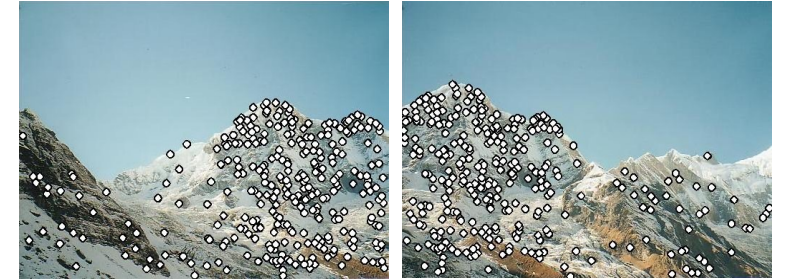*If we know where the good features are, how do we match them?*
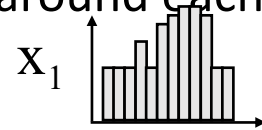
Designing feature descriptors

Local Feature Matching
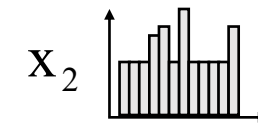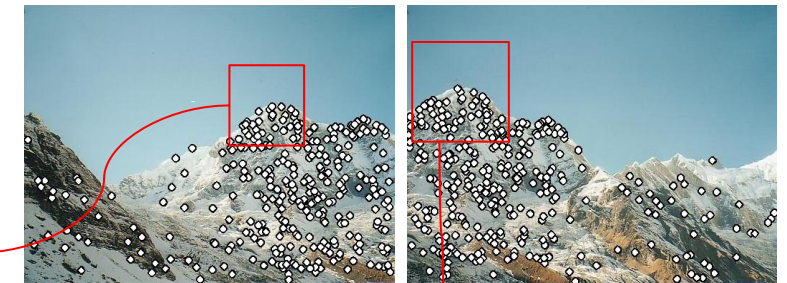
1) **Detection:**
   Find a set of distinctive features (e.g., key points)

2) **Description:**
   Extract feature descriptor around each interest point as vector.

   $$\mathbf{x}_1 = [x_1^{(1)}, \ldots, x_d^{(1)}]$$

   $$\mathbf{x}_2 = [x_1^{(2)}, \ldots, x_d^{(2)}]$$

3) **Matching:**
   Compute distance between feature vectors to find correspondence.

Image patch

Just use the pixel values of the patch
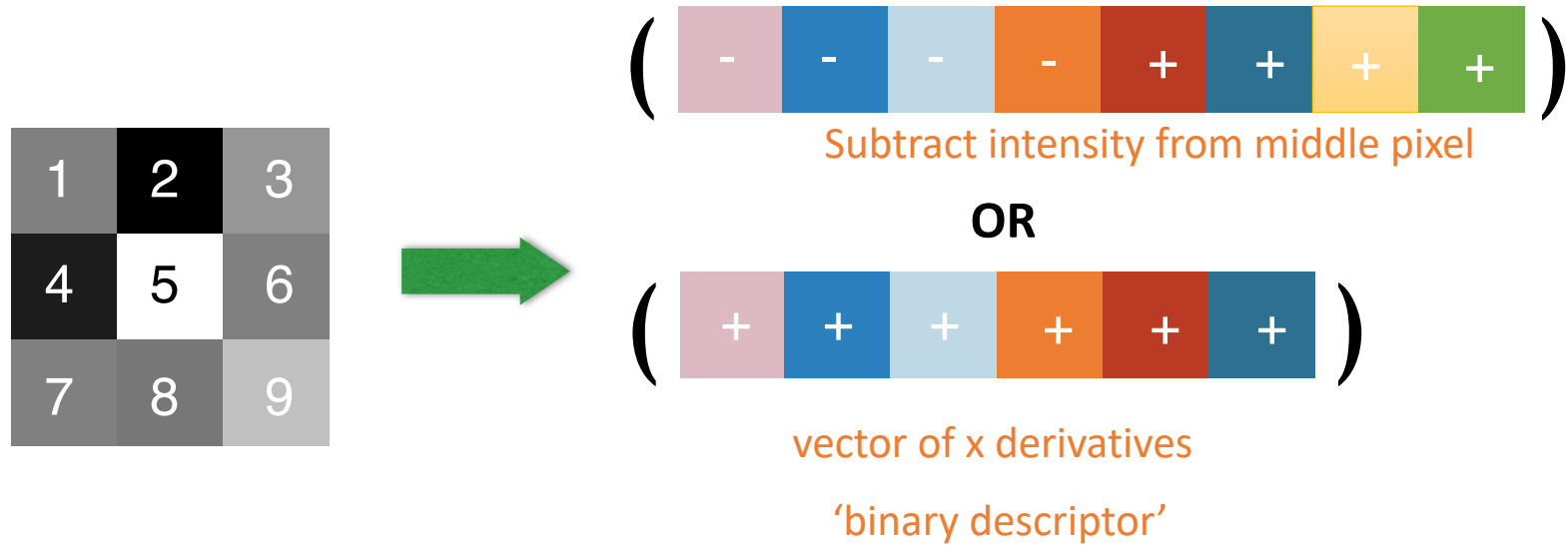

vector of intensity values

Perfectly fine if geometry and appearance is unchanged (a.k.a. template matching)

What are the problems?

How can you be less sensitive to absolute intensity values?

Image gradients

Use pixel differences

1	2	3
4	5	6
7	8	9

(- - - - + + + +)

Subtract intensity from middle pixel

OR

(+ + + + + +)

vector of x derivatives
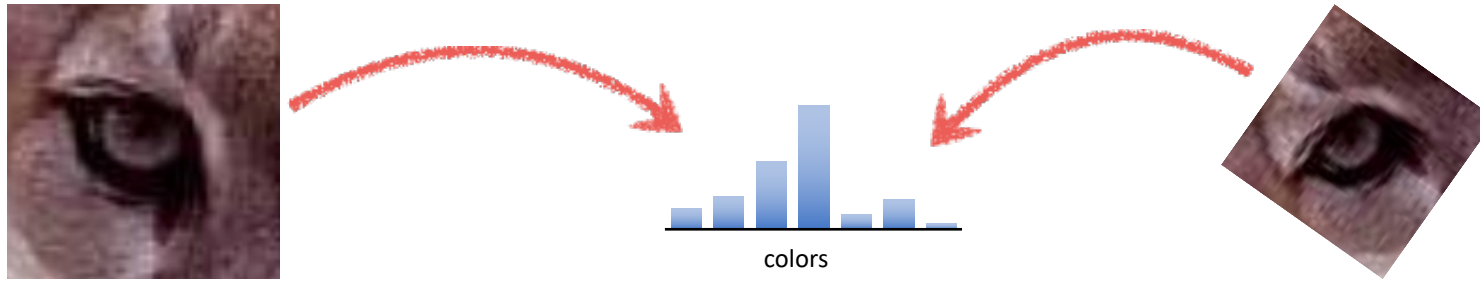
'binary descriptor'

Feature is invariant to absolute intensity values

What are the problems?

How can you be less sensitive to deformations?

Color histogram

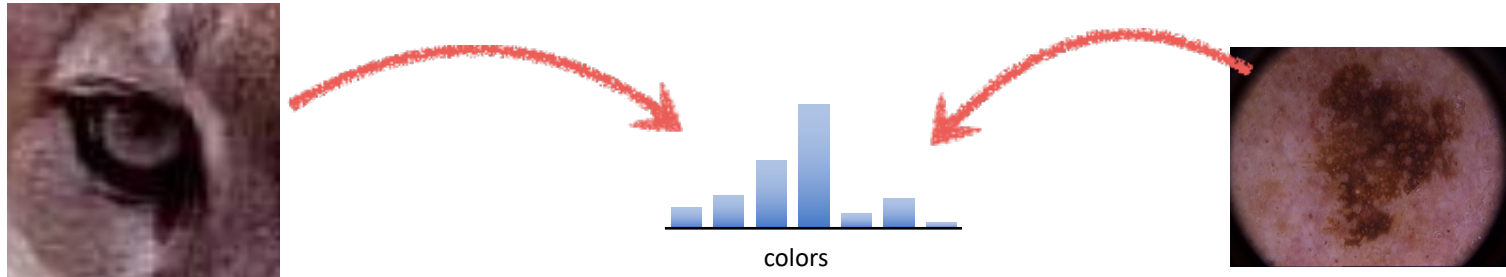Count the colors in the image using a histogram
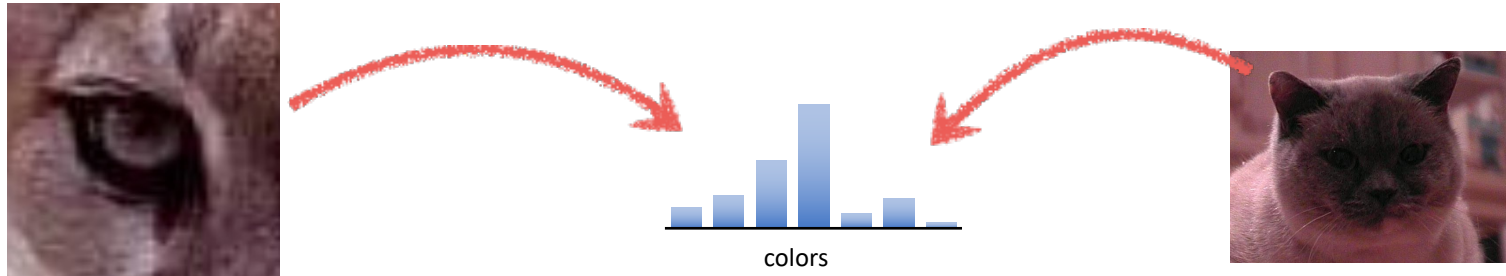

colors

Invariant to changes in scale and rotation

What are the problems?

Color histogram

Count the colors in the image using a histogram

colors

Invariant to changes in scale and rotation

What are the problems?

Color histogram

Count the colors in the image using a histogram

colors

Invariant to changes in scale and rotation

What are the problems?

How can you be more sensitive to spatial layout?