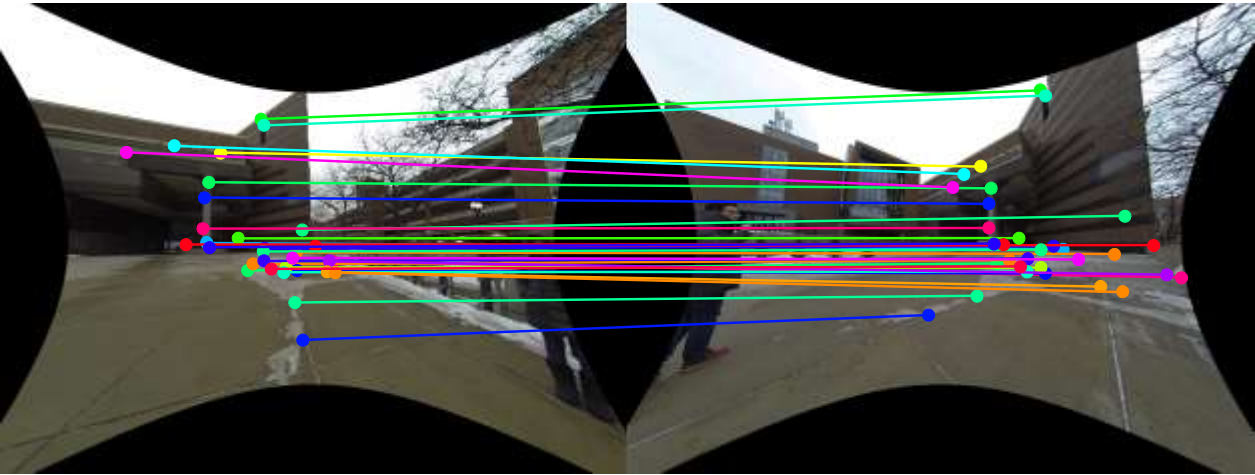




Feature Matching

How Many Correspondences?



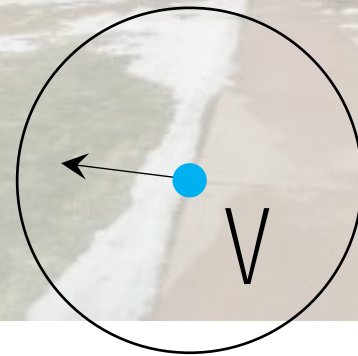
$$\begin{bmatrix} u_1^x v_1^x & u_1^y v_1^x & v_1^x & u_1^x v_1^y & u_1^y v_1^y & v_1^y & u_1^x & u_1^y & 1 \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ u_m^x v_m^x & u_m^y v_m^x & v_m^x & u_m^x v_m^y & u_m^y v_m^y & v_m^y & u_m^x & u_m^y & 1 \end{bmatrix} \mathbf{A} \mathbf{X} = \mathbf{0}$$

What is minimum m?



Local Scale Invariant Feature Transform (SIFT)

SIFT automatically finds the optimal scale of feature point and its orientation.



Desired properties:

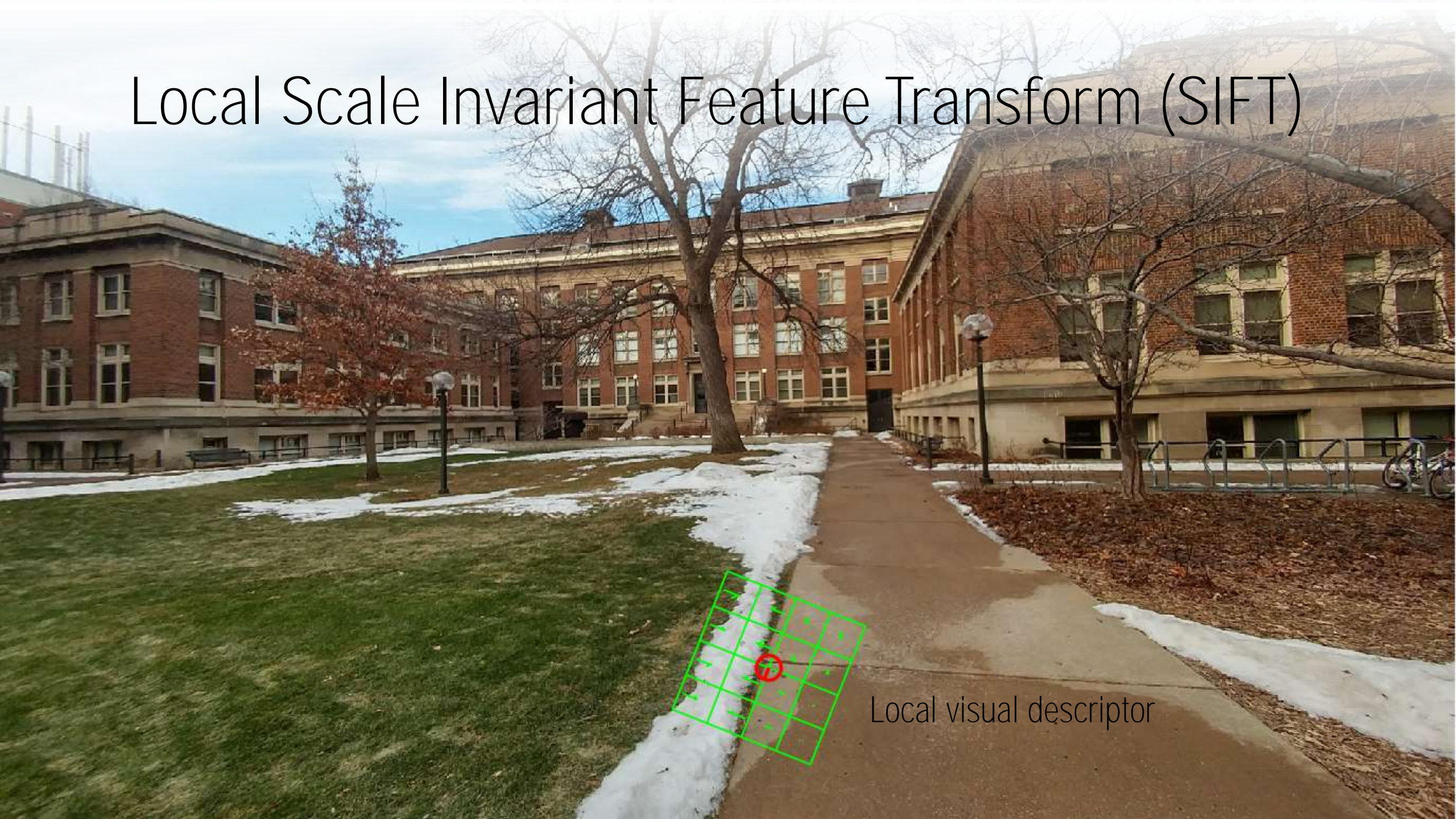
- Repeatability: the same point is repeatedly detected.
- Discriminativity: the point is unique.
- Orientation aware

Local Scale Invariant Feature Transform (SIFT)



Local visual descriptor

Local Scale Invariant Feature Transform (SIFT)



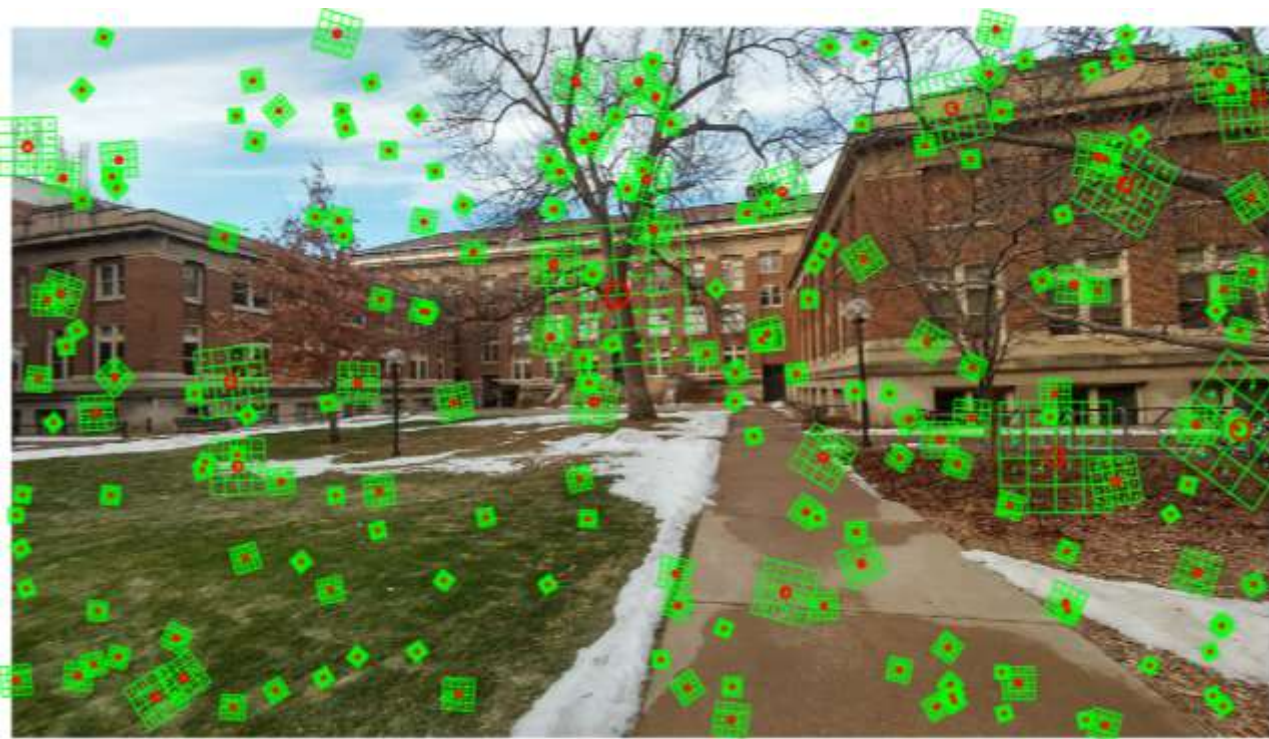
Local visual descriptor

Local Scale Invariant Feature Transform (SIFT)

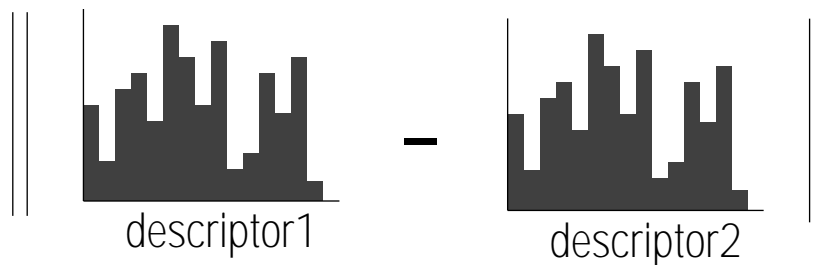


$$\left\| \begin{array}{c} \text{descriptor1} \\ \text{descriptor2} \end{array} - \begin{array}{c} \text{descriptor1} \\ \text{descriptor2} \end{array} \right\| = 0$$

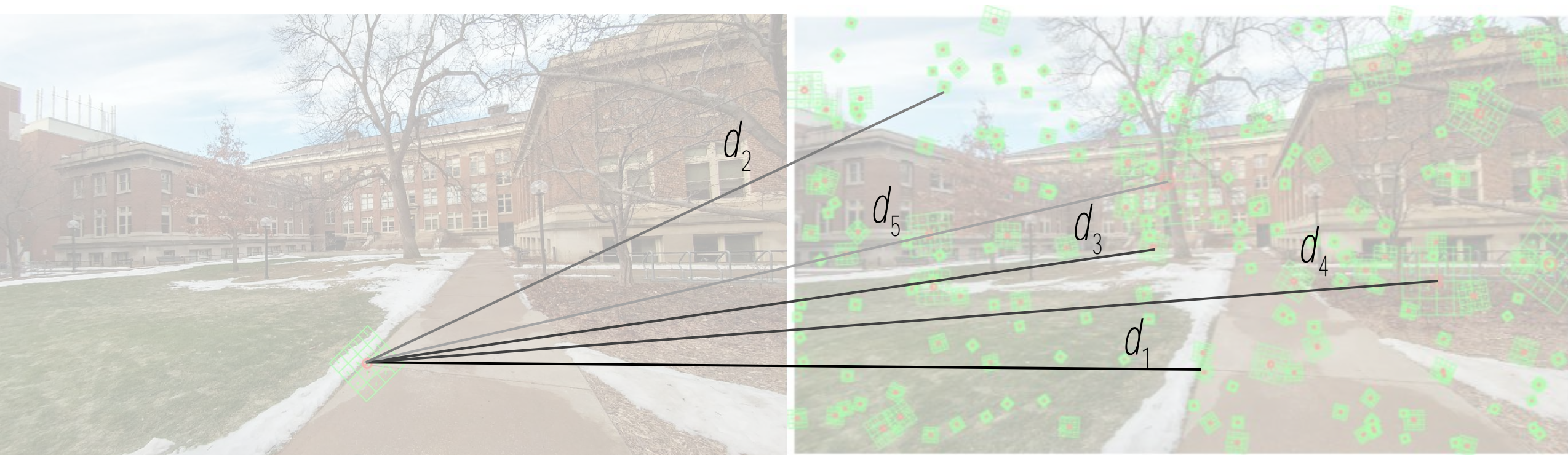
Local Scale Invariant Feature Transform (SIFT)



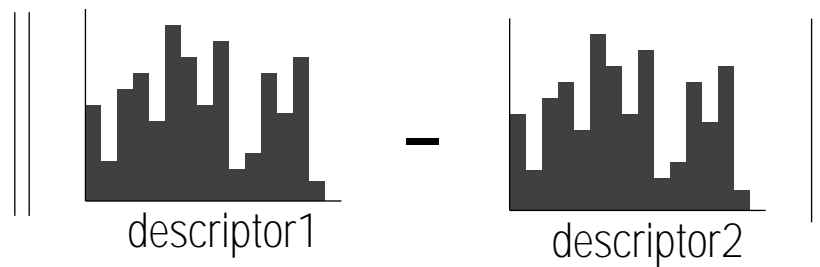
Feature match candidates



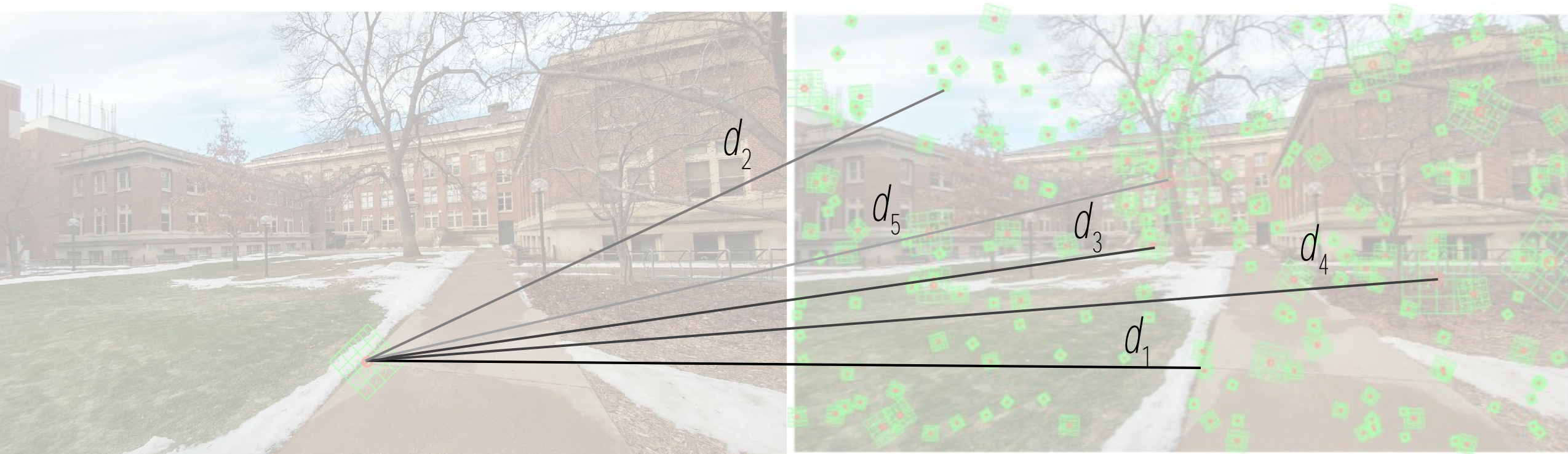
Nearest Neighbor Search



Feature match candidates



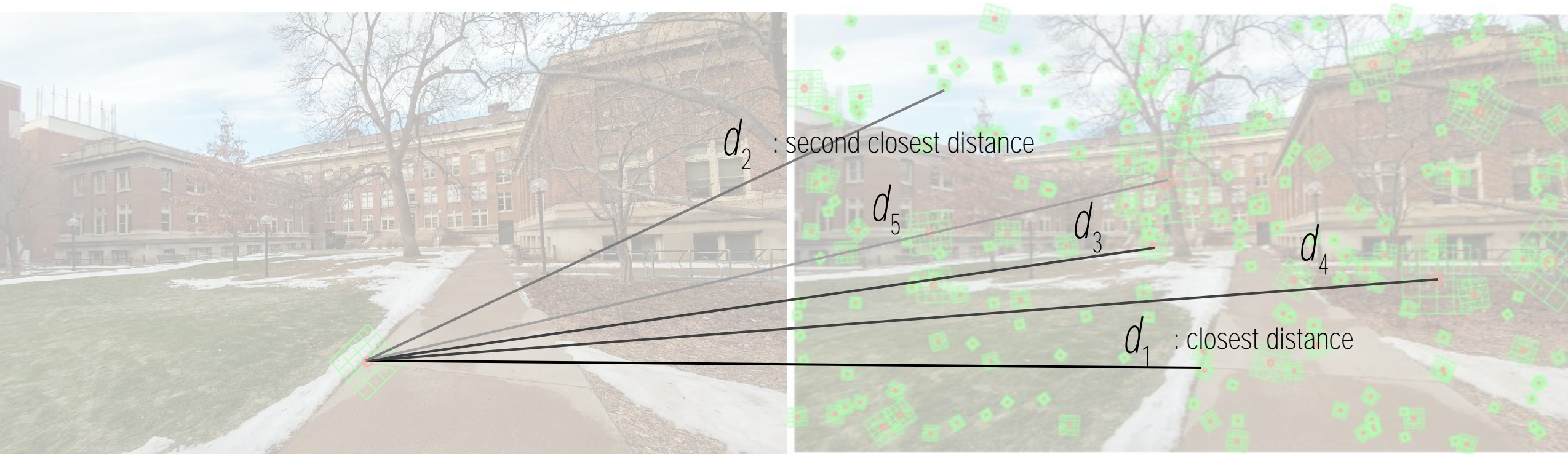
Nearest Neighbor Search



Discriminativity: how is the feature point unique?

Feature match candidates

Nearest Neighbor Search w/ Ratio Test

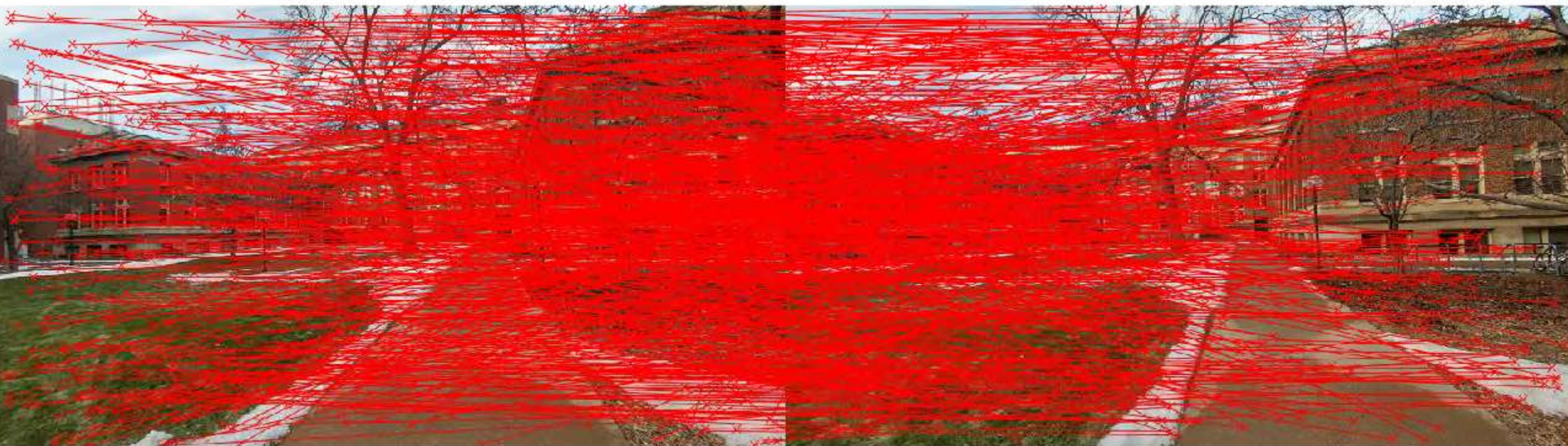


Discriminativity: how is the feature point unique?

Feature match candidates

$$\frac{d_1}{d_2} < 0.7$$

Nearest Neighbor Search w/o Ratio Test



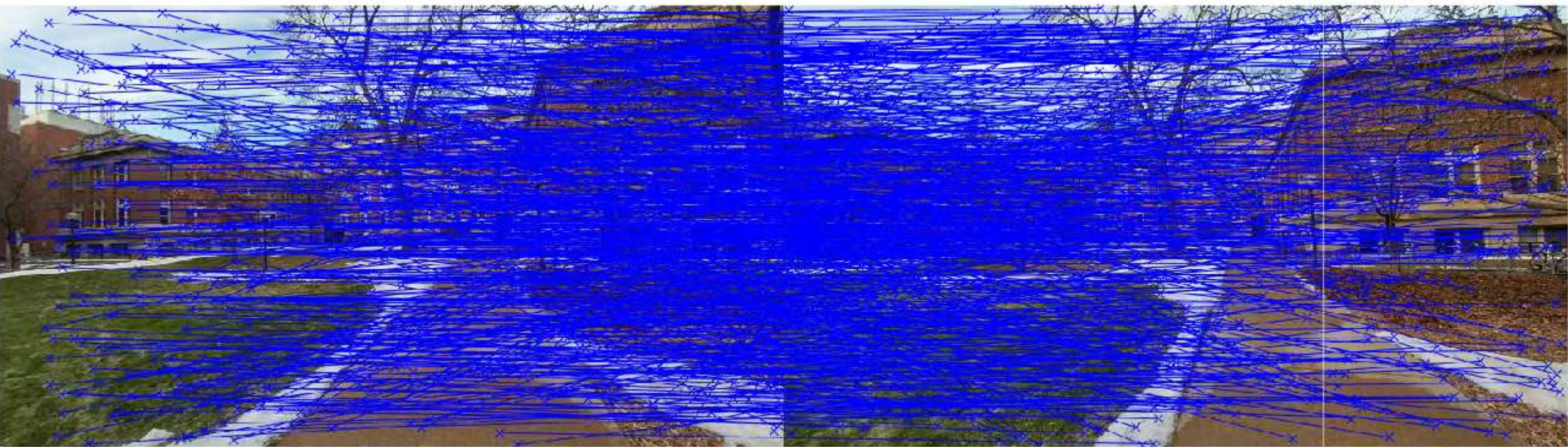
Left image → right image

Nearest Neighbor Search w/ Ratio Test



Left image → right image

Nearest Neighbor Search w/o Ratio Test



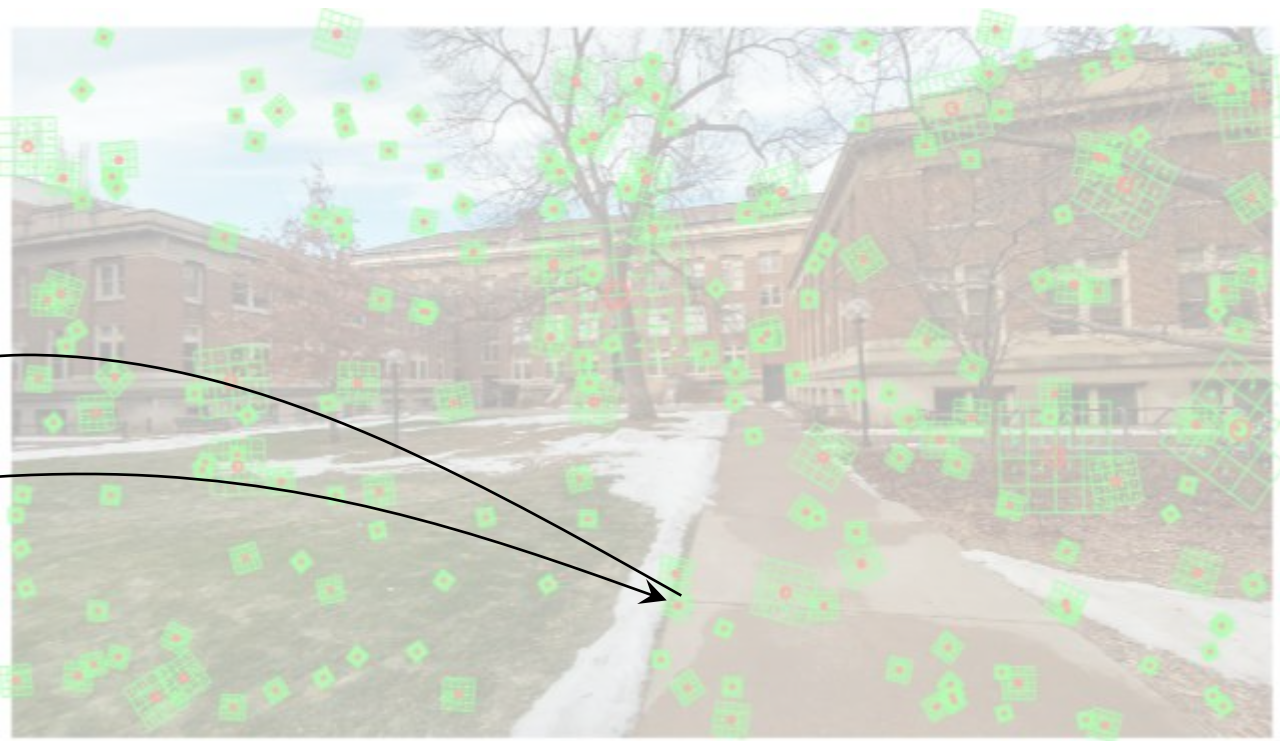
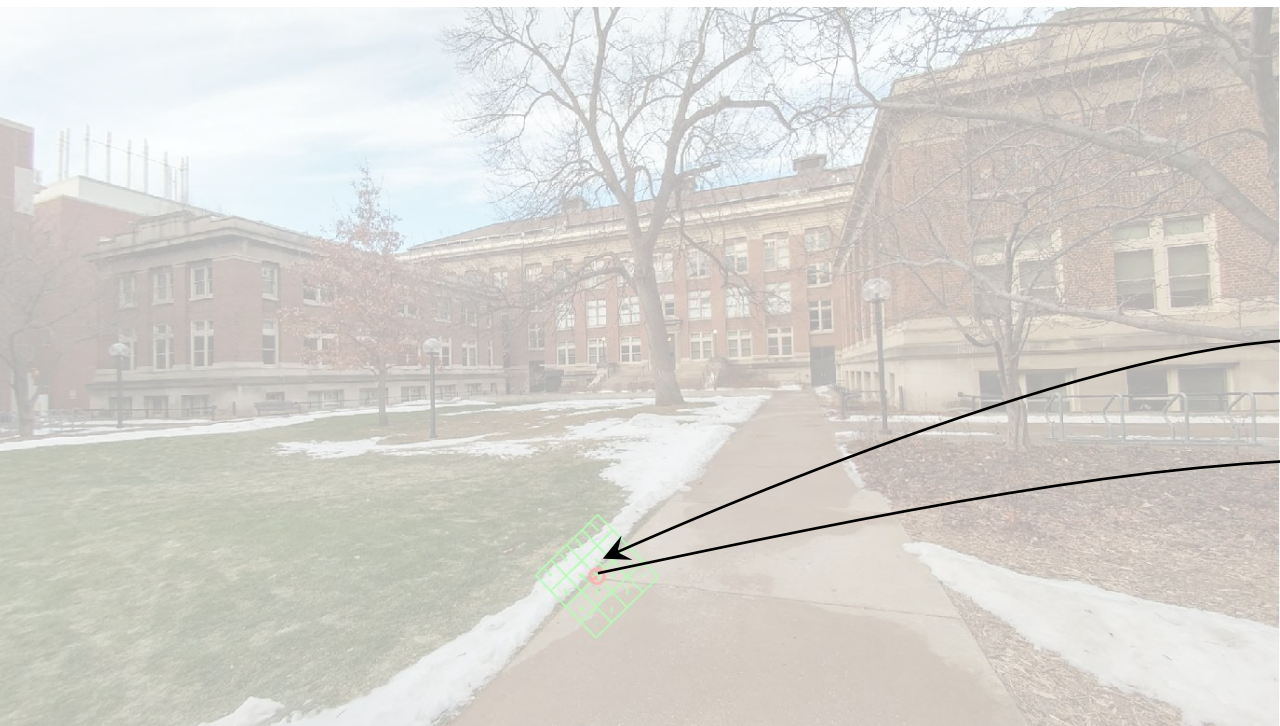
Left image ← right image

Nearest Neighbor Search w/ Ratio Test



Left image ← right image

Bi-directional Consistency Check



Consistency: would a feature match correspond to each other?

Feature match candidates

Bi-directional Consistency Check

