

Intro

- In this video we will take a quick look at other computer vision problems that utilize convolutional networks

Other computer vision tasks

We've examined image classification task

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We've examined image classification task

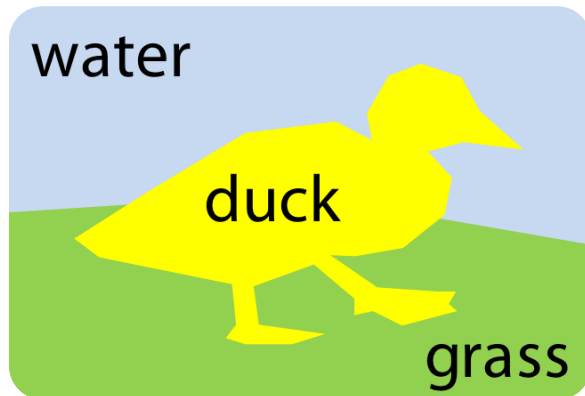
Semantic segmentation:



Other computer vision tasks

We've examined image classification task

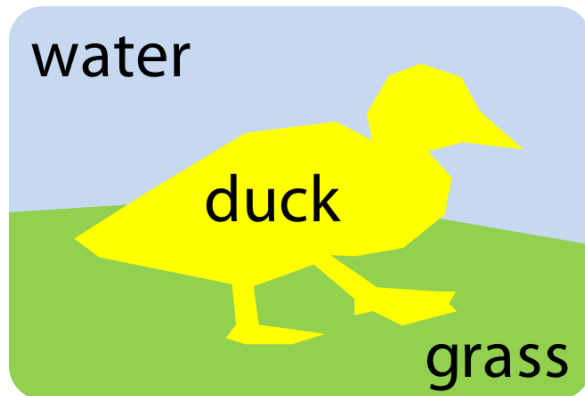
Semantic segmentation:



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Semantic segmentation:



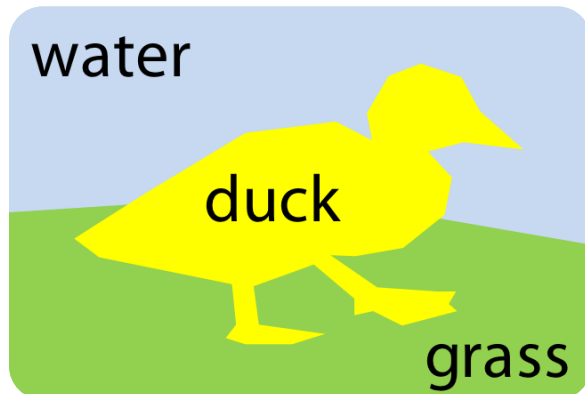
Object classification
+ localization:



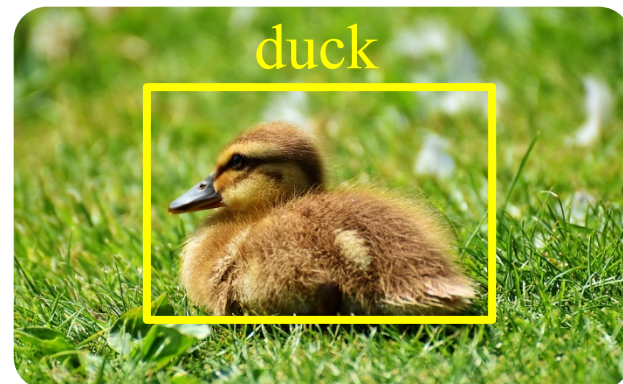
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Semantic segmentation:



Object classification
+ localization:



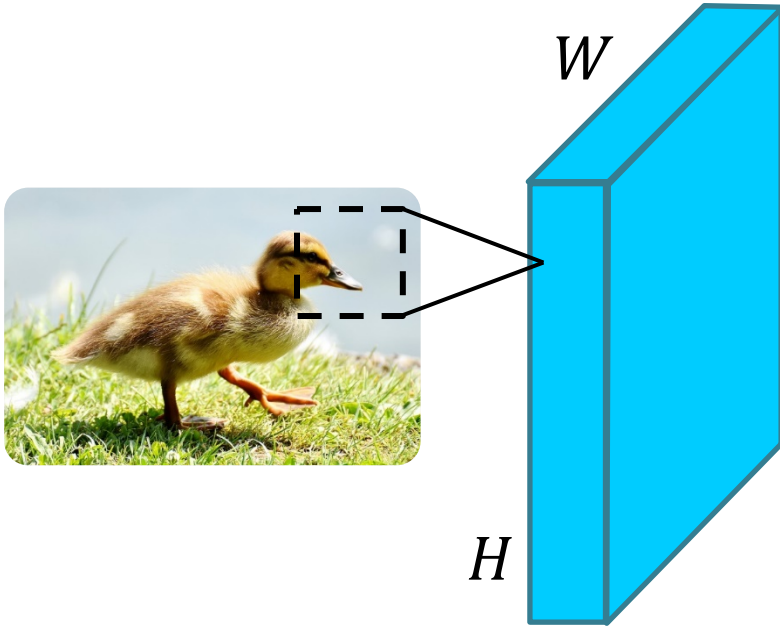
Semantic segmentation

We need to classify each pixel



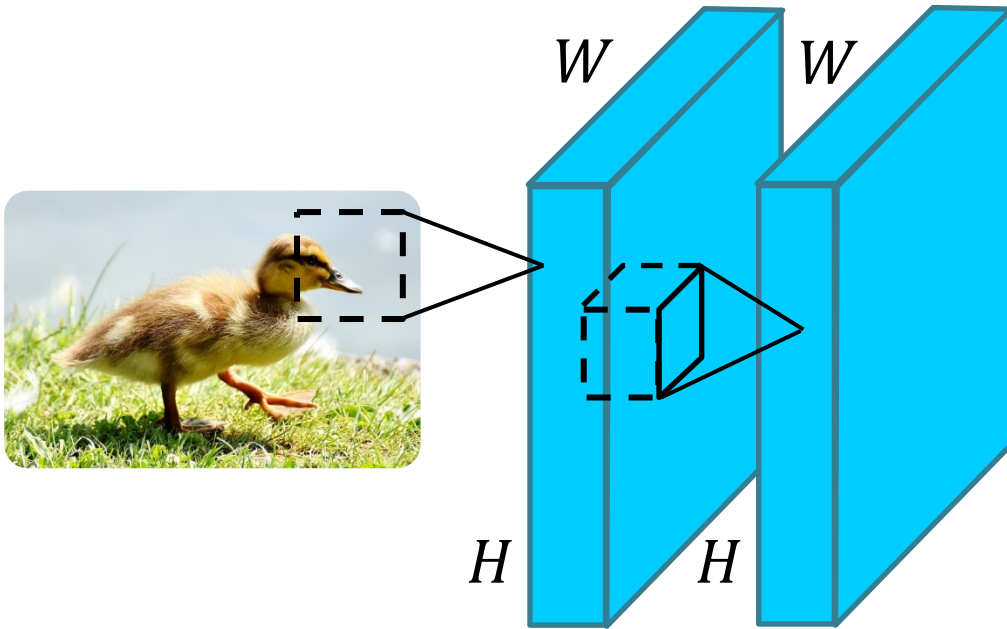
Semantic segmentation

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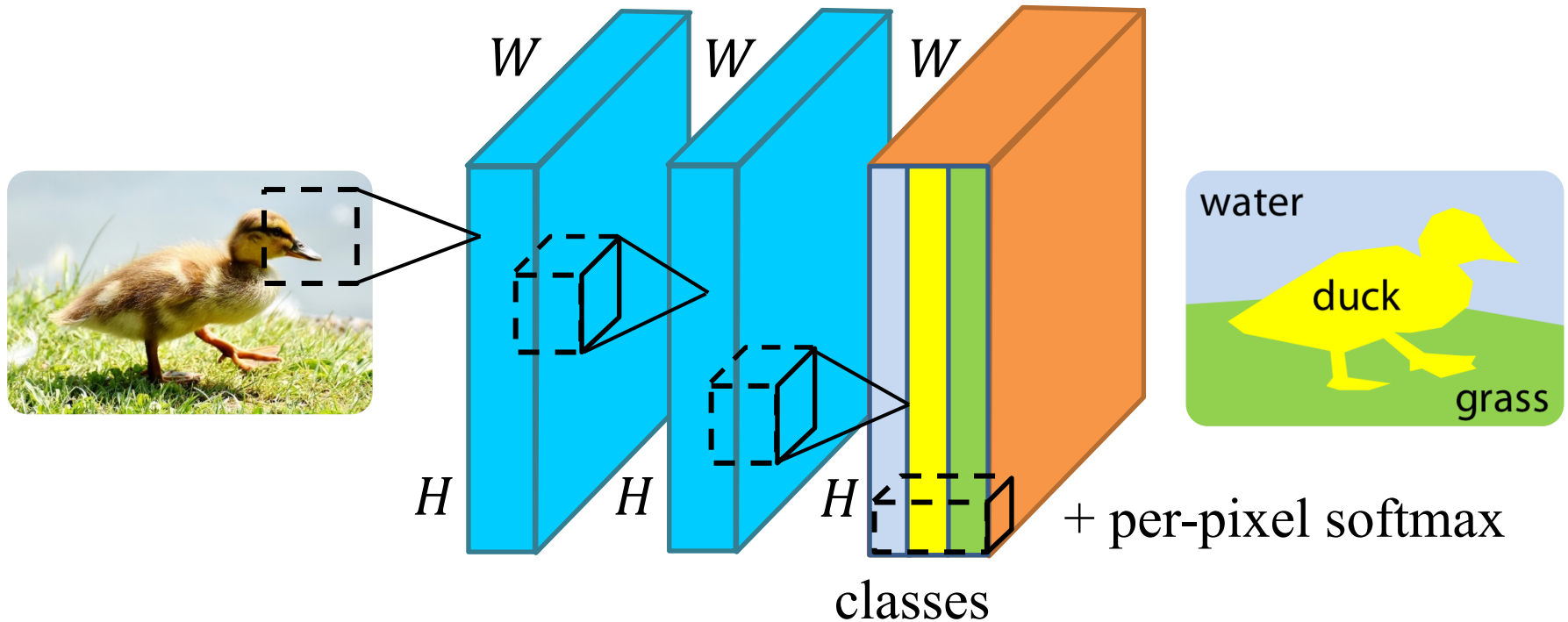
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Semantic segmentation

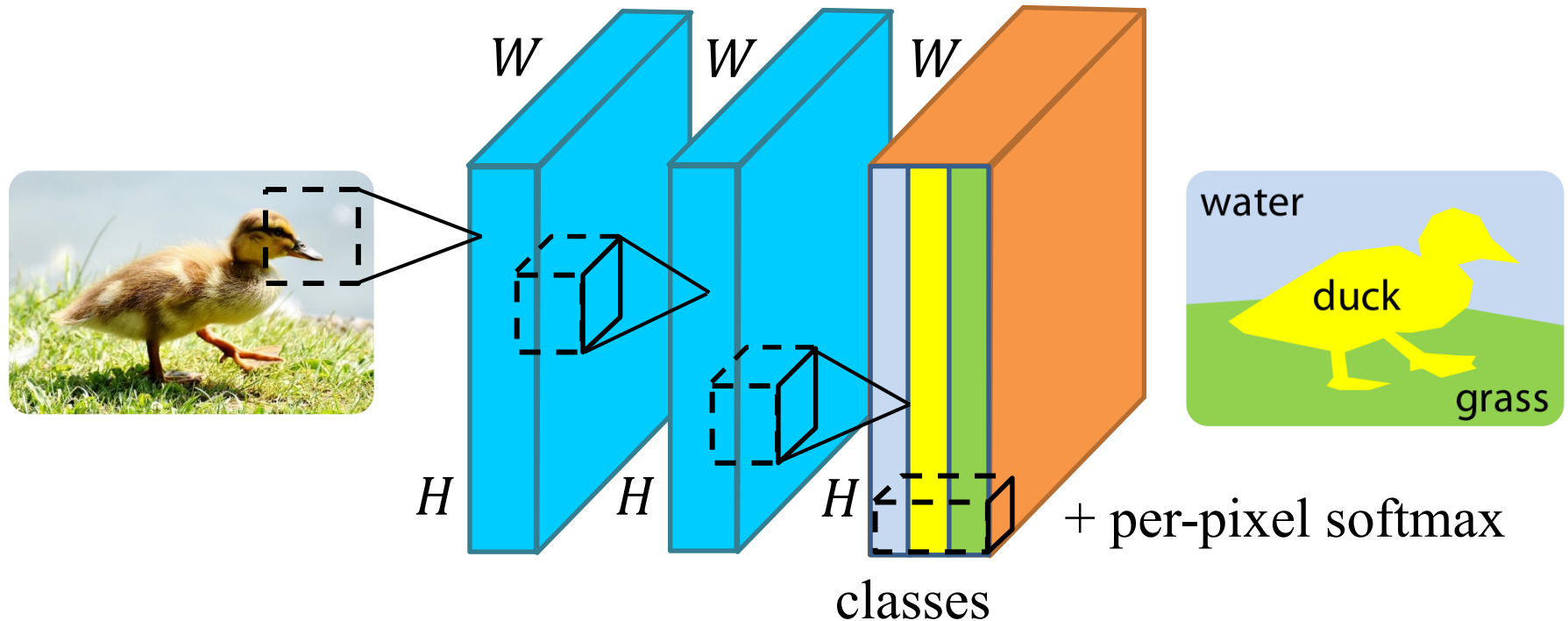
We need to classify each pixel



Naïve approach: stack convolutional layers
and add per-pixel softmax

Semantic segmentation

We need to classify each pixel

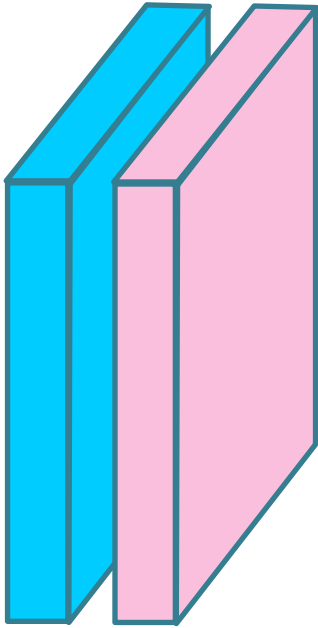


Naïve approach: stack convolutional layers
and add per-pixel softmax

We go deep but don't add pooling, too expensive

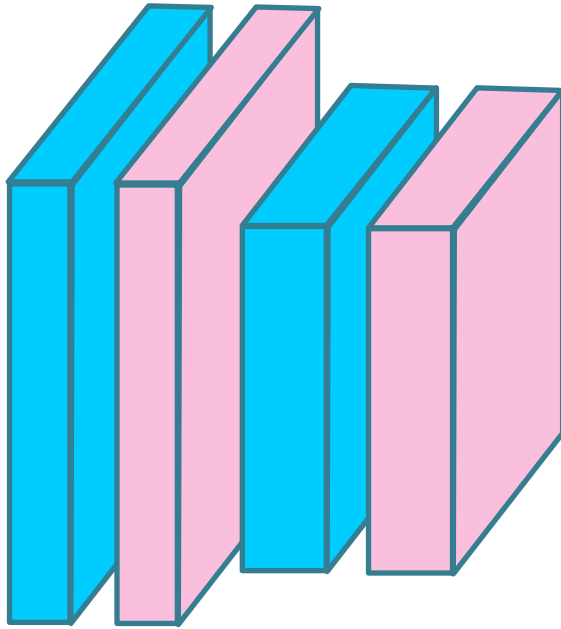
Semantic segmentation

Let's add pooling, which acts like **down-sampling**



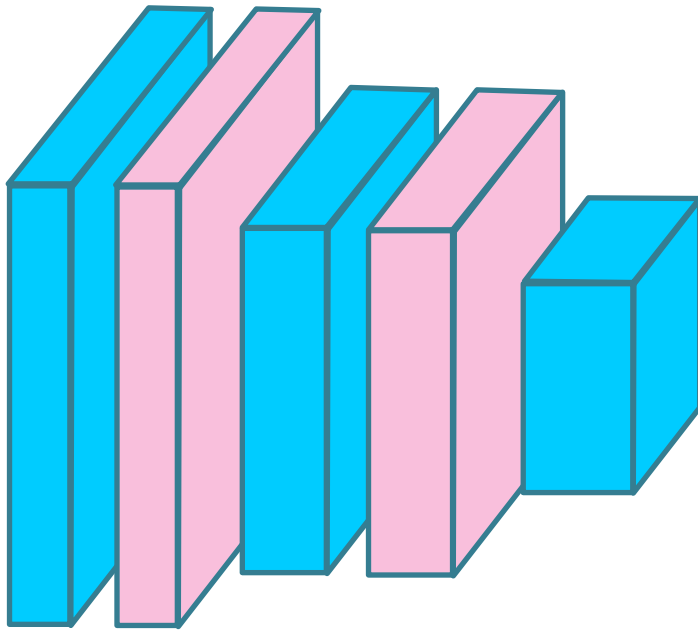
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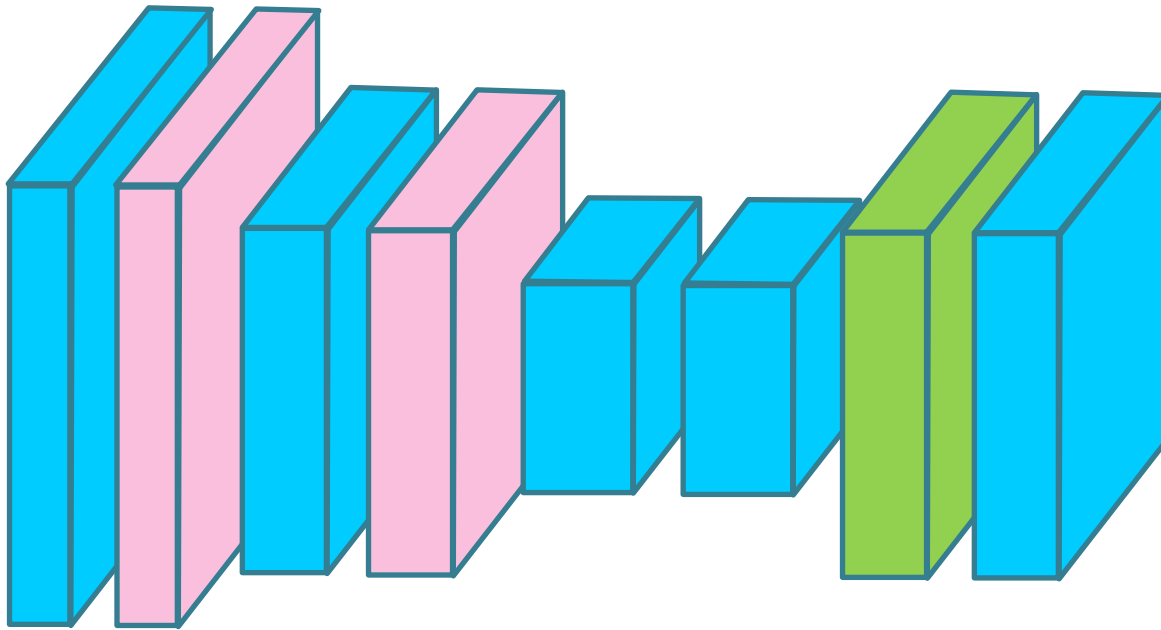


Wait a second!
We need to classify
each pixel!

Need to do **unpooling**!

Semantic segmentation

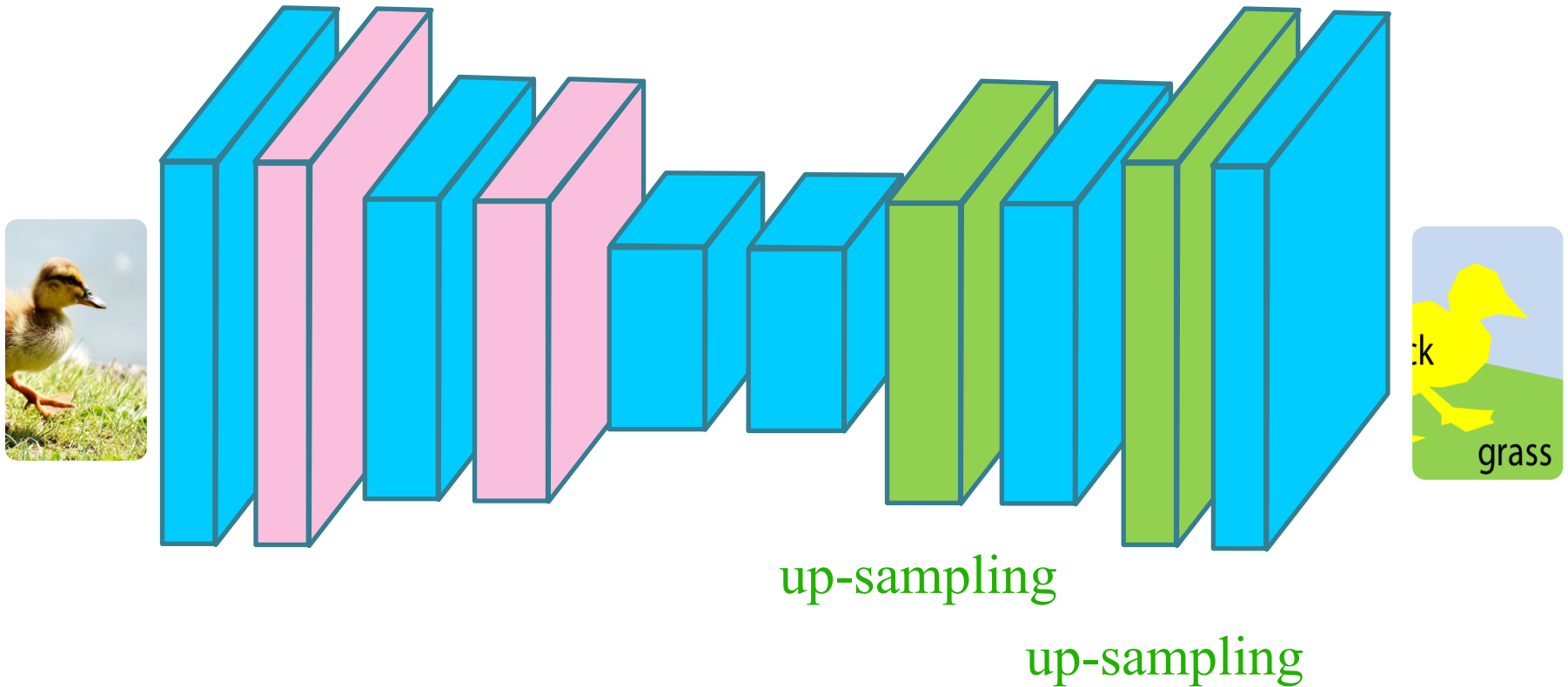
Let's add pooling, which acts like **down-sampling**



up-sampling

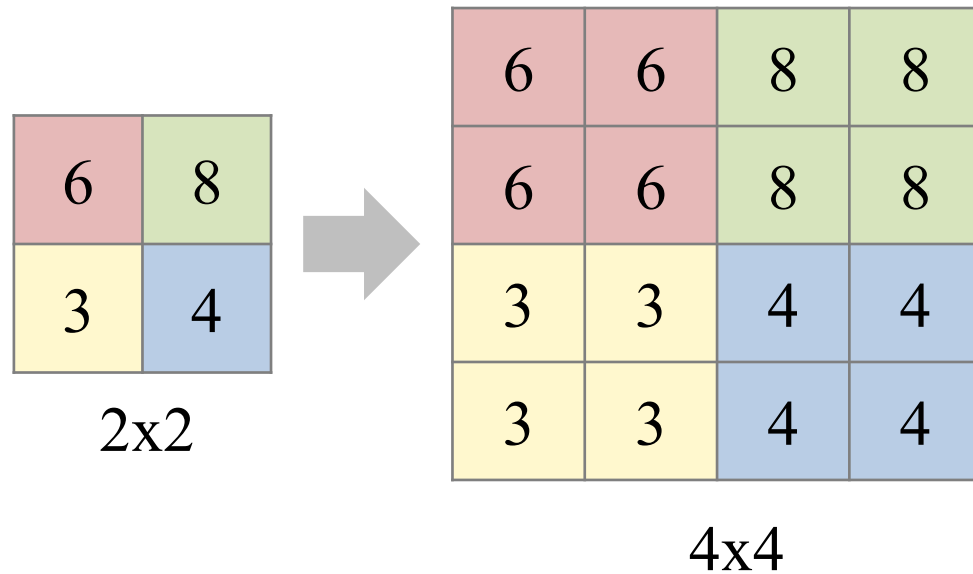
Semantic segmentation

Let's add pooling, which acts like **down-sampling**



Nearest neighbor unpooling

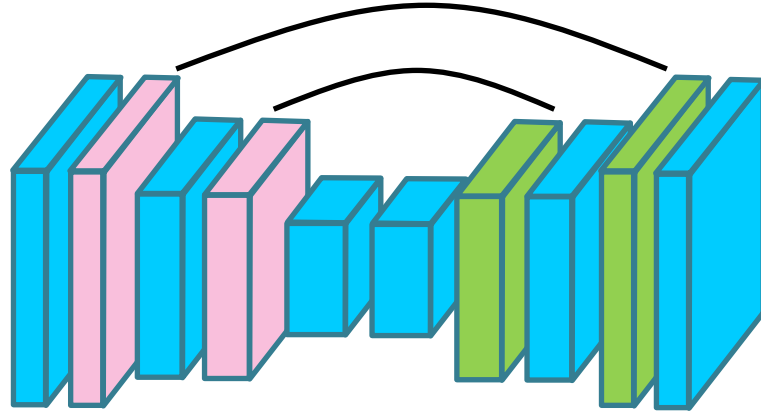
Fill with nearest neighbor values



Pixelated and not crisp!

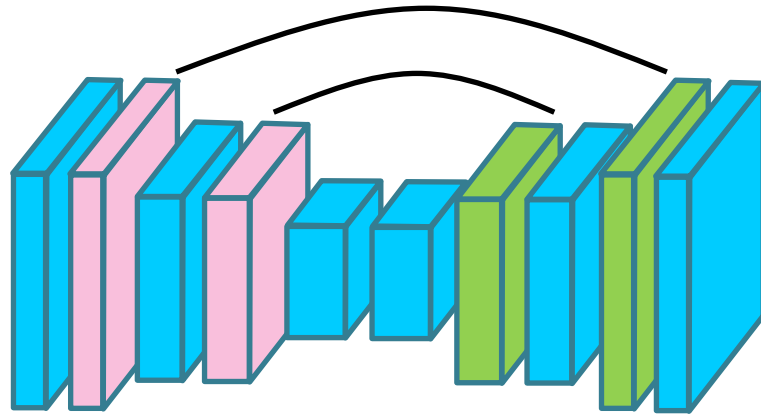
Max unpooling

Corresponding pairs of
downsampling and
upsampling layers

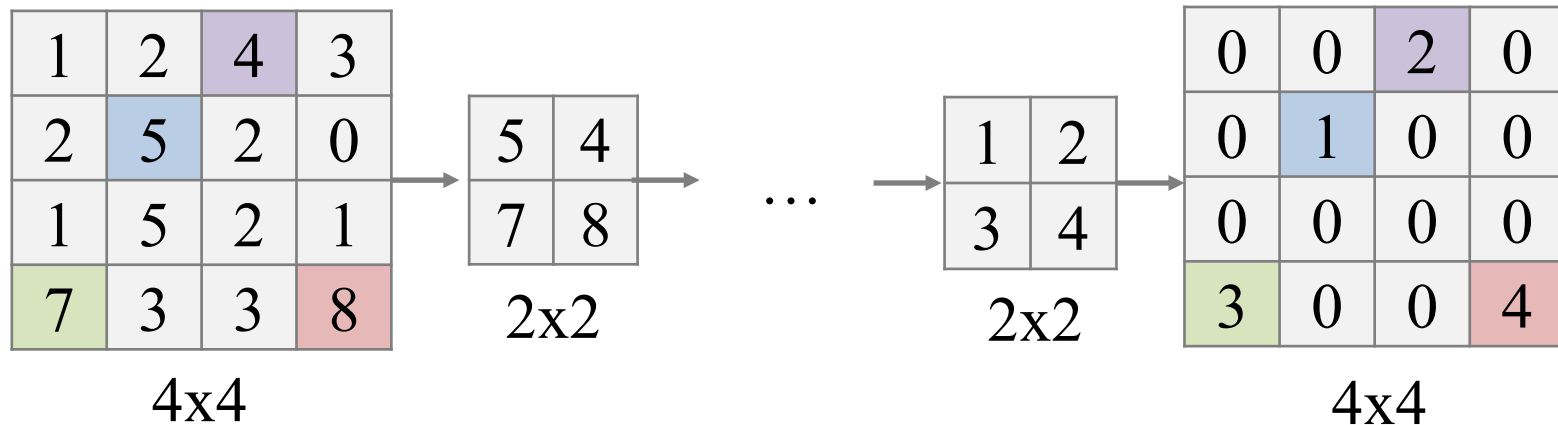


Max unpooling

Corresponding pairs of
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upsampling layers



Remember which element was max during pooling, and fill that position during unpooling:



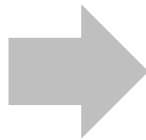
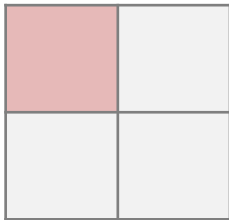
Learnable unpooling

- Previous approaches are not data-driven!
- We can replace max pooling layer with convolutional layer that has a bigger stride!
- What if we can apply convolutions to do unpooling?

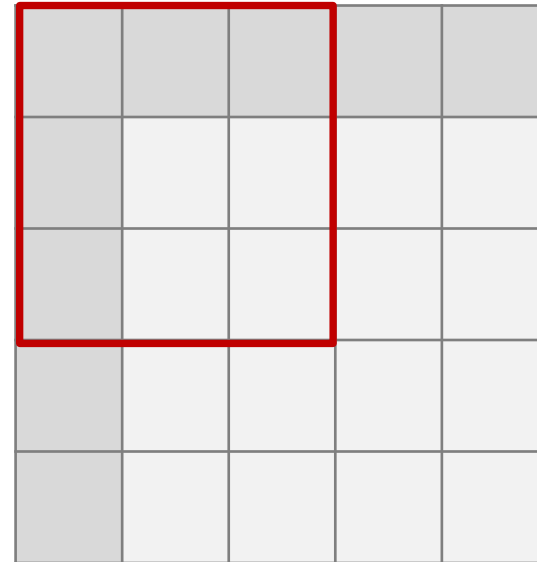
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Input: 2x2



Input gives
weight for
filter

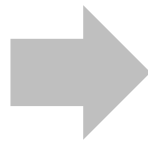
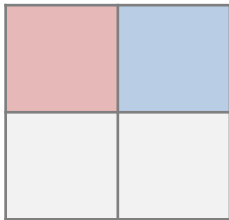


Output: 4x4

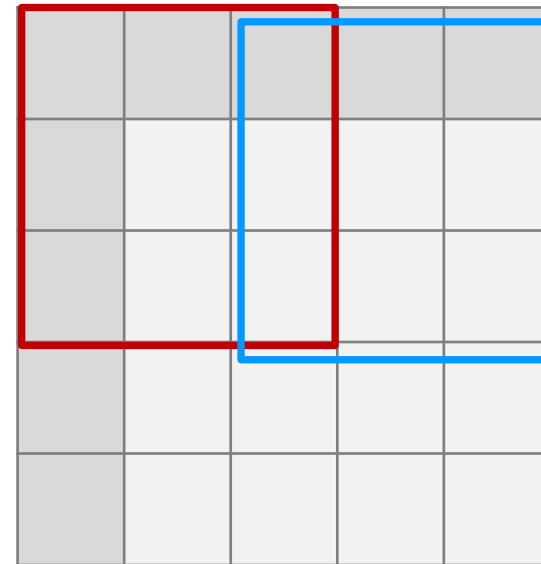
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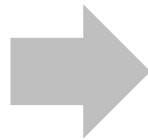
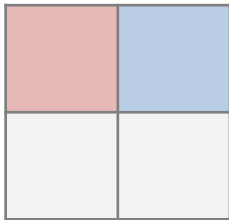
Stride: 2

Output: 4x4

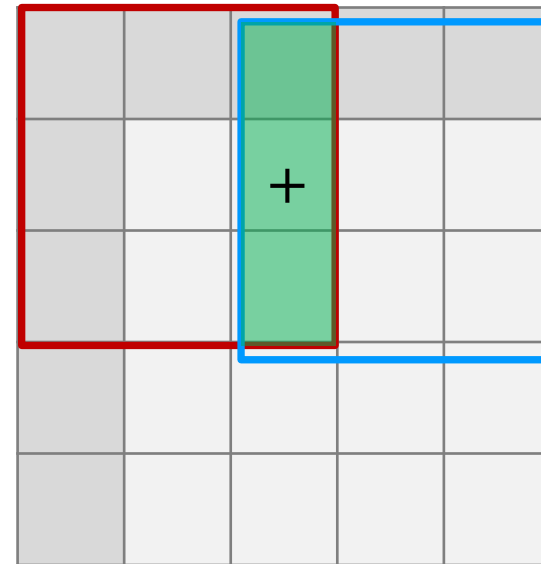
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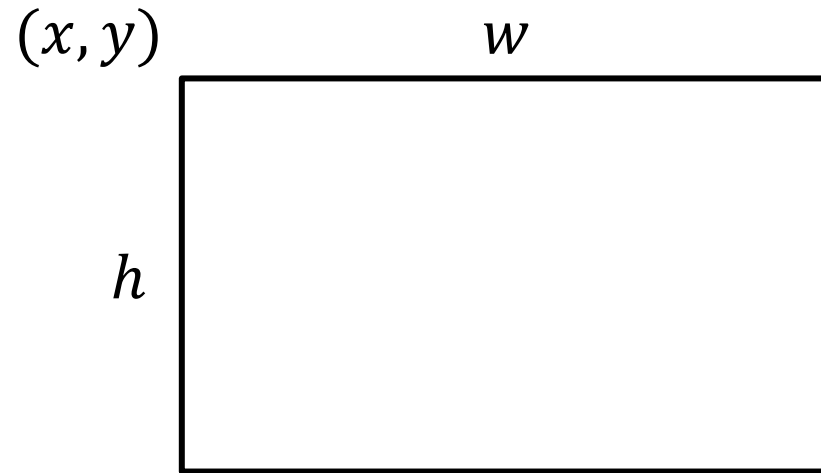


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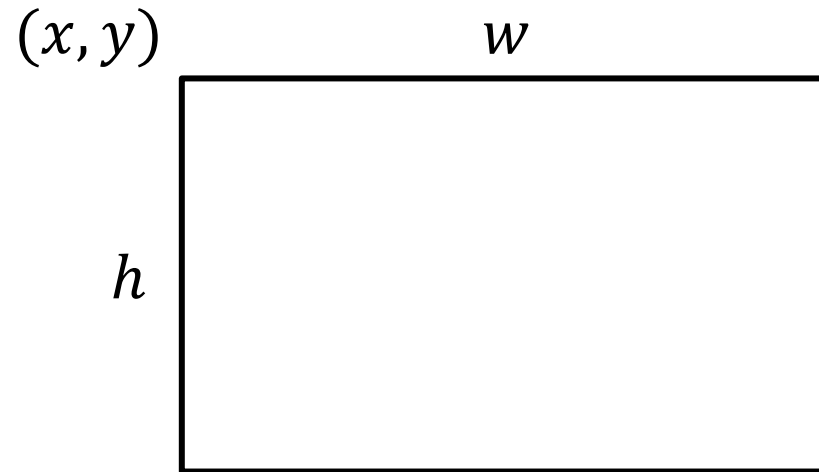
Object classification + localization

We need to find a bounding box to localize an object.



Object classification + localization

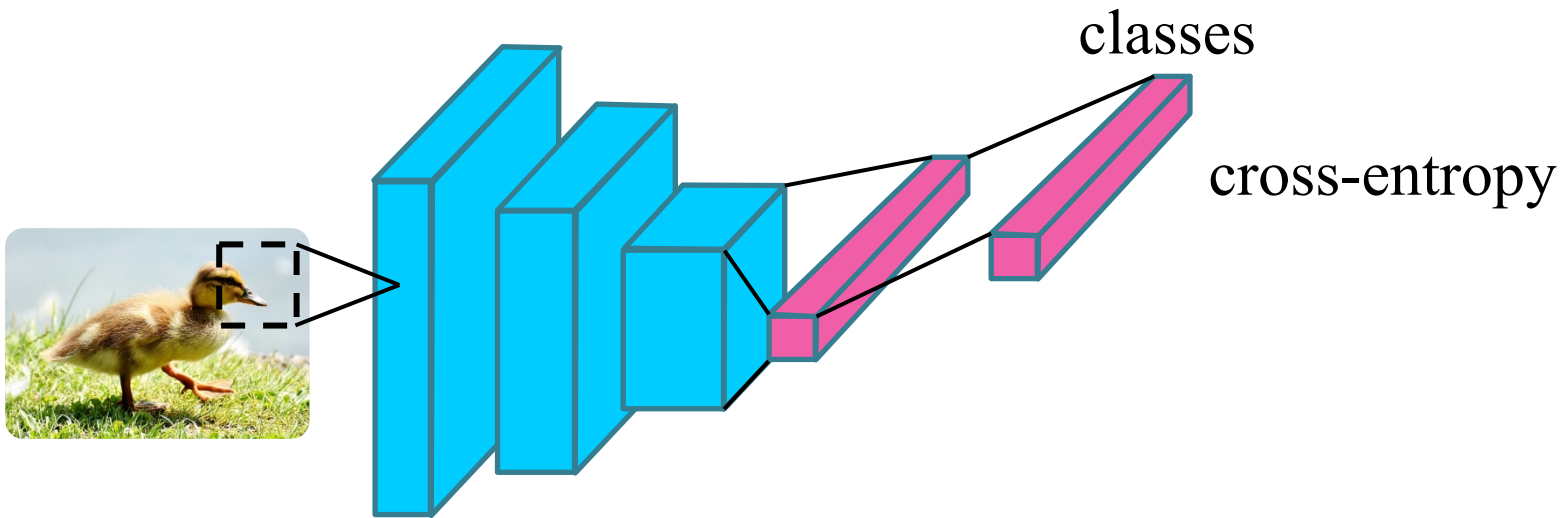
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We will use regression for (x, y, w, h) !

Object classification + localization

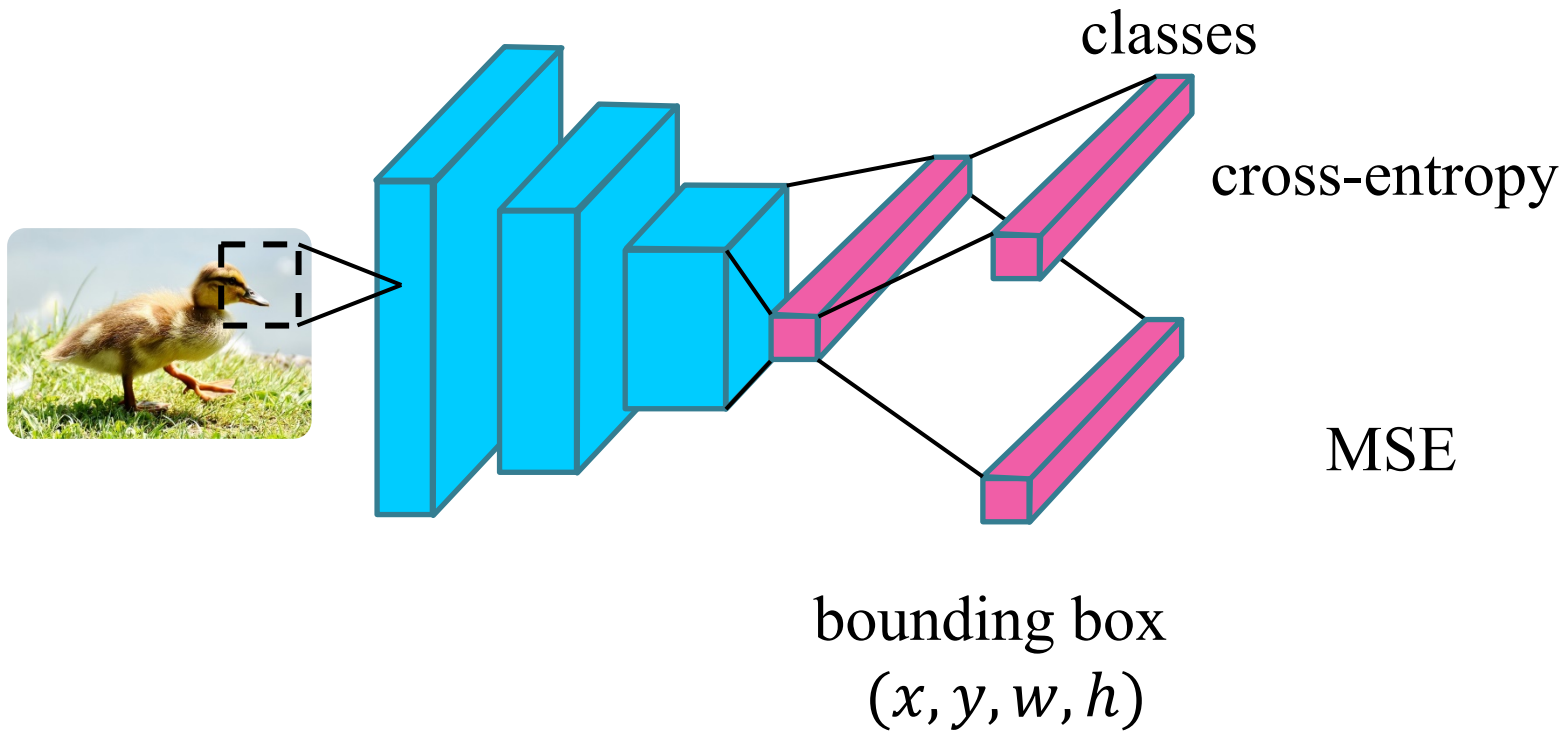
Classification network:



Do we need a second network?

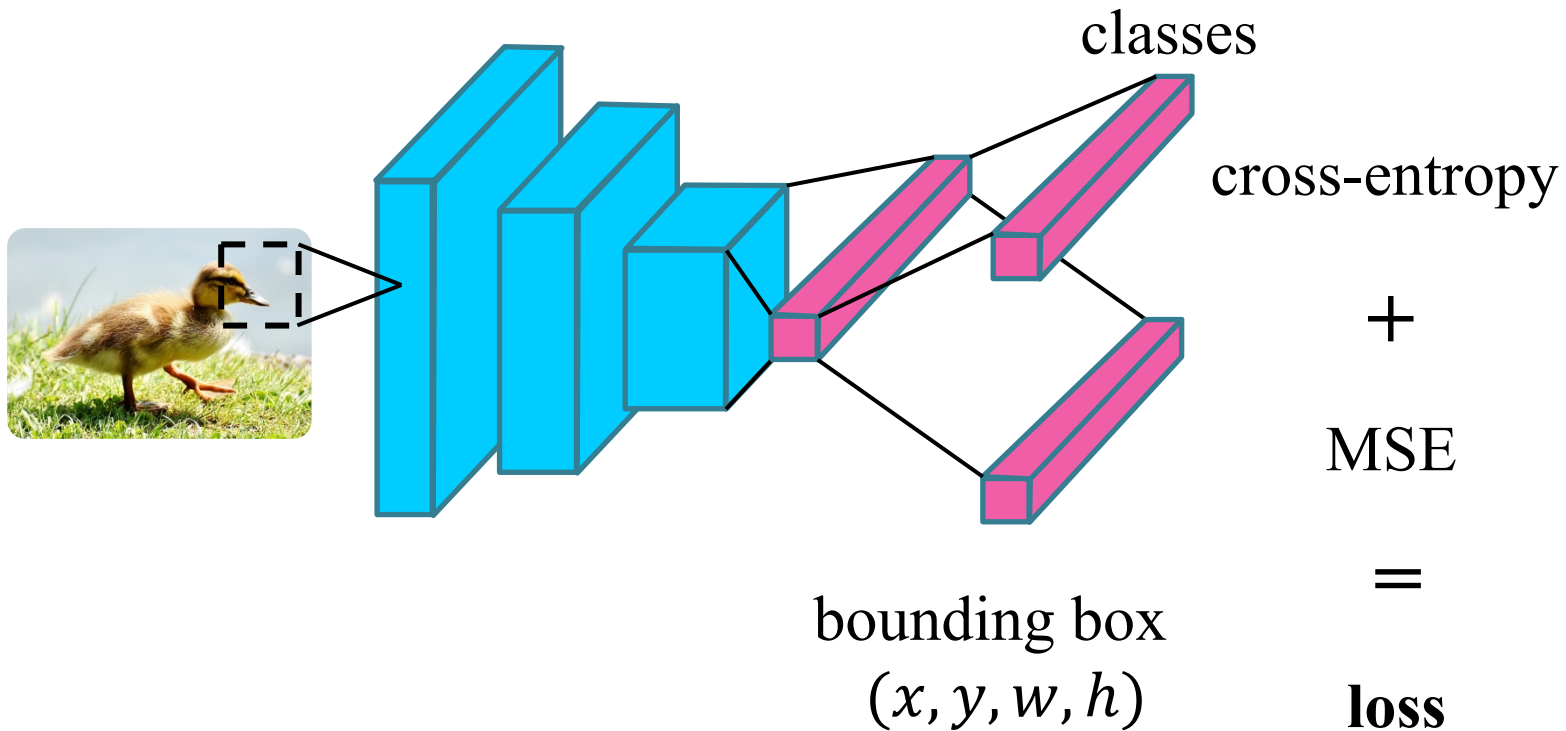
Object classification + localization

Classification + localization network:



Object classification + localization

Classification + localization network:



Summary

- In this video we took a sneak peek into other computer vision problems that successfully utilize convolutional neural networks.
- This video concludes our introduction to neural networks for images!