EECS 442 Discussion

10/04/2017

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Announcement

- HW1 grading
  - Grades have not been posted for all. Expected to see your grades by the end of this week.
  - Didn't submit original .m files? Won't lose points for this time (allow some time to make corrections). Will make the submission requirements more clear.
- HW2 updated. Due date: Friday, Oct 6.
  - Gradescope registration
  - Still need to submit code to Canvas
- Tomorrow's quiz will be at the end of the lecture.
- HW3 may be out by the end of Friday.

Today's Topic

- Two-minute Matlab Tip Sharing
- SIFT
- Matlab example: SIFT descriptor

Two-minute Matlab Tip Sharing

- Share one or two useful or interesting Matlab functions or programming tips. at the beginning/end of the discussion.
- Will keep this part if you feel it helpful.

Two-minute Matlab Tip Sharing

Count the # non-zero elements in a matrix.

```
A = sum(sum(~~A))
```

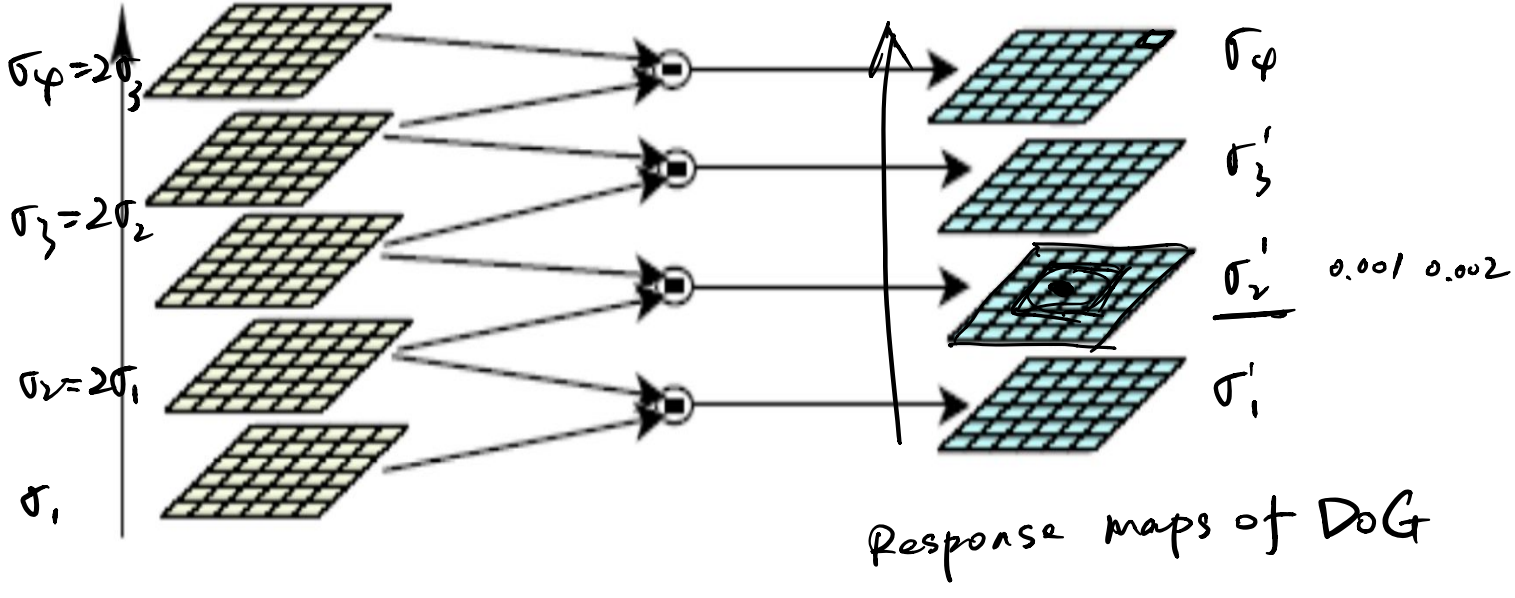
```
A =

     1     2     0
     0     2     0

>> A = ~A

A =

  2×3 logical array

   0   0   1
   1   0   1
```

```
>> A = ~A

A =

  2×3 logical array

   1   1   0
   0   1   0
```

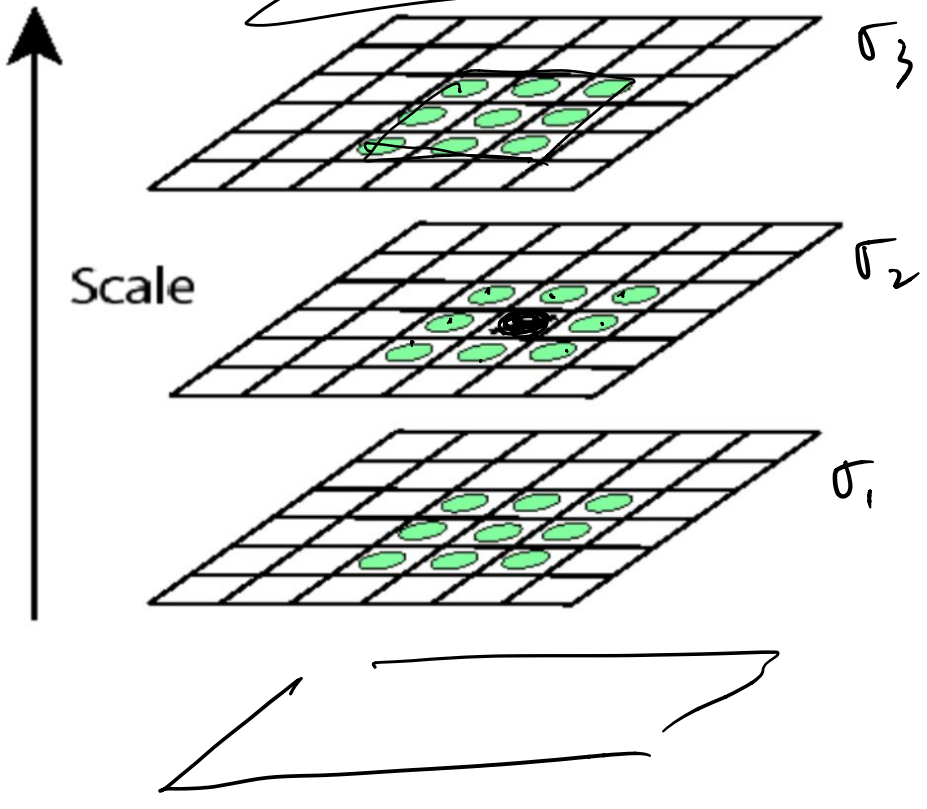
SIFT: Scale-invariant feature transform

- Detect and localize key points
  - DoG and Gaussian scale space
- Assign dominant orientation
  - Histogram of orientated gradients
- Compute descriptor

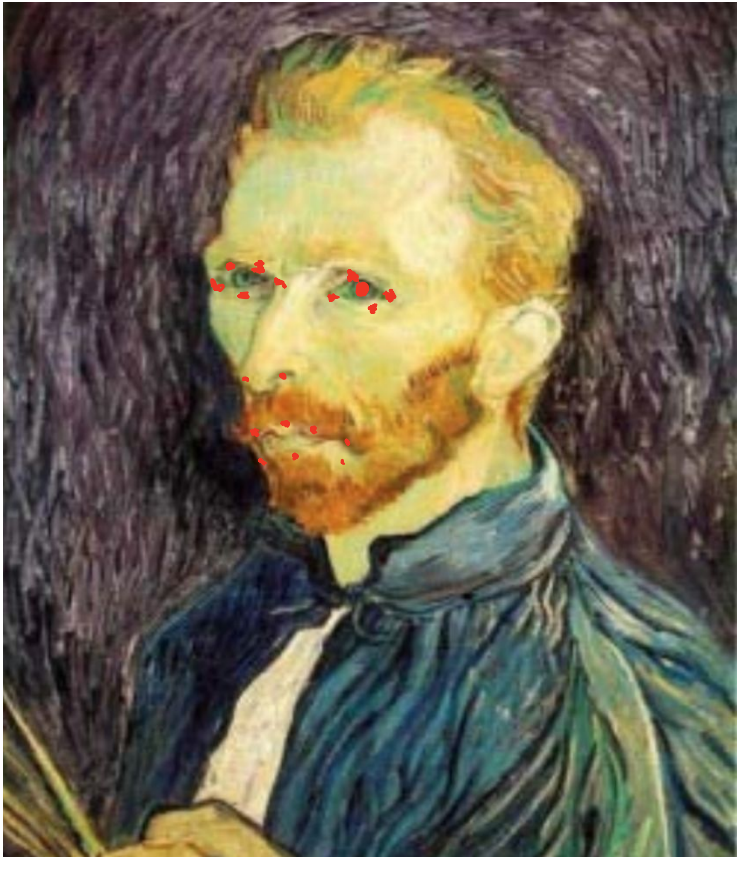
Detect and localize key points



Detect and localize key points



Detect and localize key points



For key points, we know

(x, y, scale)

Assign dominant orientation

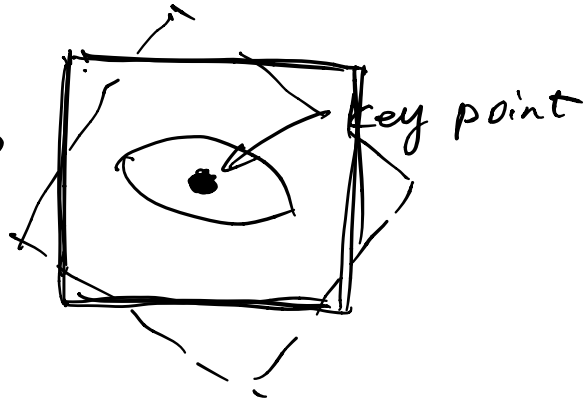
magnitude

$$m(s,t) = \sqrt{I_x^{\,2}(s,t) + I_y^{\,2}(s,t)}$$

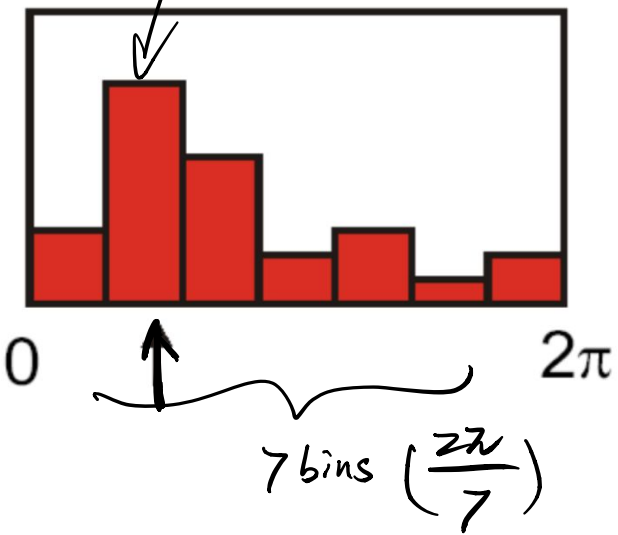
$$\theta(s,t) = \operatorname{atan}(I_y(s,t) / I_x(s,t))$$

angles

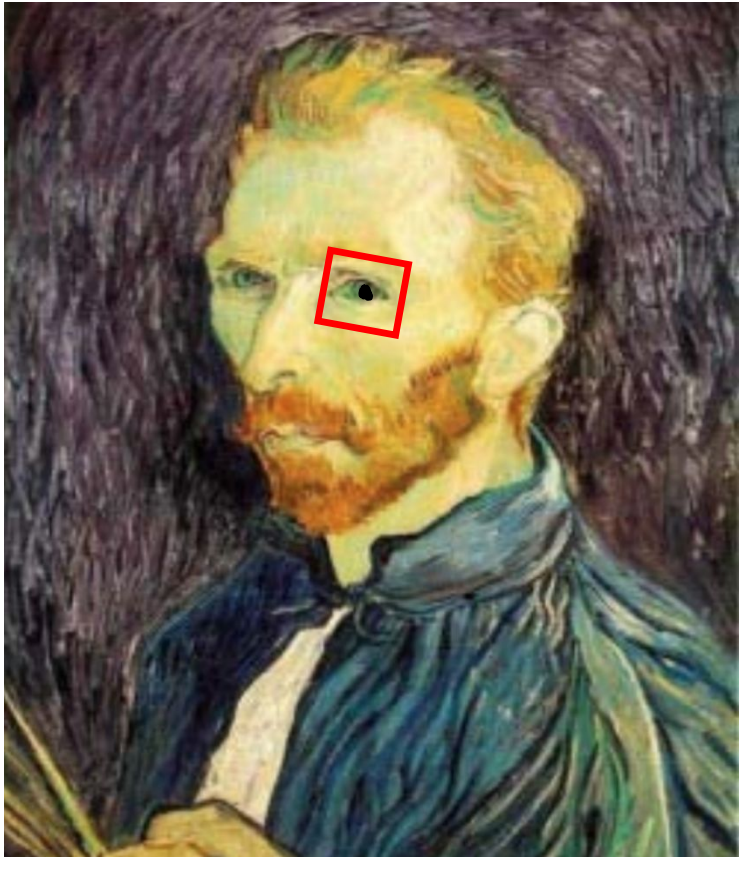
Ix, Iy

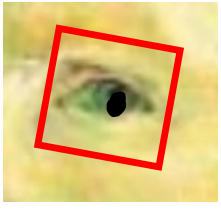


+ m(s,t)



Assign dominant orientation



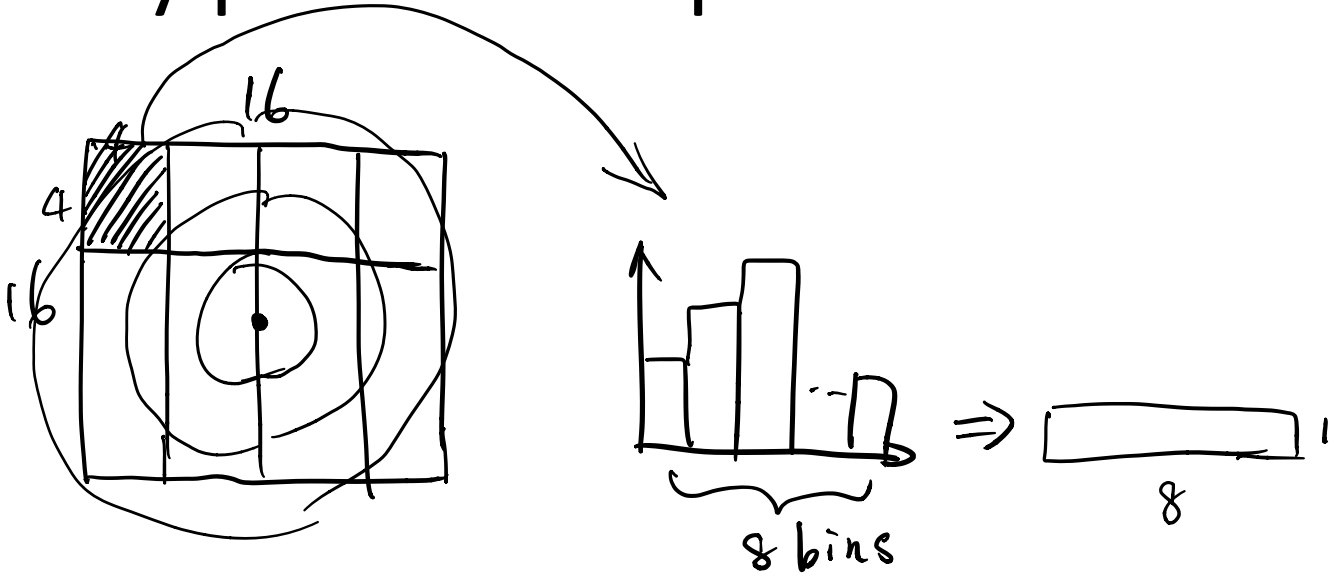


For key points, we know

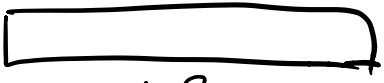
(x, y, scale, ~~rotation~~)

orientation

Key point descriptor



4x4 = 16 histograms

$\Rightarrow d =$  descriptor

128 = 16 x 8

$d = \frac{d}{\|d\|}$

SIFT: Scale-invariant feature transform

- Detect and localize key points
  -> Scale invariance
- Find dominant orientation
  -> Rotation invariance
- Compute descriptor
  -> Robust to small variance in pose and intra-class (thanks to gradient histogram) and illumination (thanks to normalization)

SIFT & SIFT descriptor

HoG