

# BRIEF: Binary Robust Independent Elementary Features

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# What is BRIEF?

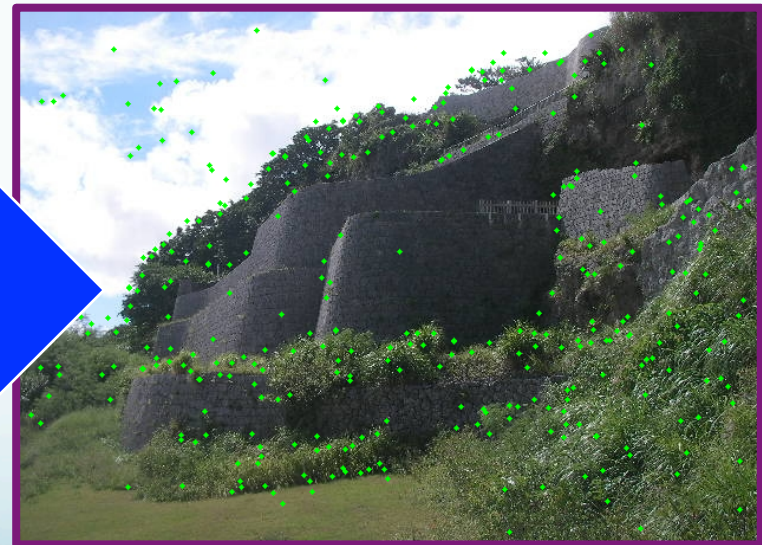
- Feature point descriptor
- Use for object recognition, image retrieval, camera localization, etc...
- High-speed processing
- Little memory usage

# What is Feature point?

- Features in image
- Detect based on luminance, etc...



Detect



# Algorithm

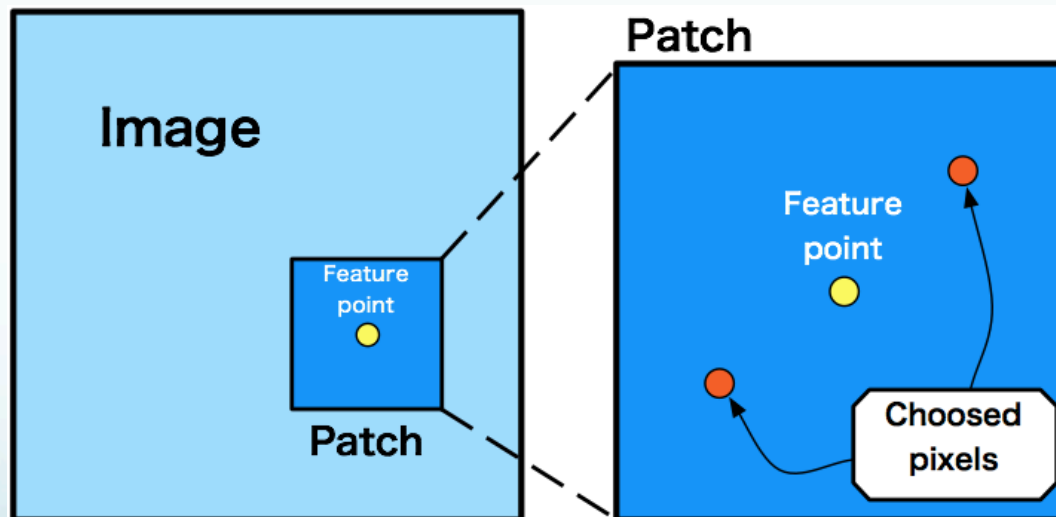
1. Create a patch centered on the feature point
2. Smooth the patch by Gaussian filter

$$f(x, y) = \frac{1}{2\pi\sigma^2} \exp\left(-\frac{x^2 + y^2}{2\sigma^2}\right)$$

# Algorithm

3. Compare two pixel intensities in the patch

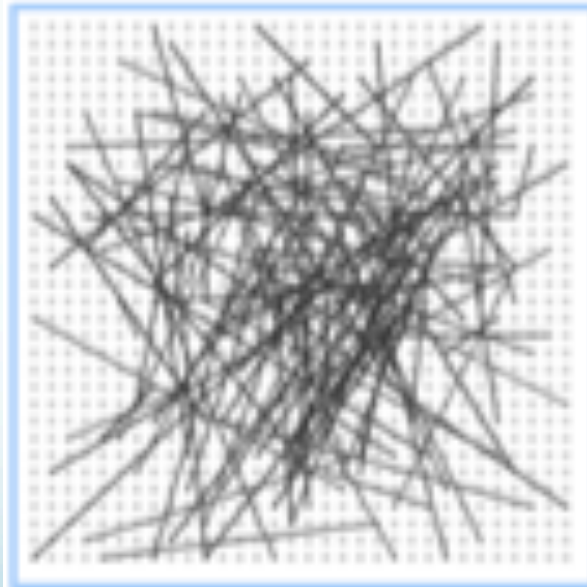
$$\tau(p; x, y) := \begin{cases} 1 & \text{if } p(x) < p(y) \\ 0 & \text{otherwise} \end{cases}$$



- $x$  and  $y$  are locations in the patch
- $p(x)$  and  $p(y)$  are the pixel intensities in the patch

# Algorithm

- Choosing of the locations,  $x$  and  $y$ , follows Gaussian distribution



# Algorithm

4. Generate a binary string of length  $n$  by  $n$  times comparison
  - The binary string is a BRIEF descriptor

$$f_{n_d}(p) := \sum_{1 \leq i \leq n_d} 2^{i-1} \tau(p; x_i, y_i)$$

- Length of the string is 128, 256 and 512 bit
- High-speed matching by using Hamming distance

# Good and Bad point

- Good
  - High-speed processing
  - Little memory usage
  - Strong to illumination and blur change
- Bad
  - Weak to the rotation of the viewpoint,  
and the change in the position of a light source