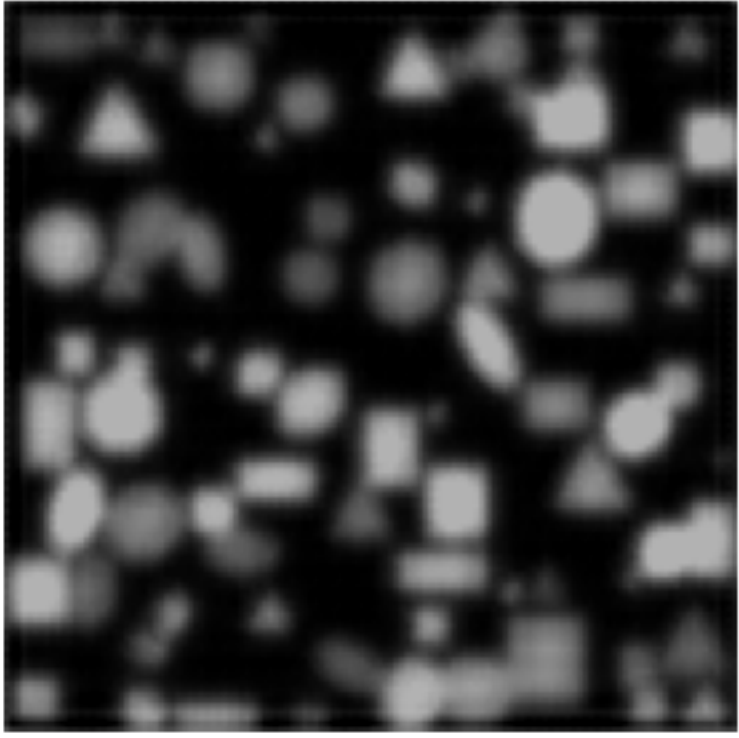
Filters 399



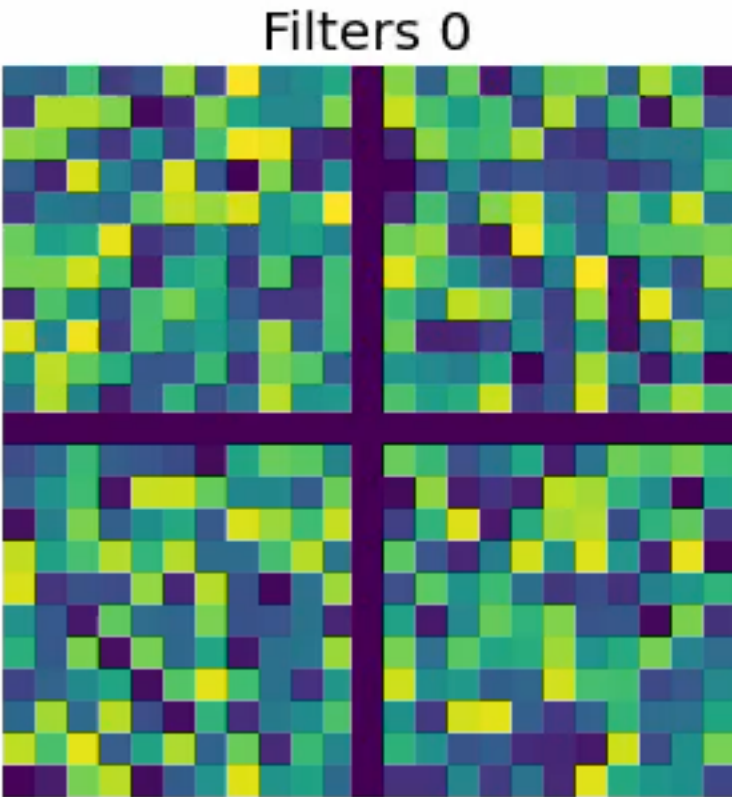
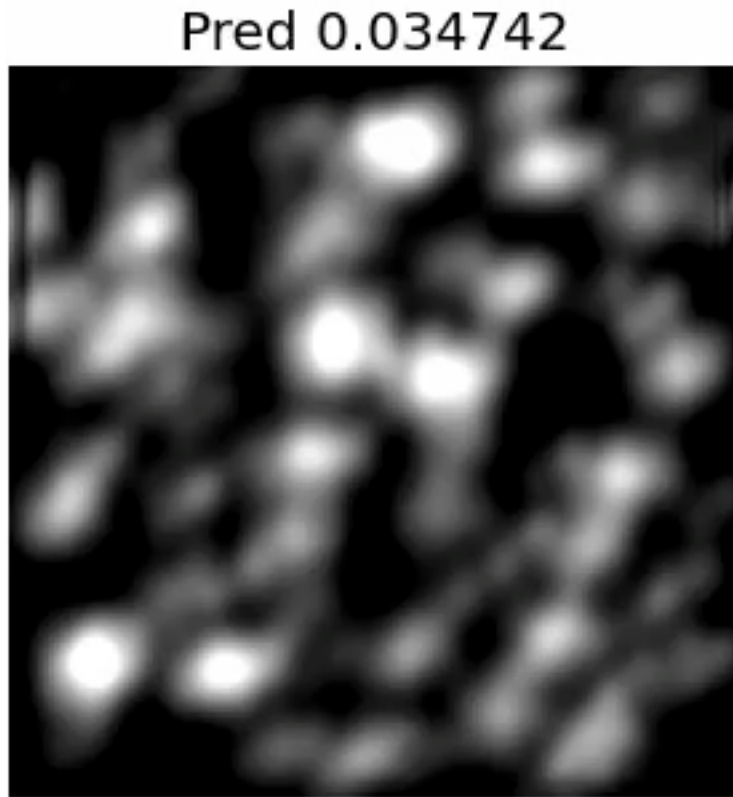
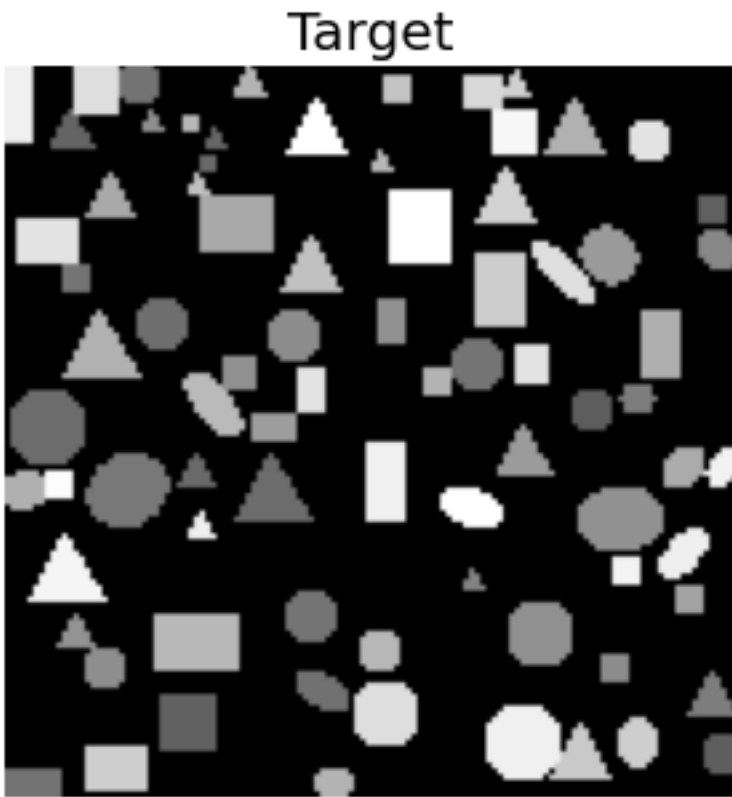
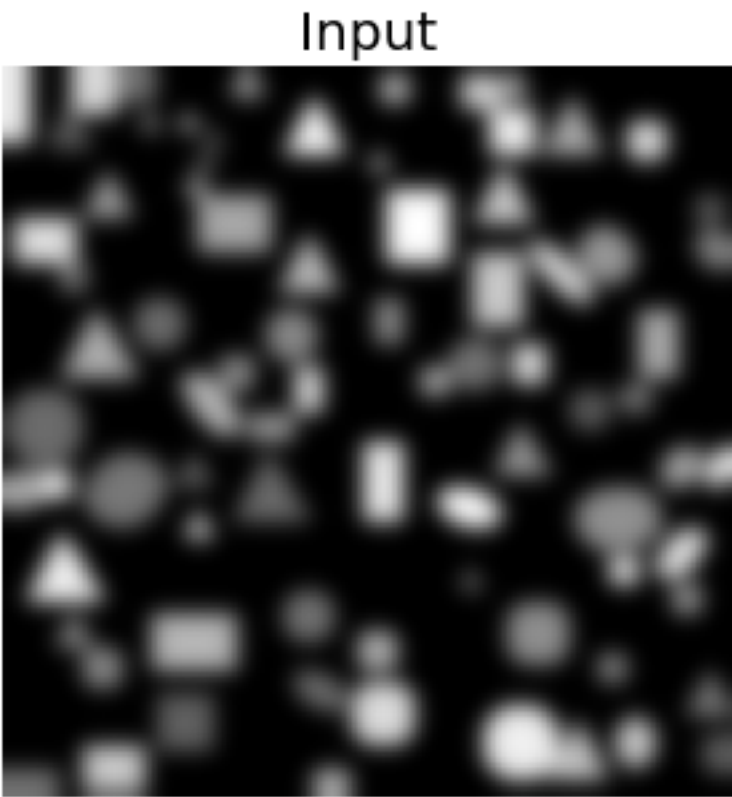
UNet 937 parameters
4 layers, 1 channels, 3x3



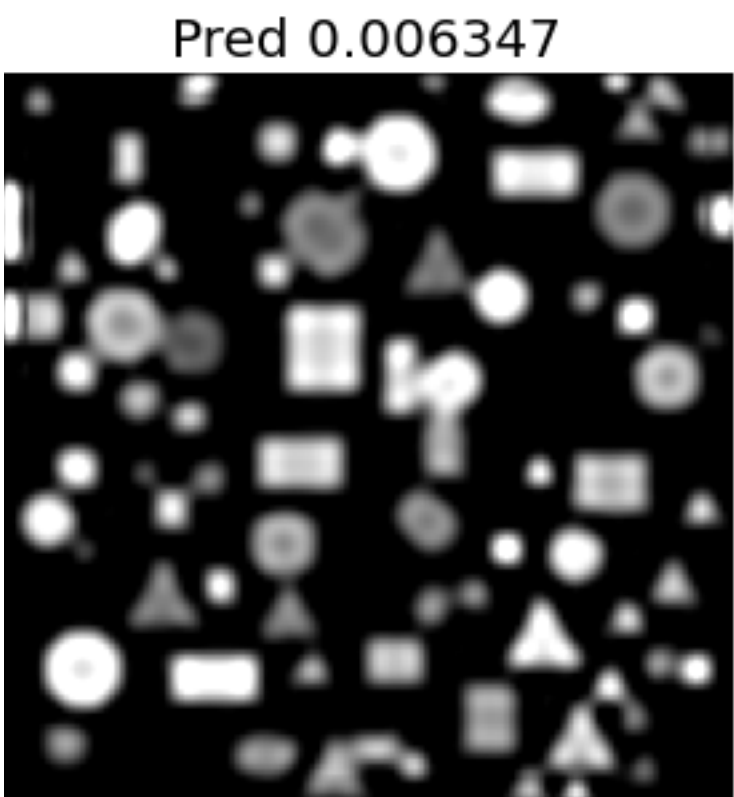
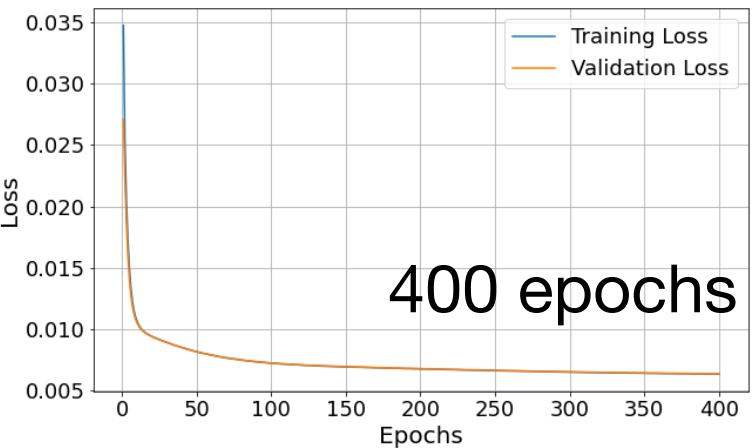
Pred 0.000423



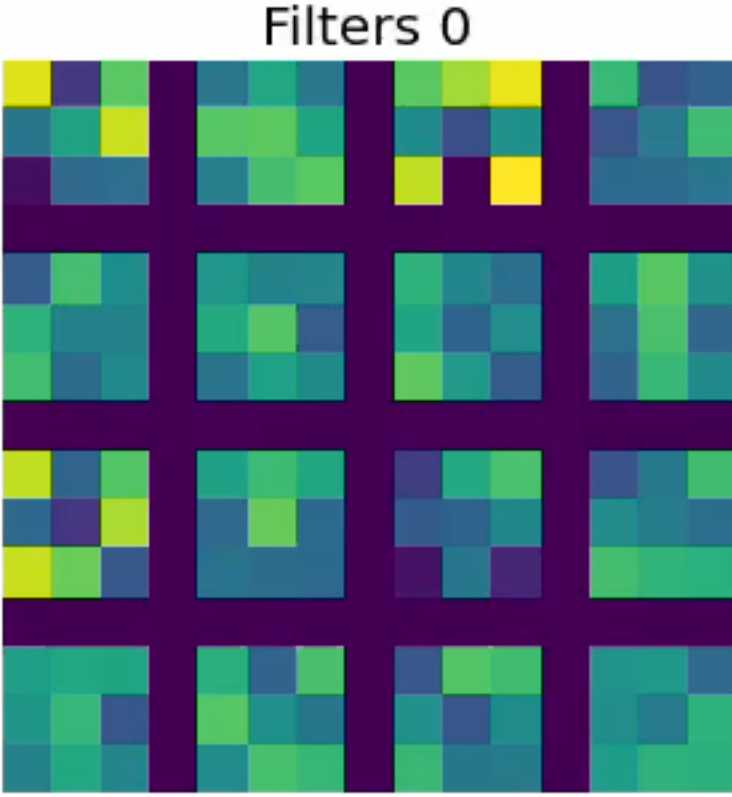
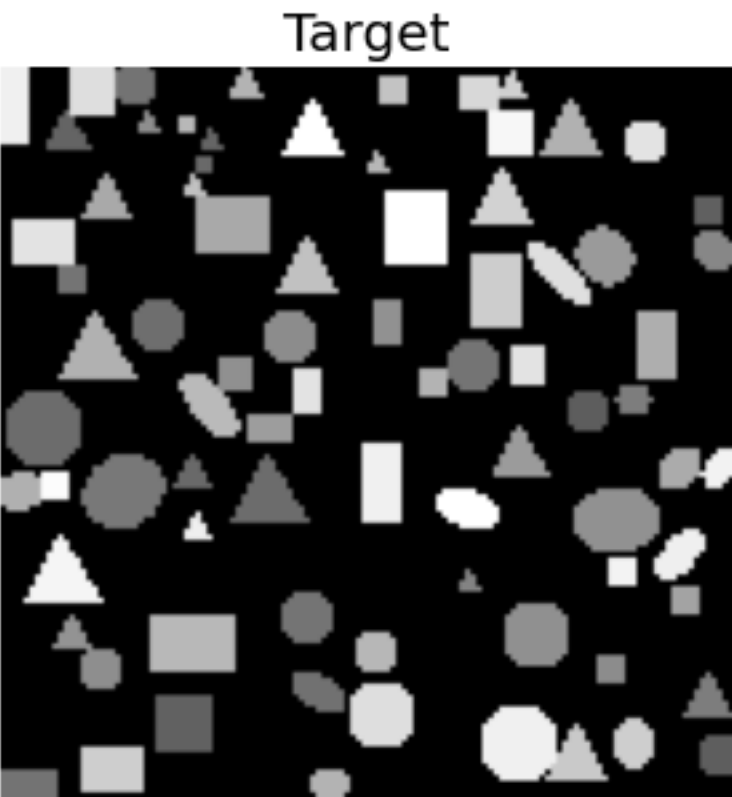
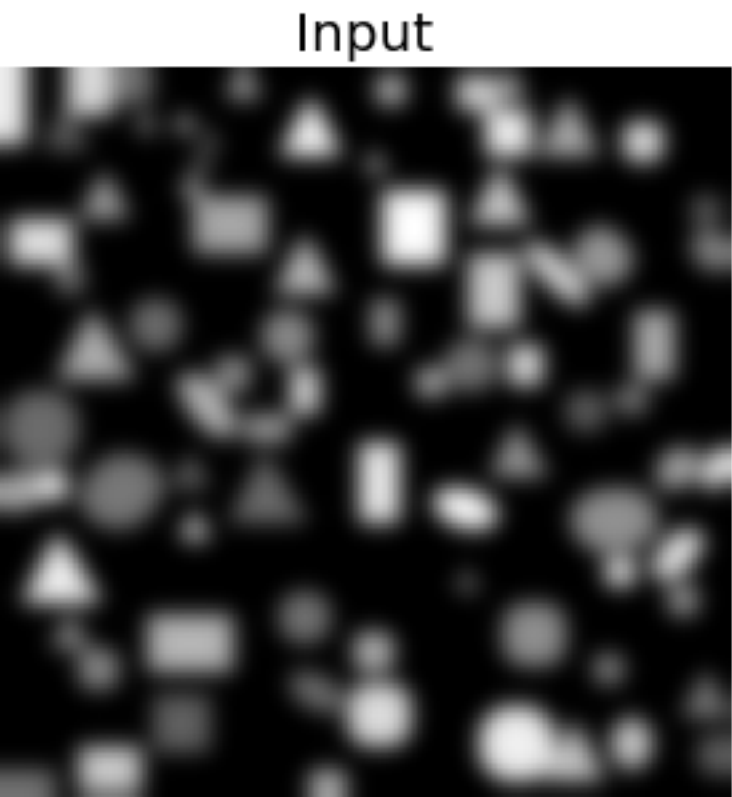
Blur to Shape



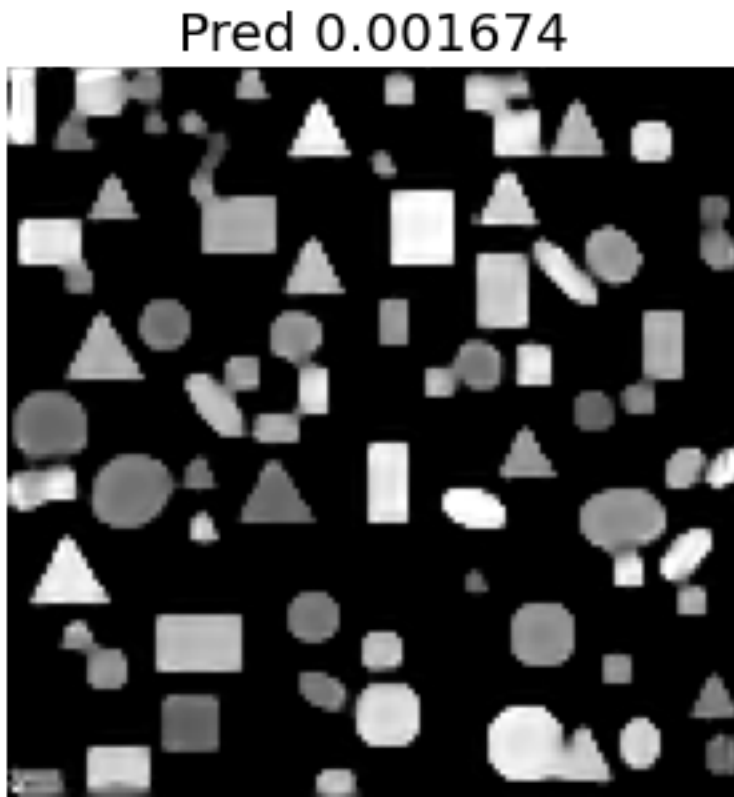
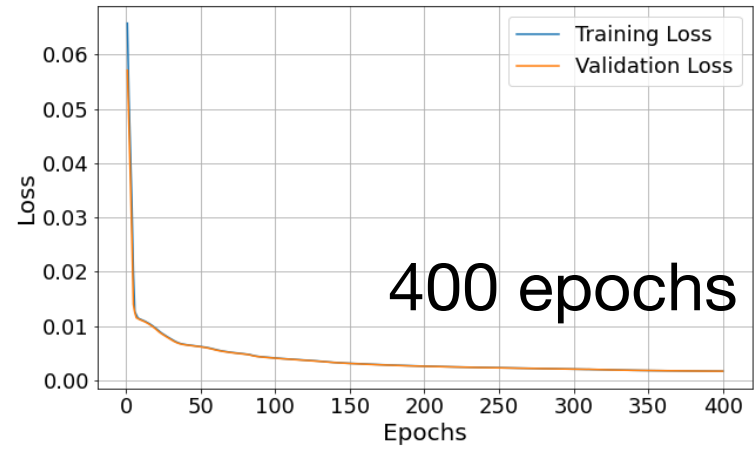
CNN 488 parameters
1 layer, 4 channels, 11x11



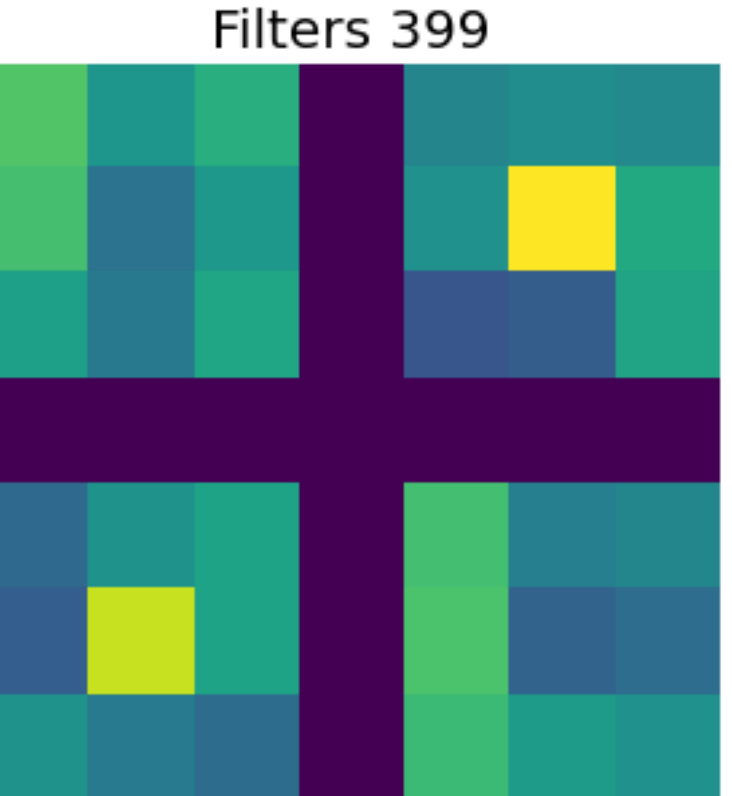
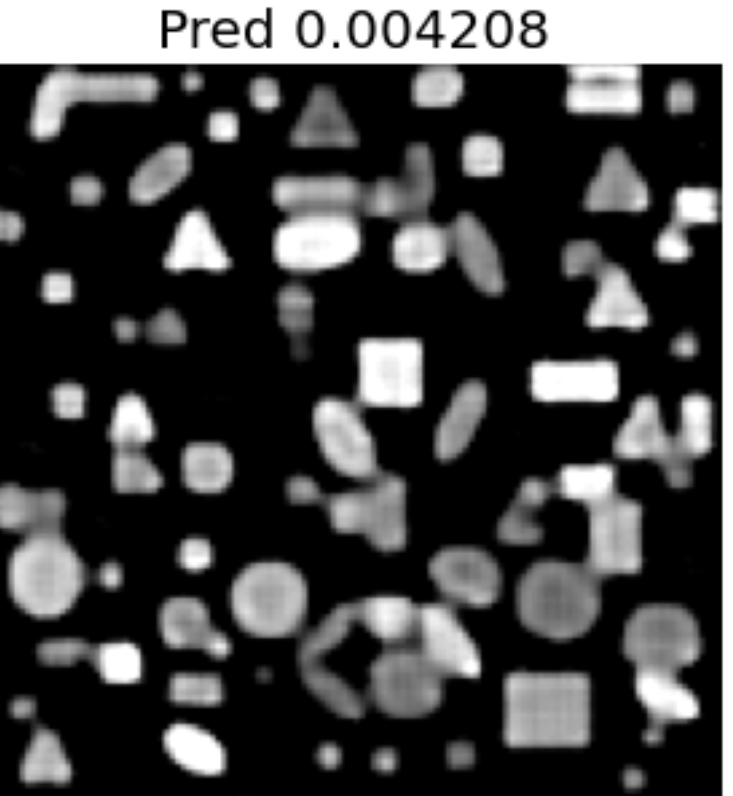
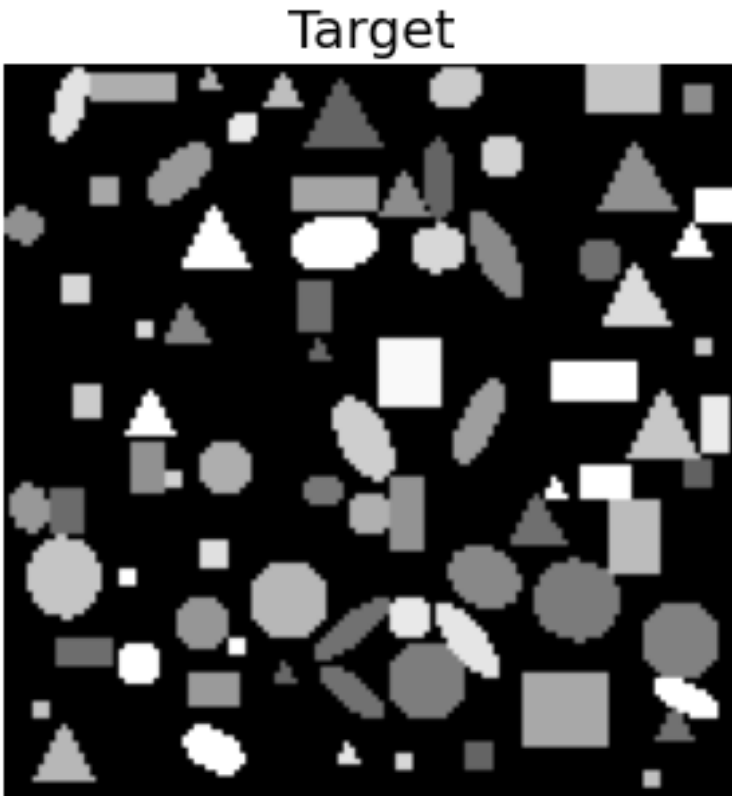
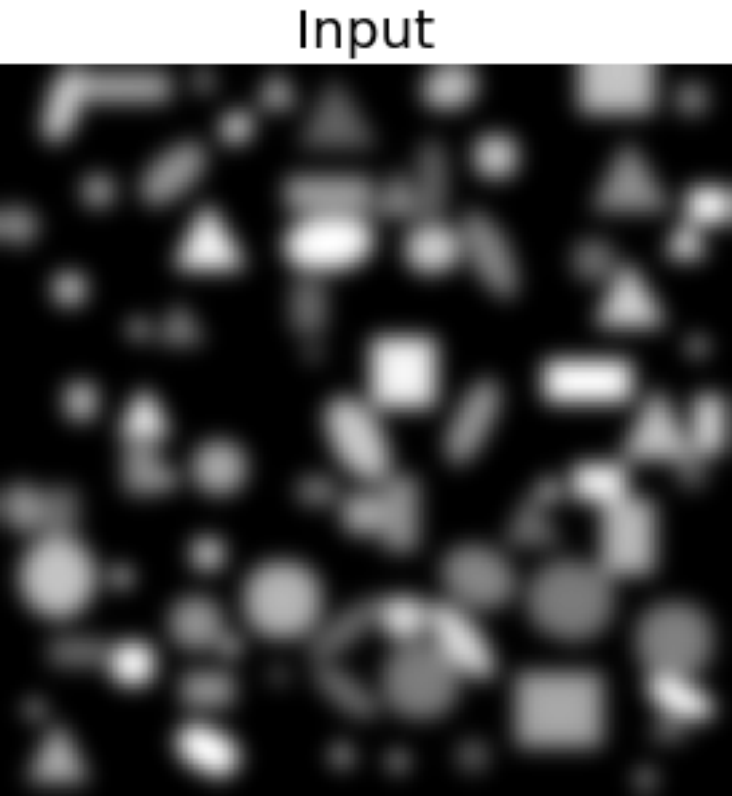
Blur to Shape



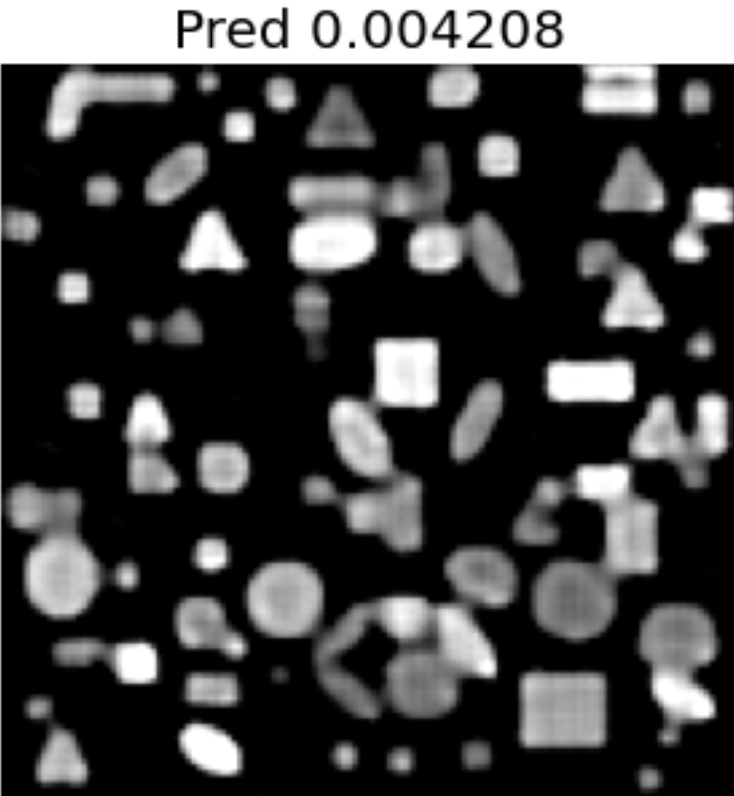
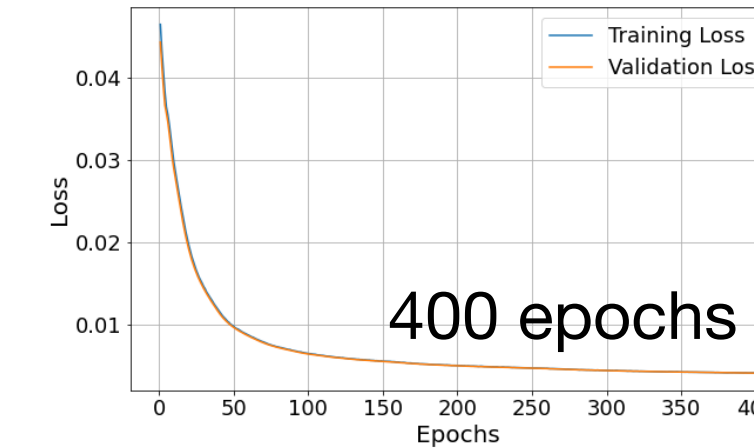
CNN 489 parameters
4 layers, 4 channels, 3x3



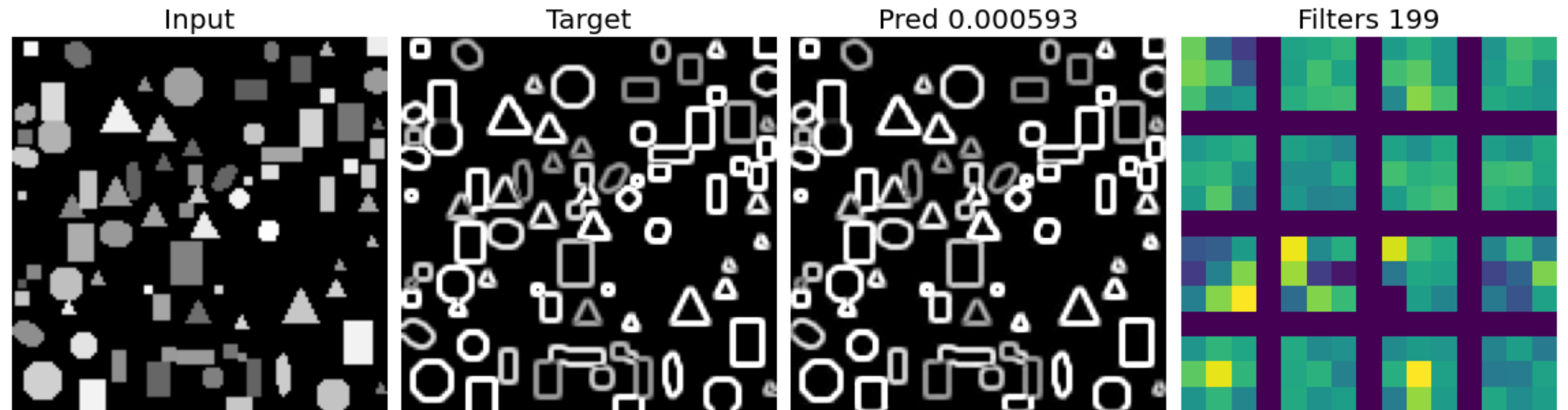
Blur to Shape



UNet 937 parameters
4 layers, 1 channels, 3x3



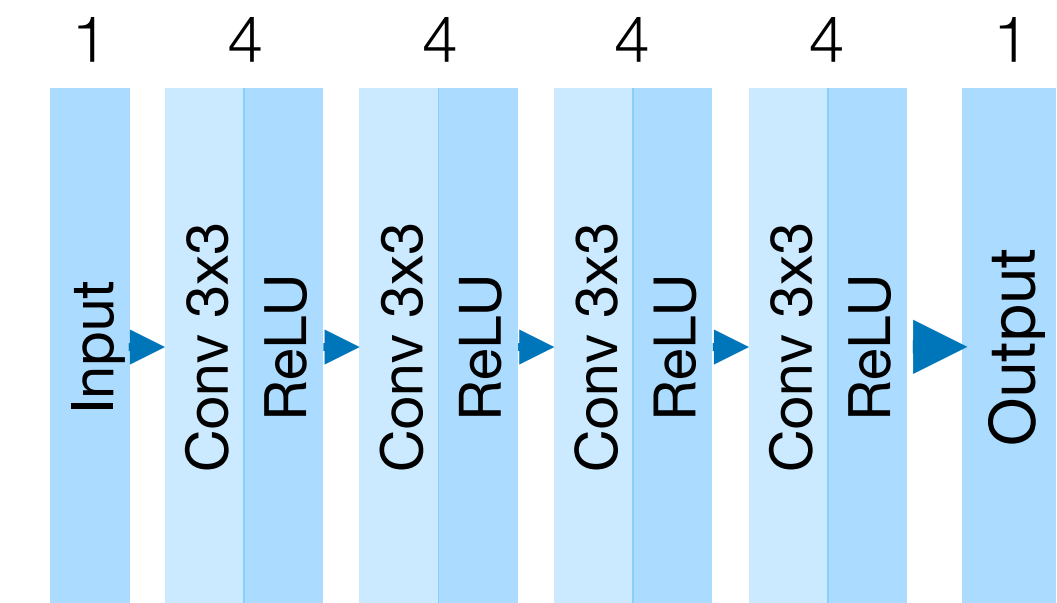
Sharp to Edge



```
class SimpleCNN_4L4C(nn.Module):
```

```
    def __init__(self):
        size = 3
        self.name = f'4L-4x{kernel_size}x{kernel_size}'
        super(SimpleCNN_4L4C, self).__init__()
        self.layer1 = nn.Conv2d(in_channels=1, out_channels=4, kernel_size=size)
        self.relu1 = nn.ReLU()
        self.layer2 = nn.Conv2d(in_channels=4, out_channels=4, kernel_size=size)
        self.relu2 = nn.ReLU()
        self.layer3 = nn.Conv2d(in_channels=4, out_channels=4, kernel_size=size)
        self.relu3 = nn.ReLU()
        self.layer4 = nn.Conv2d(in_channels=4, out_channels=4, kernel_size=size)
        self.relu4 = nn.ReLU()
        self.output_layer = nn.Conv2d(in_channels=4, out_channels=1, kernel_size=1)
```

```
    def forward(self, x):
        x = self.layer1(x)
        x = self.relu1(x)
        x = self.layer2(x)
        x = self.relu2(x)
        x = self.layer3(x)
        x = self.relu3(x)
        x = self.layer4(x)
        x = self.relu4(x)
        x = self.output_layer(x)
        return x
```



CNN 489 parameters