Designing Descriptors

16-385 Computer Vision (Kris Kitani)

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Feature matching is important for tasks like…
Object instance recognition

Schmid and Mohr 1997

Sivic and Zisserman, 2003

Rothganger et al. 2003

Lowe 2002
Image mosaicing
If we know where the good features are, how do we match them?
How do we describe an image patch?

Patches with similar content should have similar descriptors.
Challenges of designing a feature descriptor
Photometric transformations
Geometric transformations

objects will appear at different scales, translation and rotation
Designing a feature descriptor
(the search for image invariants)
What is the best descriptor for an image feature?
Image patch

Just use the pixel values of the patch

1 2 3
4 5 6
7 8 9

(1 2 3 4 5 6 7 8 9)

vector of intensity values

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

What are the problems?
Image patch

Just use the pixel values of the patch

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

Feature is invariant to absolute intensity values

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Image gradients

Use pixel differences

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

Invariant to changes in scale and rotation

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What are the problems?
How can you be more sensitive to spatial layout?
Spatial histograms

Compute histograms over spatial ‘cells’

Retains rough spatial layout
Some invariance to deformations

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What are the problems?
How can you be completely invariant to rotation?
Orientation normalization

Use the dominant image gradient direction to normalize the orientation of the patch.

save the orientation angle $\theta$ along with $(x, y, s)$

What are the problems?