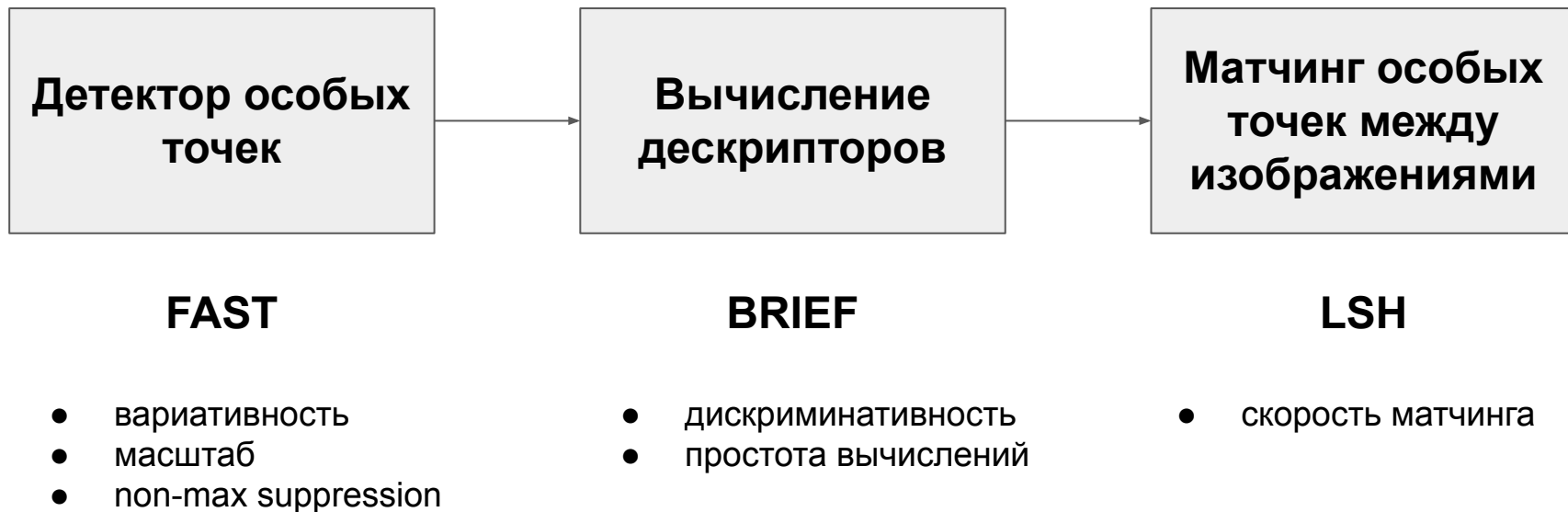
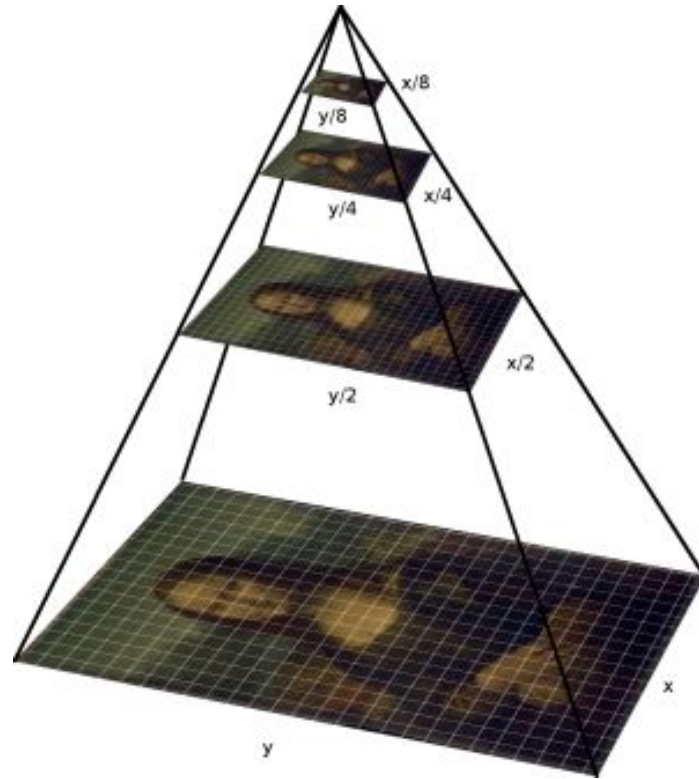


ORB: Oriented FAST and Rotated BRIEF

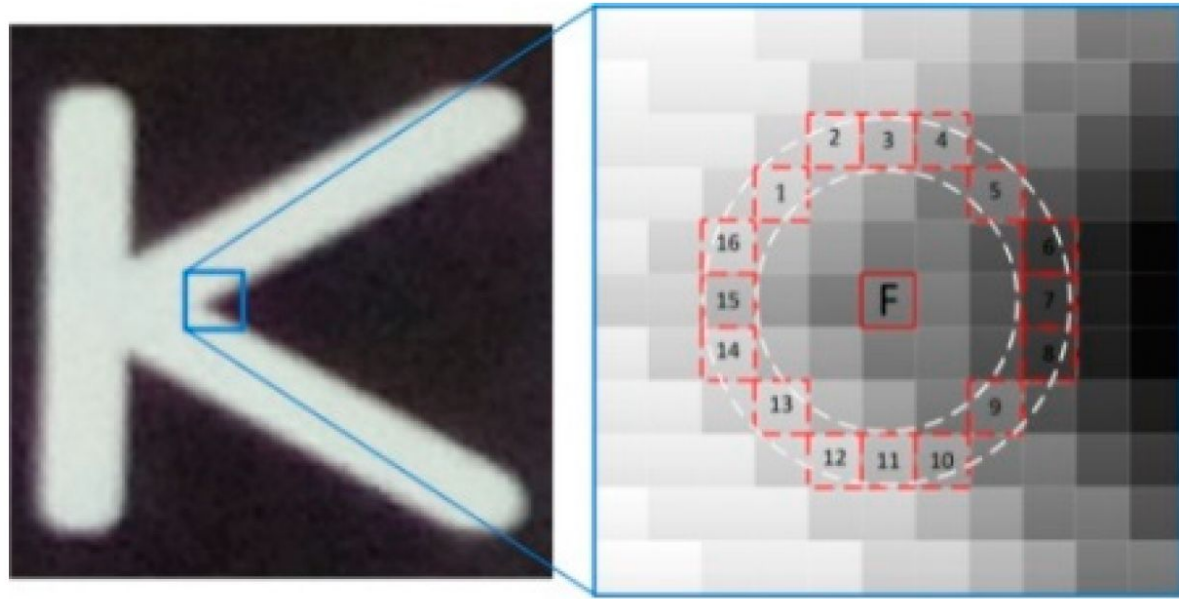
ORB: Oriented FAST and Rotated BRIEF



Multiscale

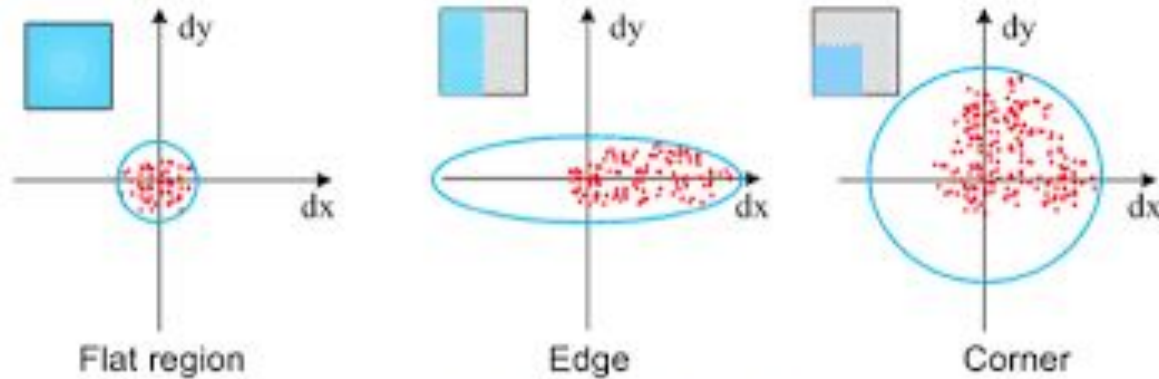


FAST: Features from Accelerated Segment Test



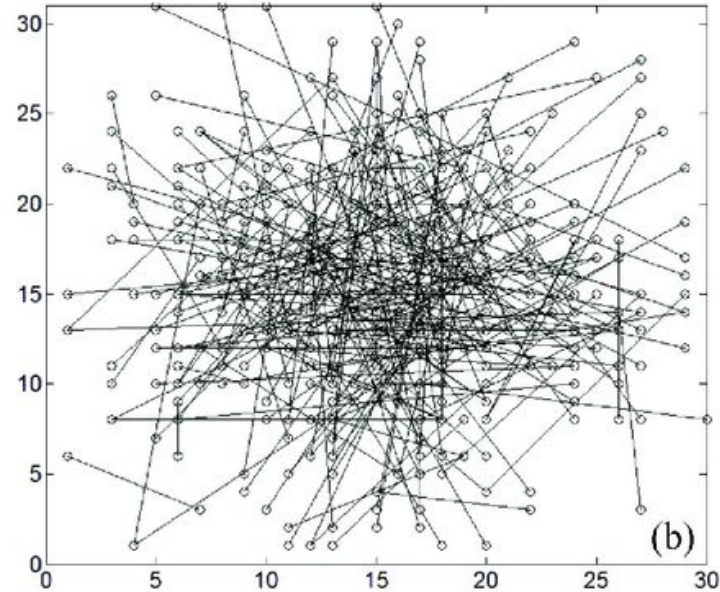
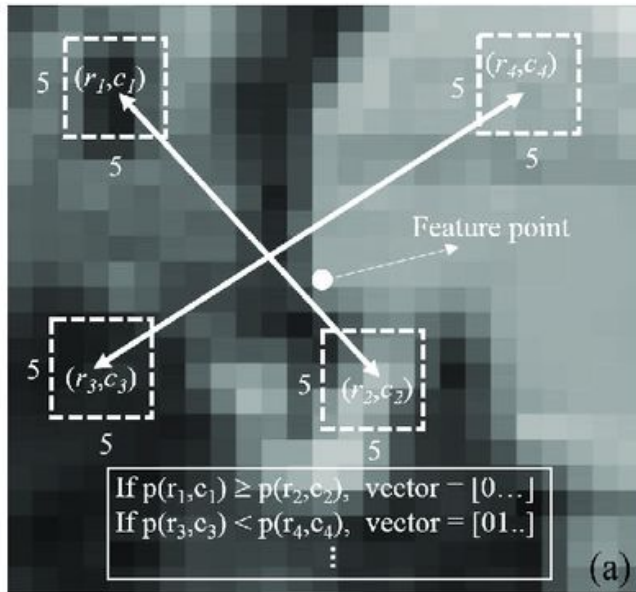
Harris Corner Detector

$$f(\Delta x, \Delta y) = \sum_{(x_k, y_k) \in W} (I(x_k, y_k) - I(x_k + \Delta x, y_k + \Delta y))^2$$



$$\lambda_{min} \approx \frac{\lambda_1 \lambda_2}{(\lambda_1 + \lambda_2)}$$

BRIEF: Binary Robust Independent Elementary Features

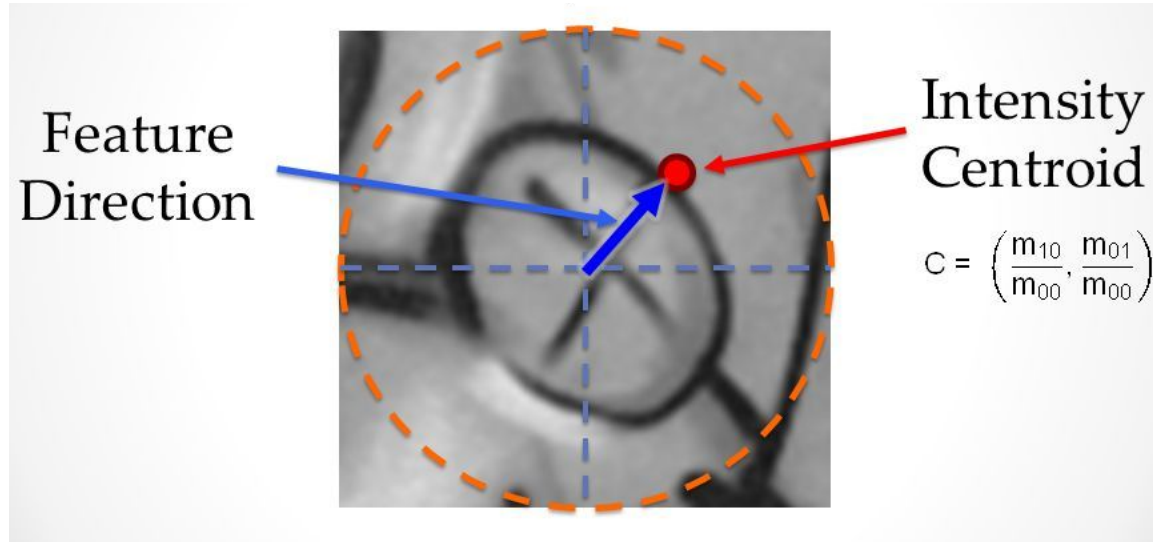


BRIEF: Binary Robust Independent Elementary Features

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

$$f_n(\mathbf{p}) := \sum_{1 \leq i \leq n} 2^{i-1} \tau(\mathbf{p}; \mathbf{x}_i, \mathbf{y}_i)$$

BRIEF: Binary Robust Independent Elementary Features



$$m_{pq} = \sum_{x,y} x^p y^q I(x, y)$$

$$C = \left(\frac{m_{10}}{m_{00}}, \frac{m_{01}}{m_{00}} \right)$$

$$\theta = \text{atan2}(m_{01}, m_{10})$$

BRIEF: Binary Robust Independent Elementary Features

$$\mathbf{S} = \begin{pmatrix} \mathbf{x}_1, \dots, \mathbf{x}_n \\ \mathbf{y}_1, \dots, \mathbf{y}_n \end{pmatrix}$$

$$\mathbf{S}_\theta = \mathbf{R}_\theta \mathbf{S}$$

$$g_n(\mathbf{p}, \theta) := f_n(\mathbf{p}) | (\mathbf{x}_i, \mathbf{y}_i) \in \mathbf{S}_\theta$$

BRIEF: Binary Robust Independent Elementary Features

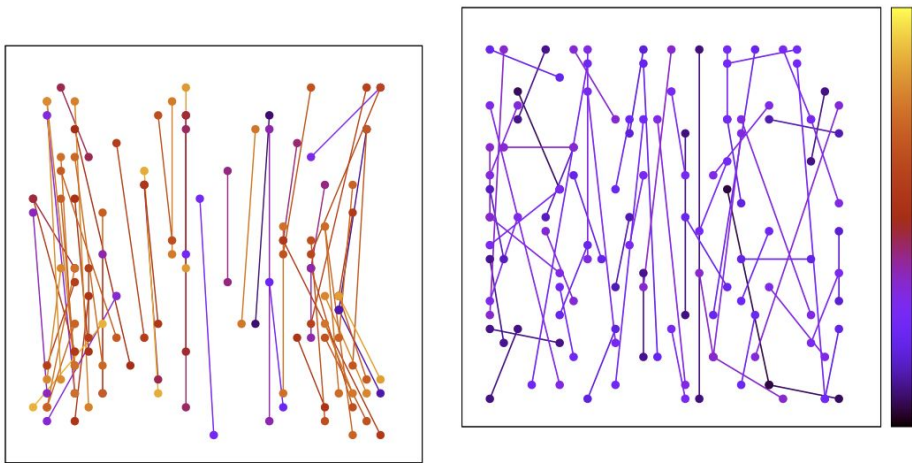
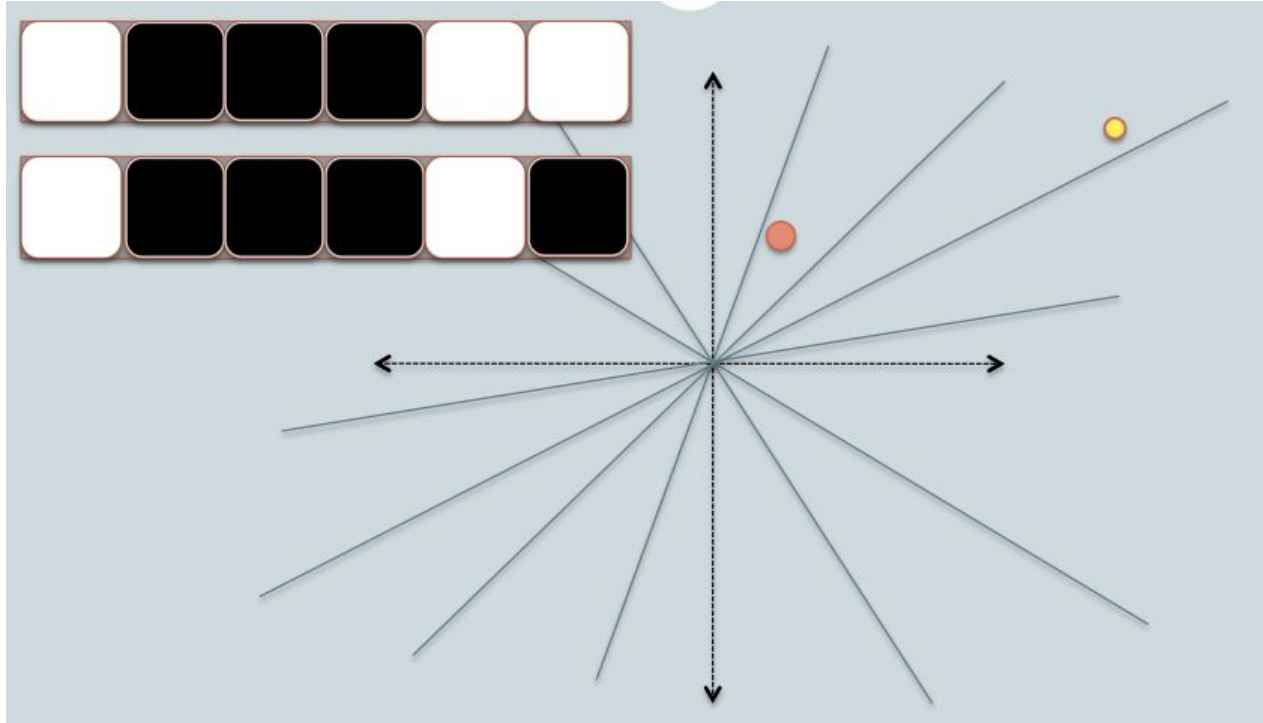


Figure 6. A subset of the binary tests generated by considering high-variance under orientation (left) and by running the learning algorithm to reduce correlation (right). Note the distribution of the tests around the axis of the keypoint orientation, which is pointing up. The color coding shows the maximum pairwise correlation of each test, with black and purple being the lowest. The learned tests clearly have a better distribution and lower correlation.

ORB: Matching (LSH)



ORB vs SIFT

- Основное преимущество ORB - это скорость работы
- Упрощен процесс определения ключевых точек
- Благодаря бинарным дескрипторам, скорость поиска похожих точек удастся существенно повысить
- При этом, качество работы алгоритма сопоставимо с SIFT

OpenCV

- [cv2.ORB\(\)](#)
- [cv2.FastFeatureDetector\(\)](#)
- [cv2.cornerHarris\(\)](#)
- [cv2.FlannBasedMatcher\(\)](#)