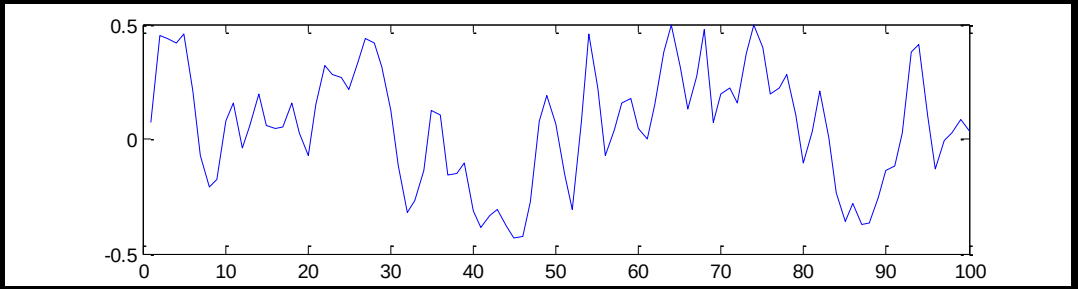
CS4495/6495
Introduction to Computer Vision

2A-L4 *Filters as templates*

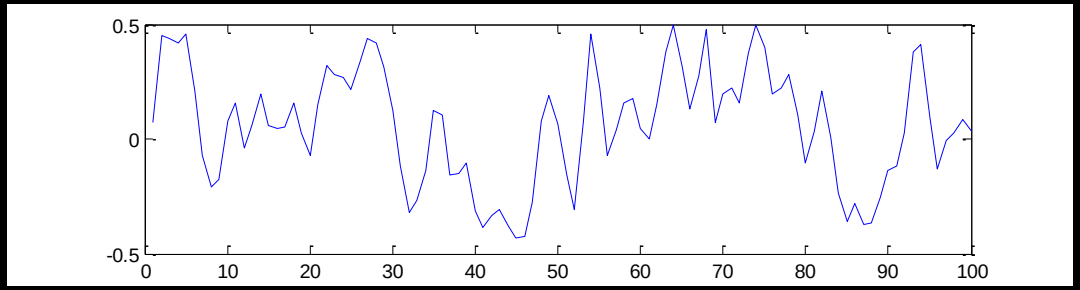
1D (nx)correlation

Signal

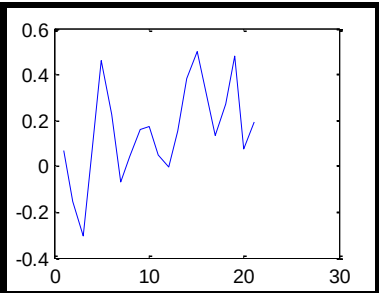


1D (nx)correlation

Signal

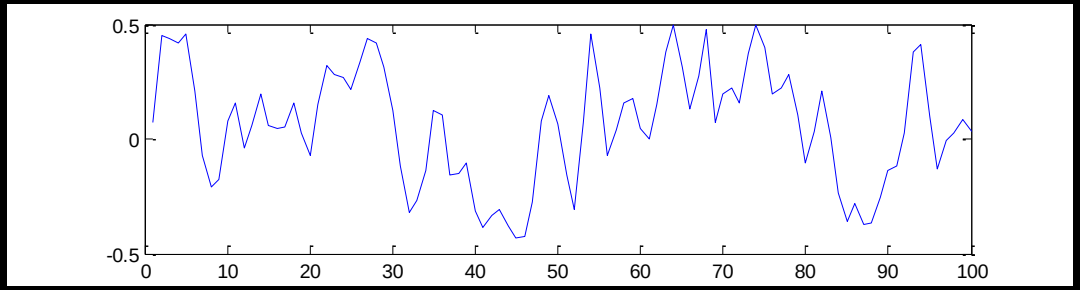


Filter

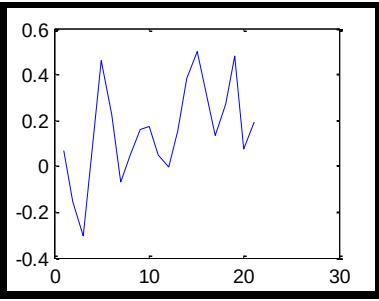


1D (nx)correlation

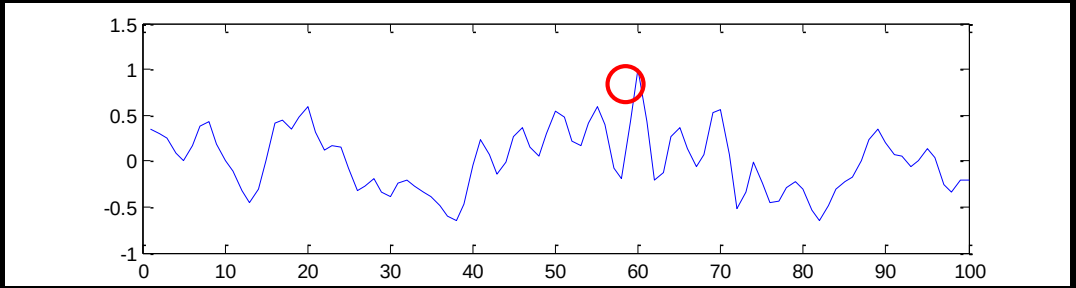
Signal



Filter



Normalized cross-correlation

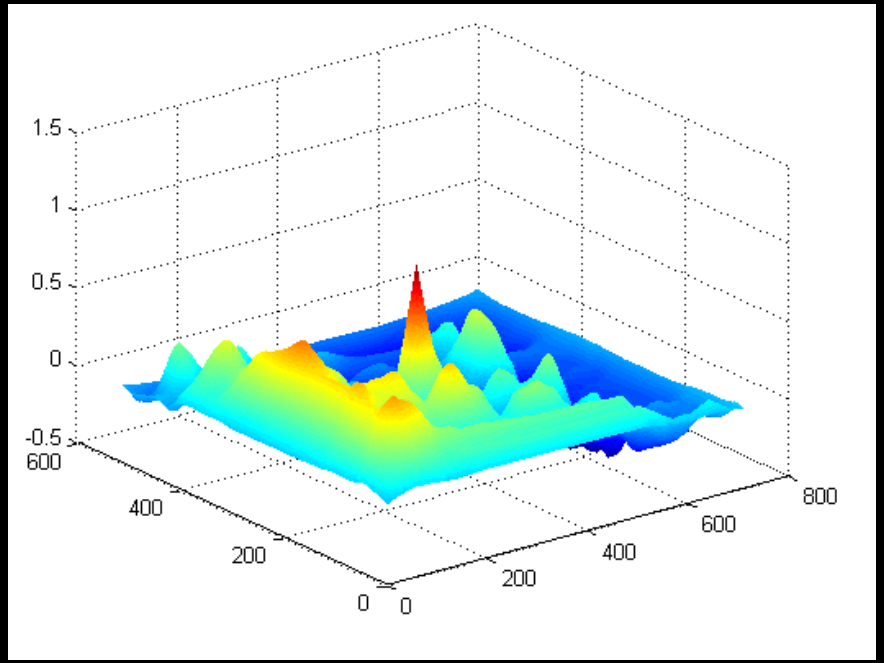


Matlab cross-correlation doc

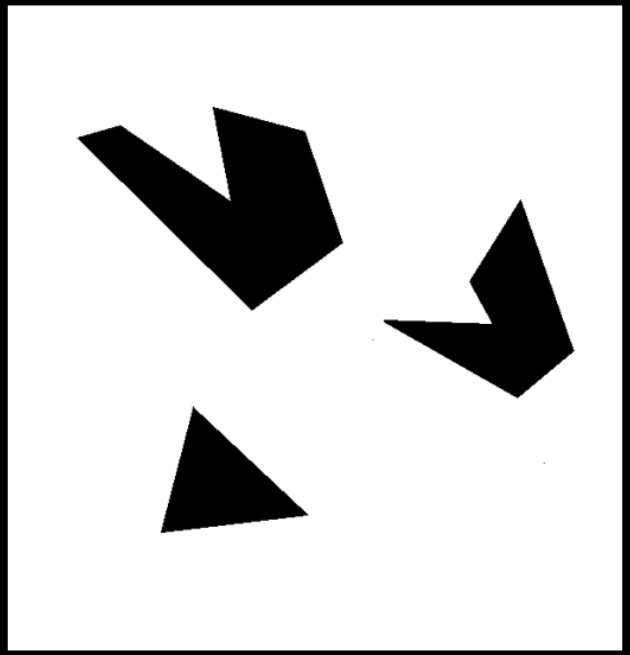
```
onion   = rgb2gray(imread('onion.png'));
peppers = rgb2gray(imread('peppers.png'));
imshowpair(peppers,onion,'montage')
```

Matlab cross-correlation doc

```
c = normxcorr2(onion,peppers);
figure, surf(c), shading flat;
```

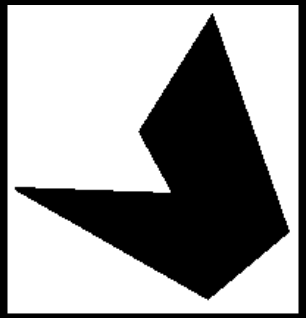


Template matching



Scene

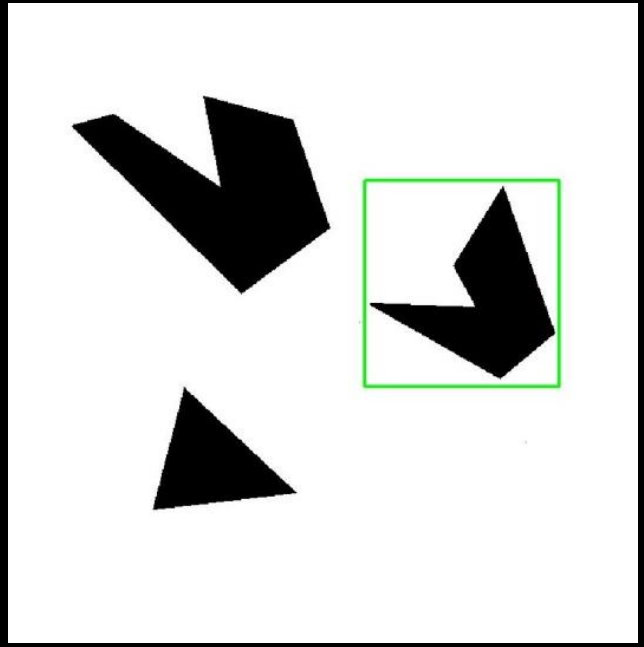
A toy example



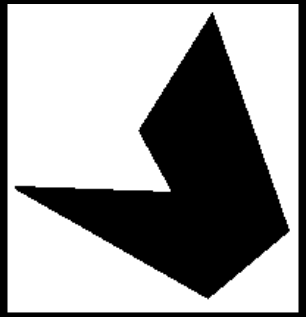
Template (mask)

K. Grauman

Template matching

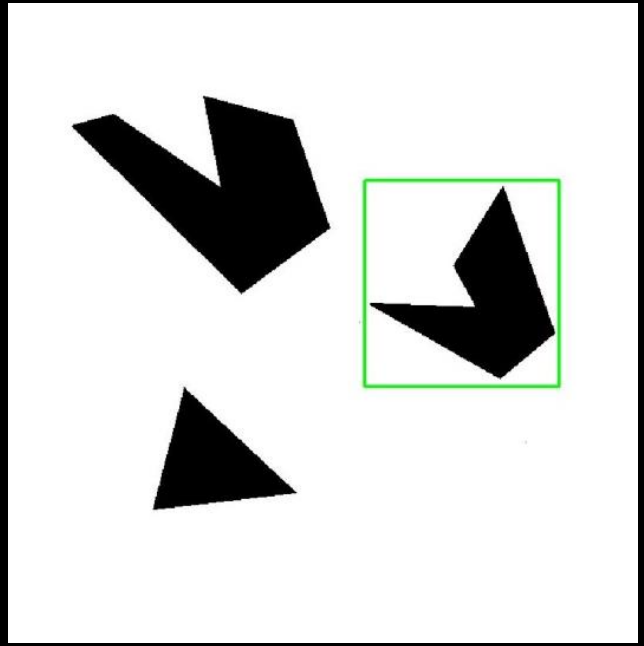


Detected template

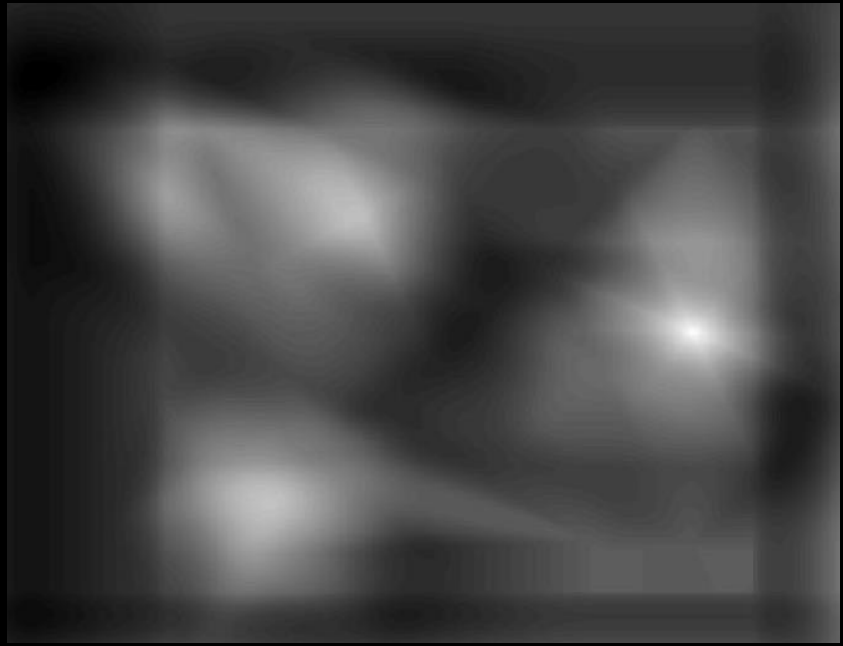


Template (mask)

Template matching



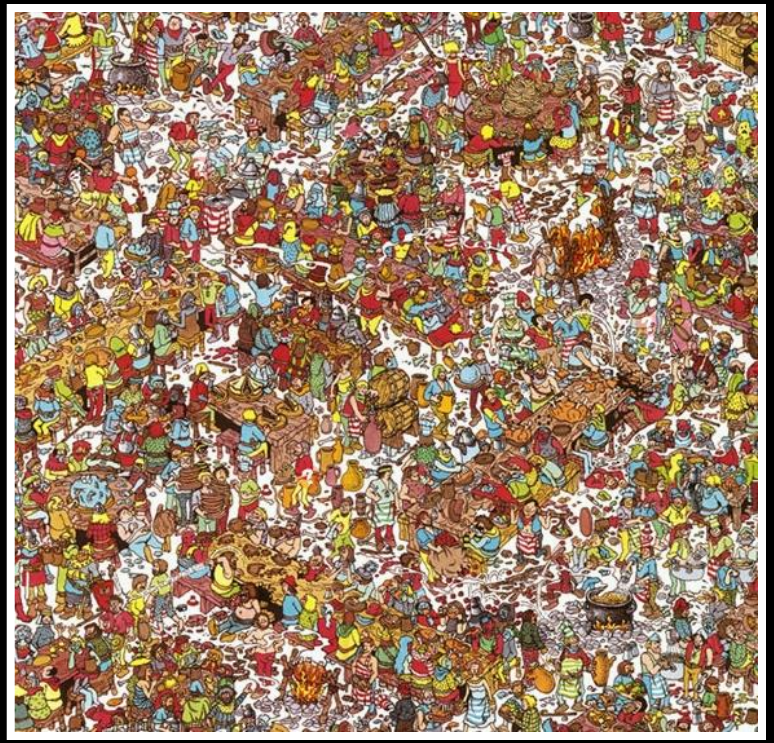
Detected template

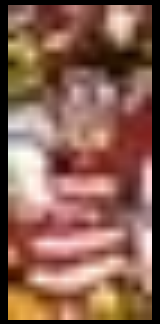


Correlation map

Where's Waldo?

Scene





Template

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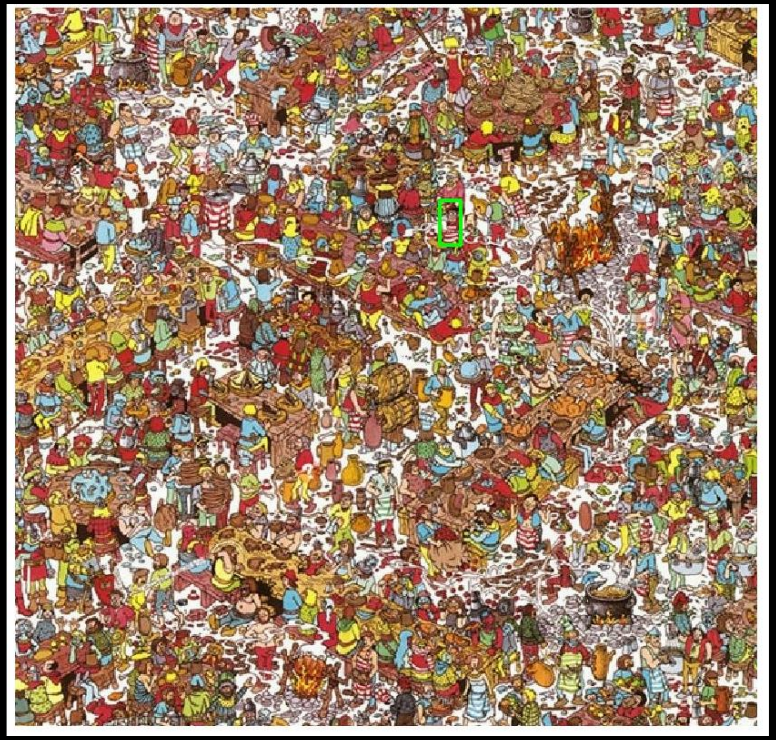
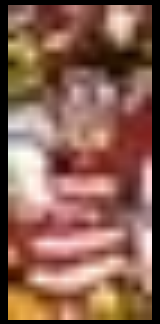
Where’s Waldo?

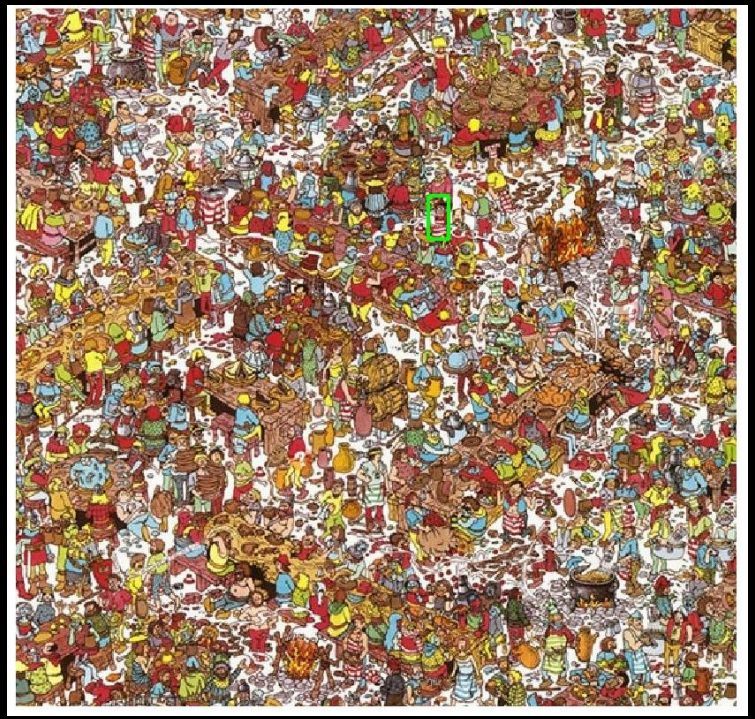


Detected Template

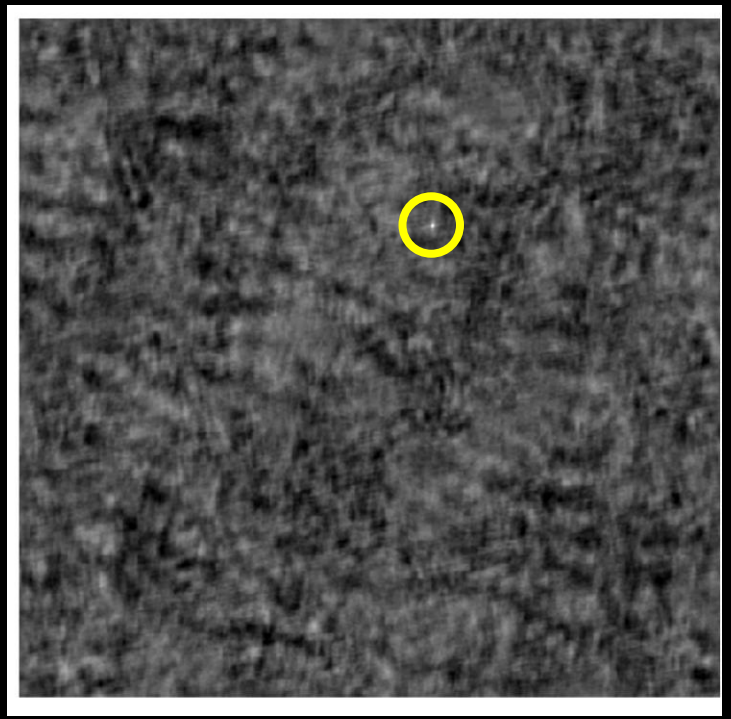


Template

Where's Waldo?



Detected template



Correlation map

Quiz

Would this method work for finding Waldo in most situations?

- Yes – normalized correlation is powerful.
- No – we don’t have the right template.
- Partially – explain how?

Template matching

What if the template is not identical to some sub-image in the scene?

Scene

Template

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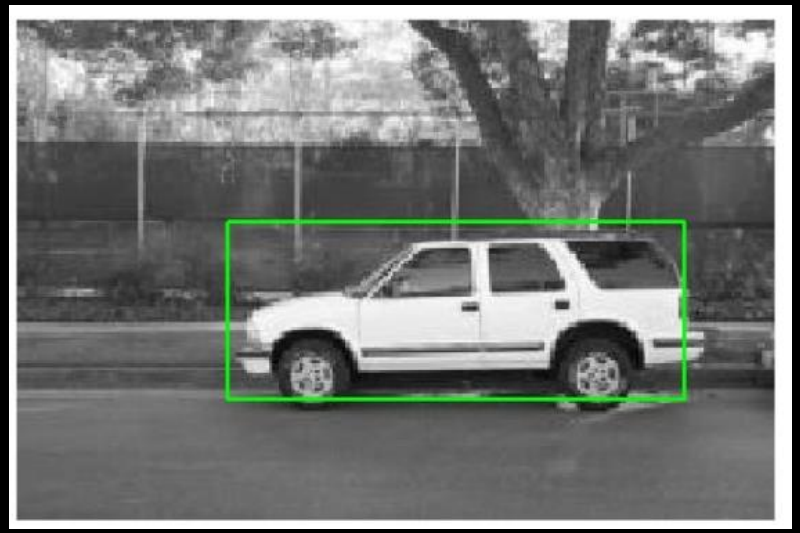
Template matching

Match can be meaningful, if scale, orientation, and general appearance is right.



Detected template

Template

Summary

- We can use filters to localize “interesting” areas in an image by looking at how well a filter responds at different locations.

- Going forward we will use filters both to compute functions (like the smoothing) and to find strong responses to those functions (like templates).