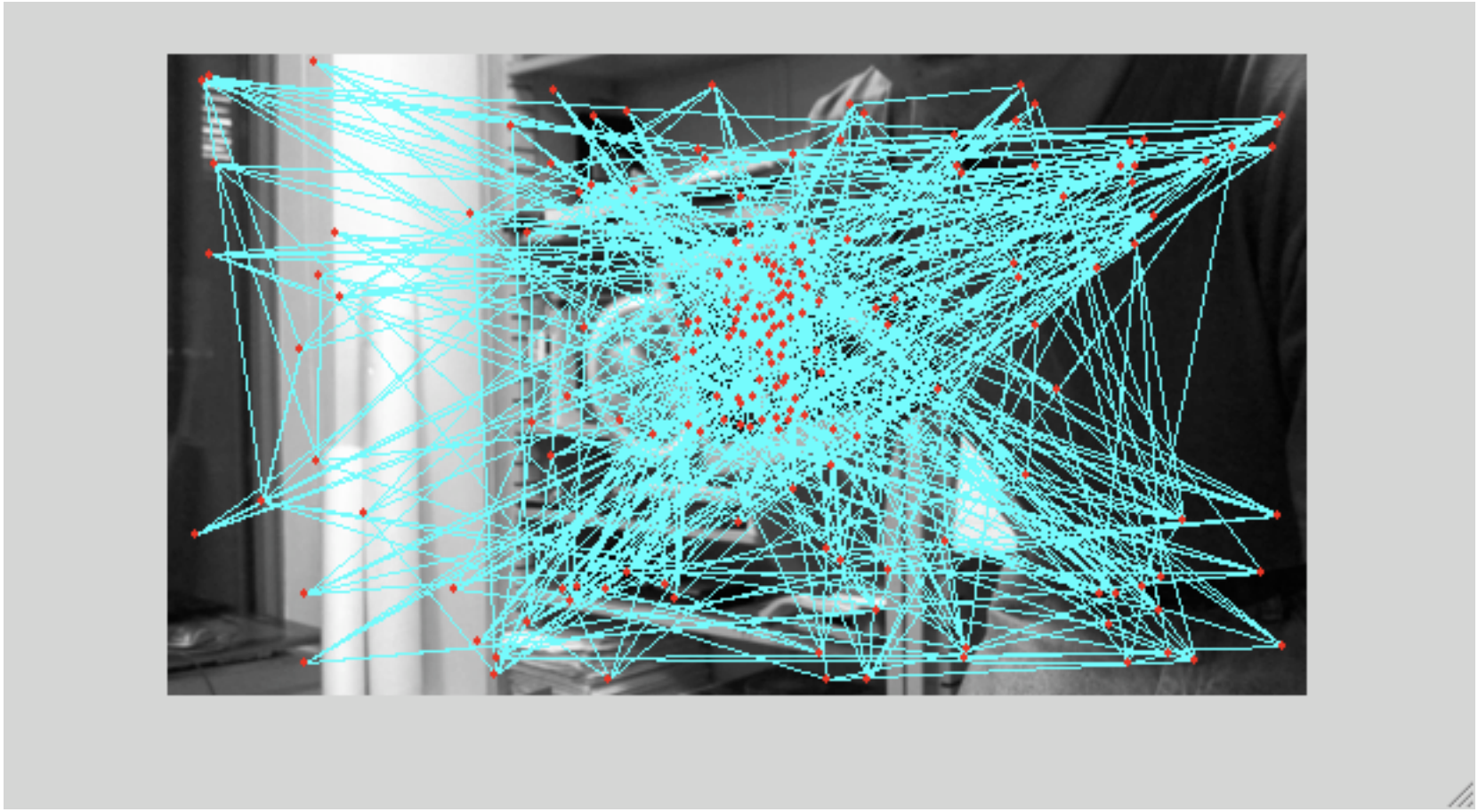
Matching SIFT

Template

Matching SIFT

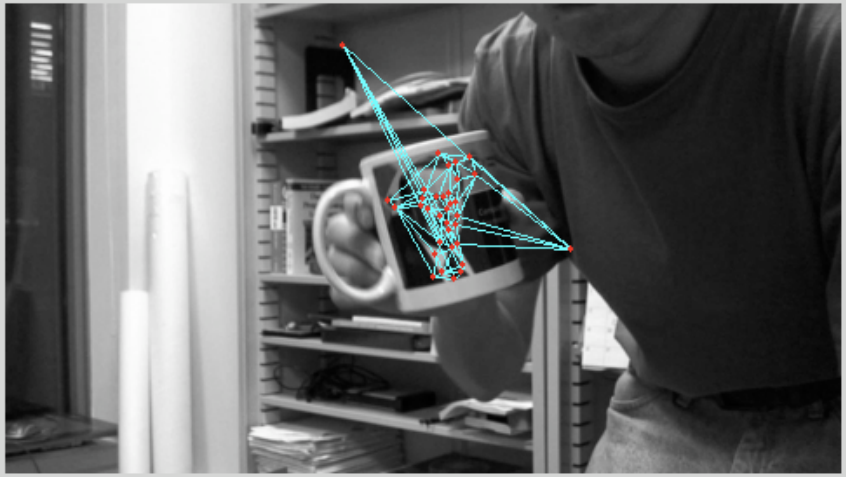
Target image

Matching SIFT Using Nearest Neighbor



Matching result

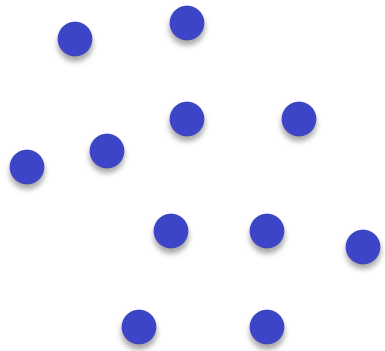
Matching SIFT Using Nearest Neighbor



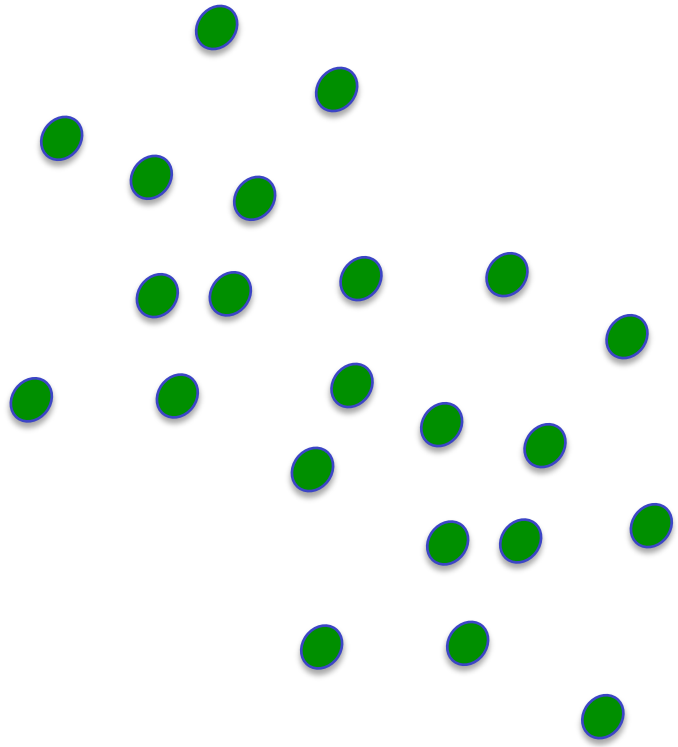
Matching points whose ratio
(best_match_cost / second_best_match_cost) < 0.7

RANSAC

- Generate matching hypothesis



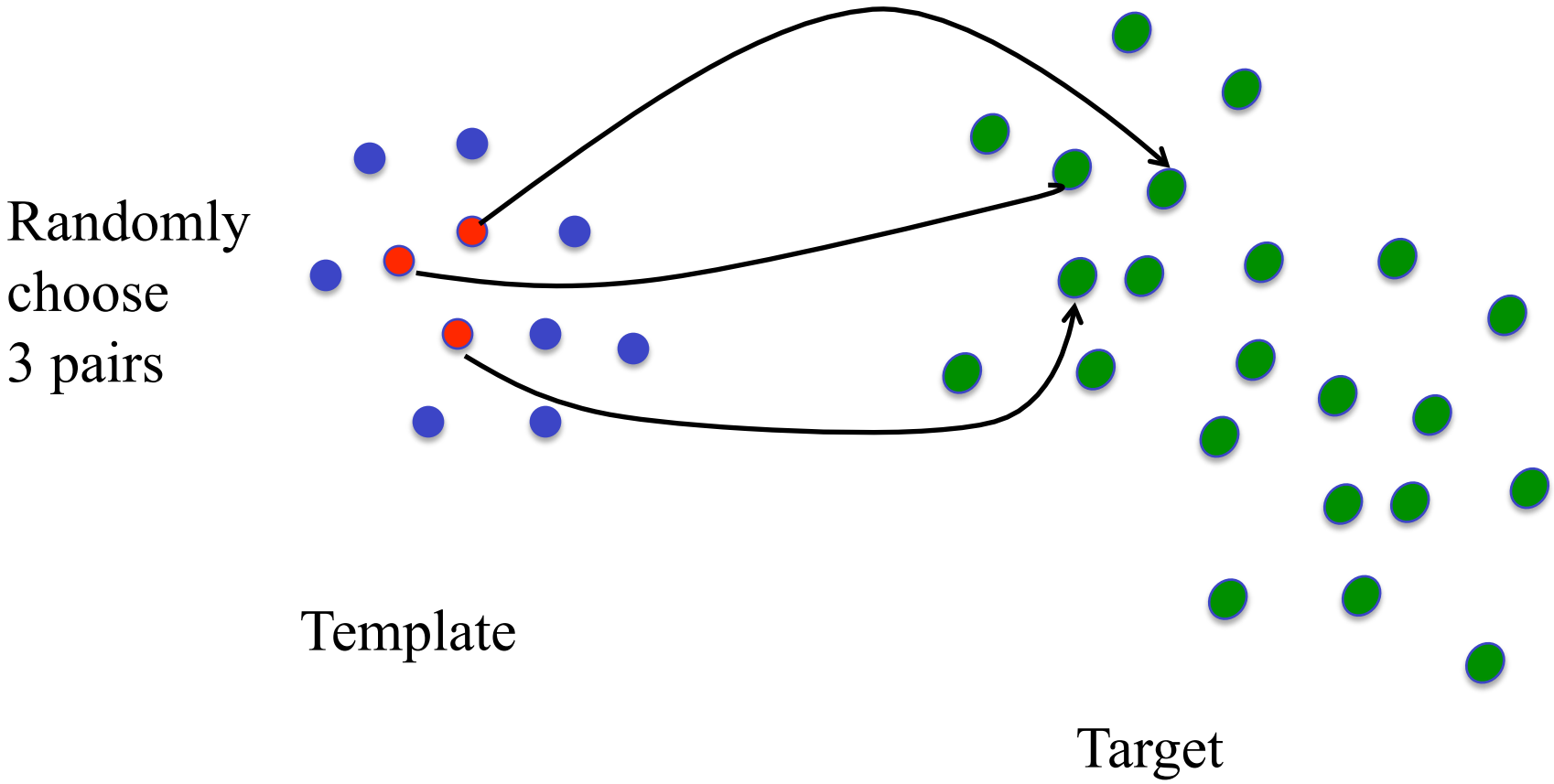
Template



Target

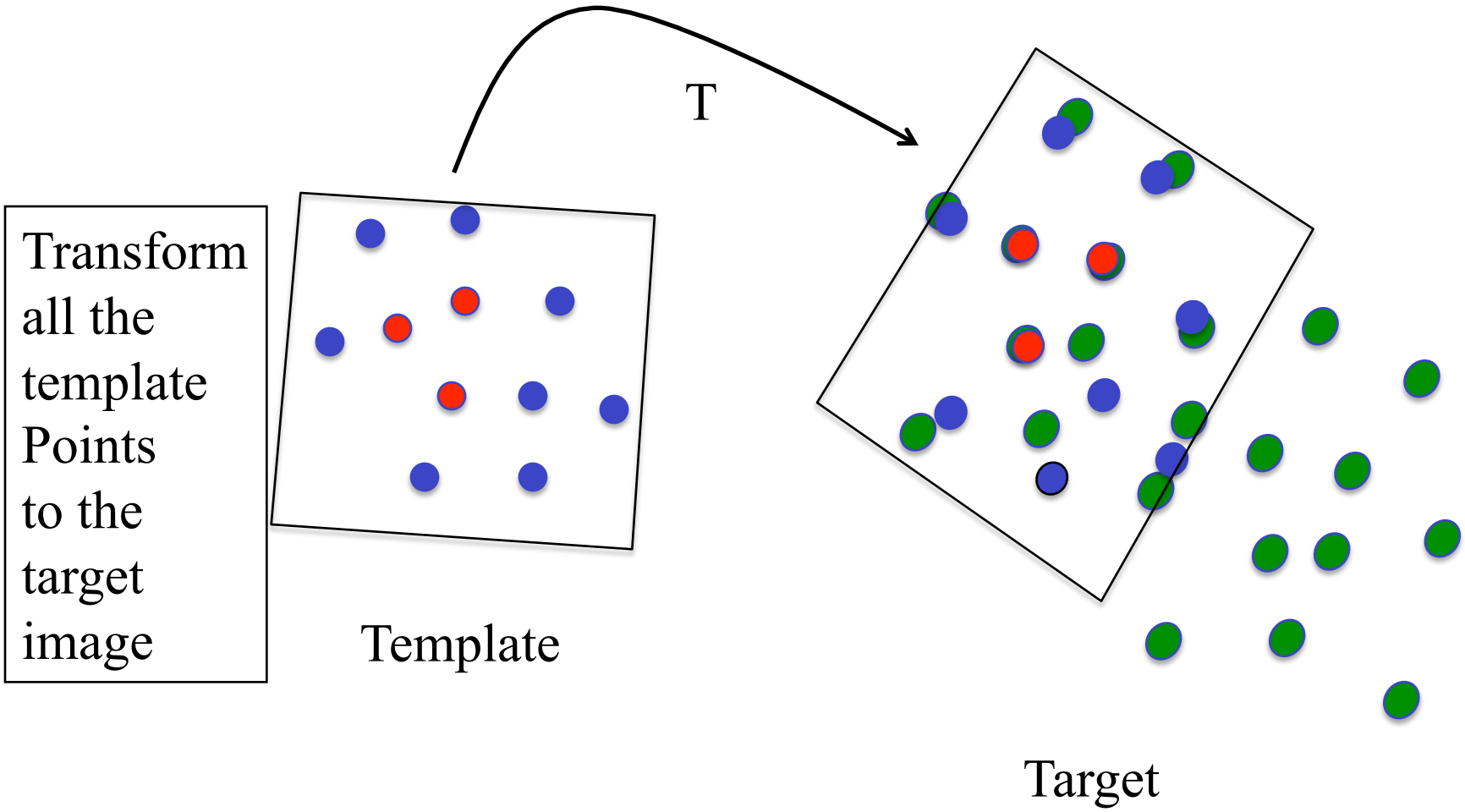
RANSAC

- Generate matching hypothesis



RANSAC

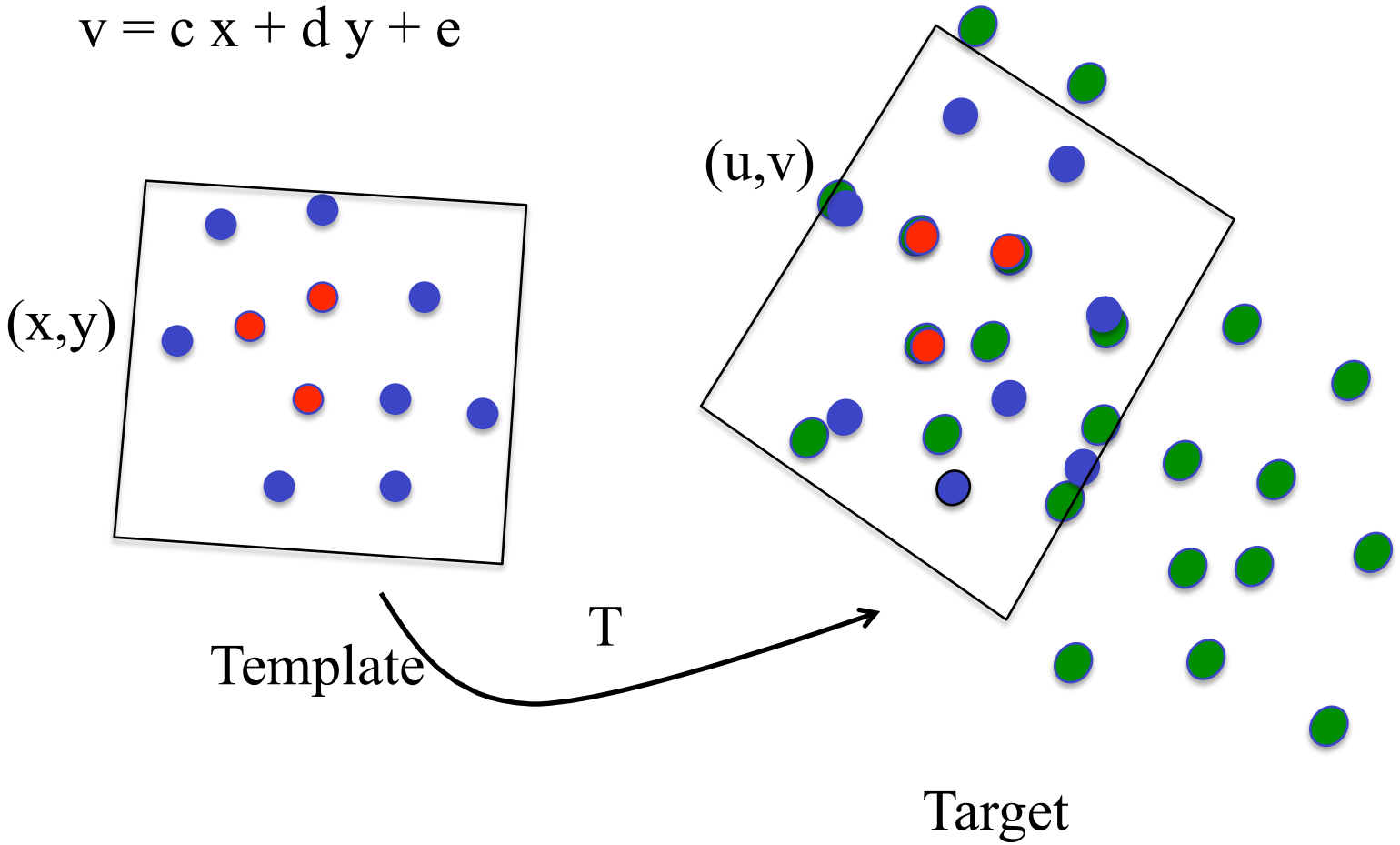
- Generate matching hypothesis



Affine Transformation

Point (x,y) is mapped to (u,v) by the linear function:

$$u = a\,x + b\,y + c$$
$$v = c\,x + d\,y + e$$



Affine Transformation

Point (x,y) is mapped to (u,v) by the linear function:

$$u = a\,x + b\,y + c$$
$$v = c\,x + d\,y + e$$

In matrix format:

$$\begin{bmatrix} u \\ v \end{bmatrix} = \begin{bmatrix} a & b \\ c & d \end{bmatrix} \begin{bmatrix} x \\ y \end{bmatrix} + \begin{bmatrix} c \\ e \end{bmatrix}$$

Affine Transformation

Point (x,y) is mapped to (u,v) by the linear function:

$$u = a\,x + b\,y + c$$
$$v = c\,x + d\,y + e$$

Using homogeneous coordinates:

$$\begin{bmatrix} u \\ v \\ 1 \end{bmatrix} = \begin{bmatrix} a & b & c \\ c & d & e \\ 0 & 0 & 1 \end{bmatrix} \begin{bmatrix} x \\ y \\ 1 \end{bmatrix}$$

Matlab

```
t = cp2tform(src_points, target_points, 'affine');
```

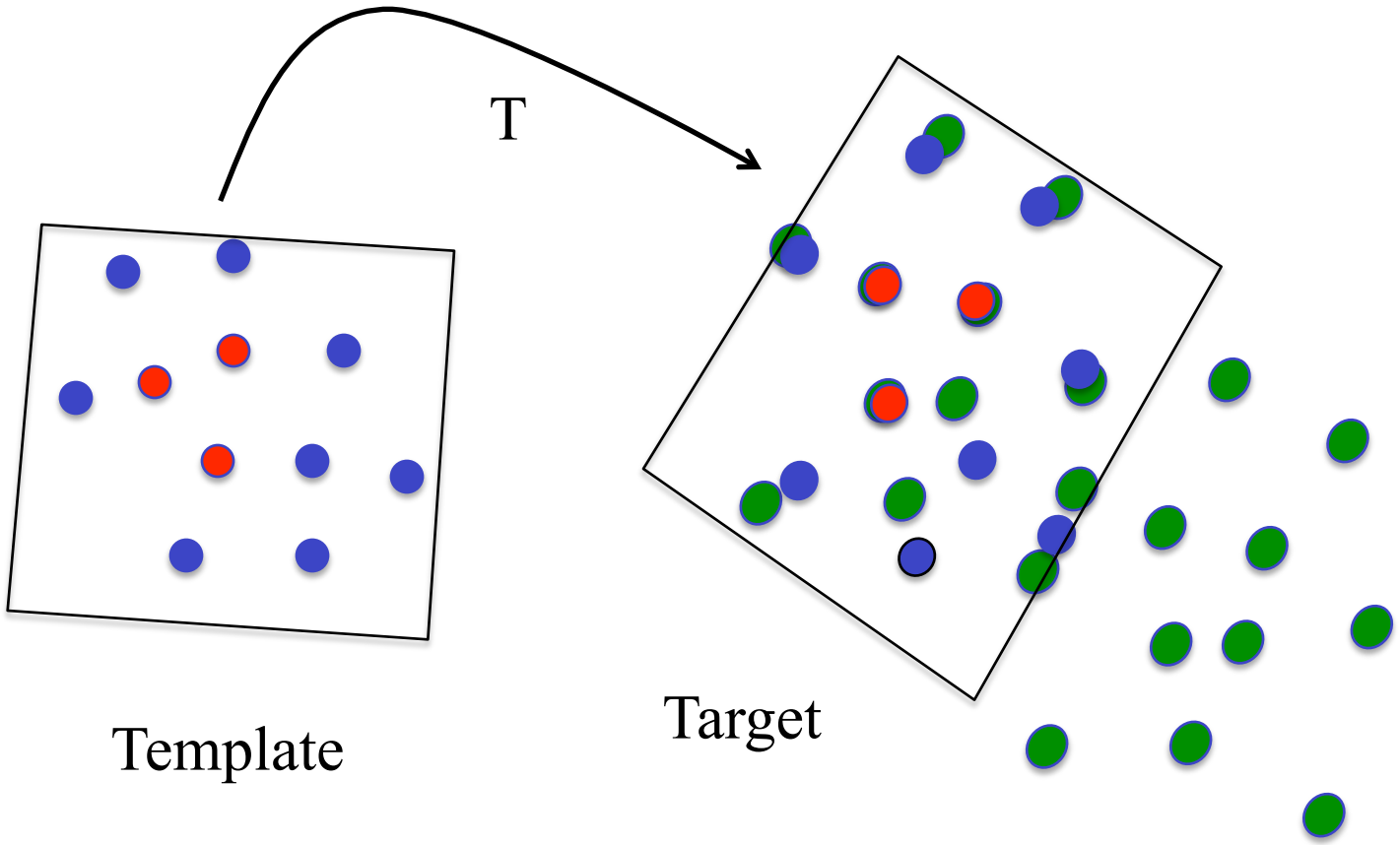
src_points: (x1 y1; x2 y2; x3 y3; …)
target_points: (u1 v1; u2 v2; u3 v3; …)

```
q = [x y 1] * t.tdata.T;  % q = [u ,v, 1]
```

Other transformations: 'similarity', 'projective'

RANSAC

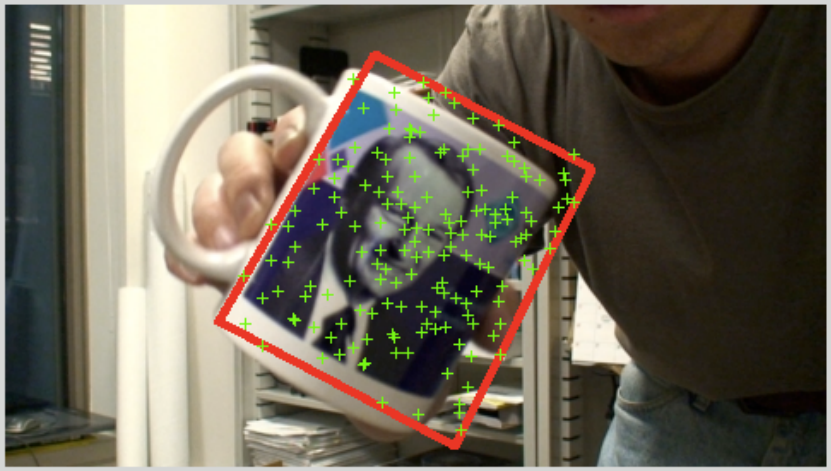
- Validation



Match points to the closes sift target points and compute the overall SIFT feature difference

Demo and Assignment Discussion

Template

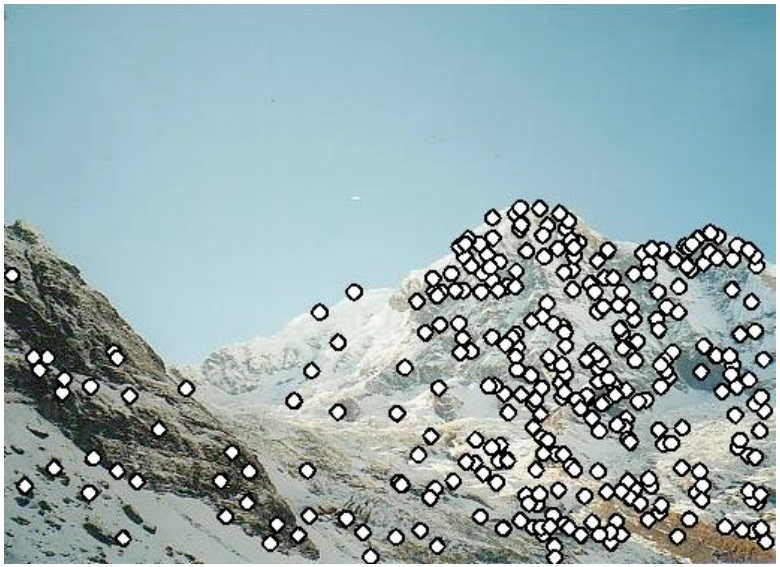


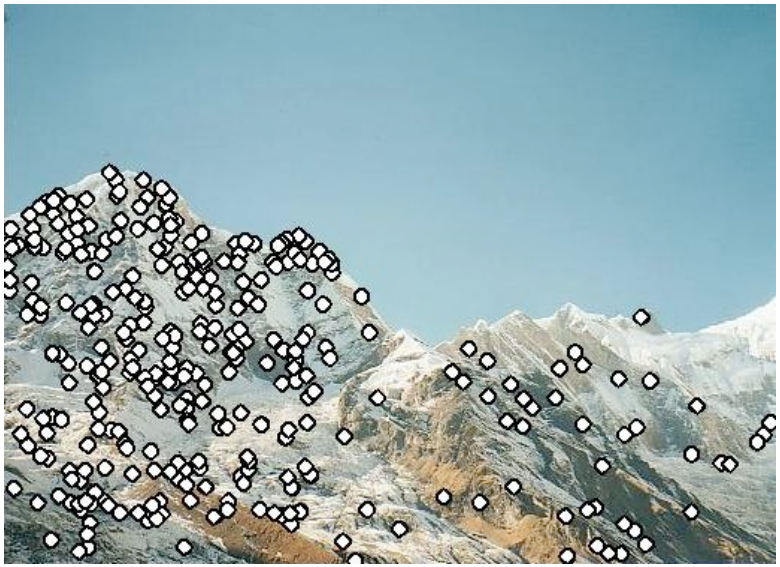
Target

Feature-based alignment outline

Source: L. Lazebnik

Feature-based alignment outline

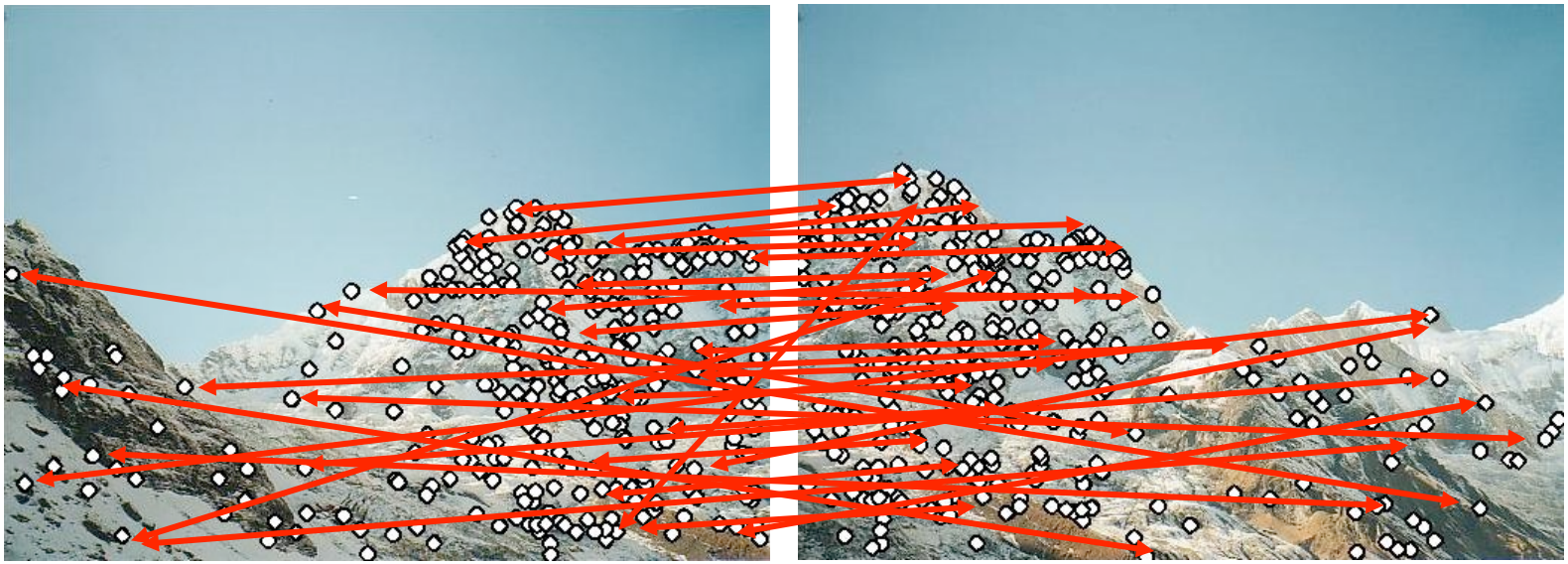




- Extract features

Source: L. Lazebnik

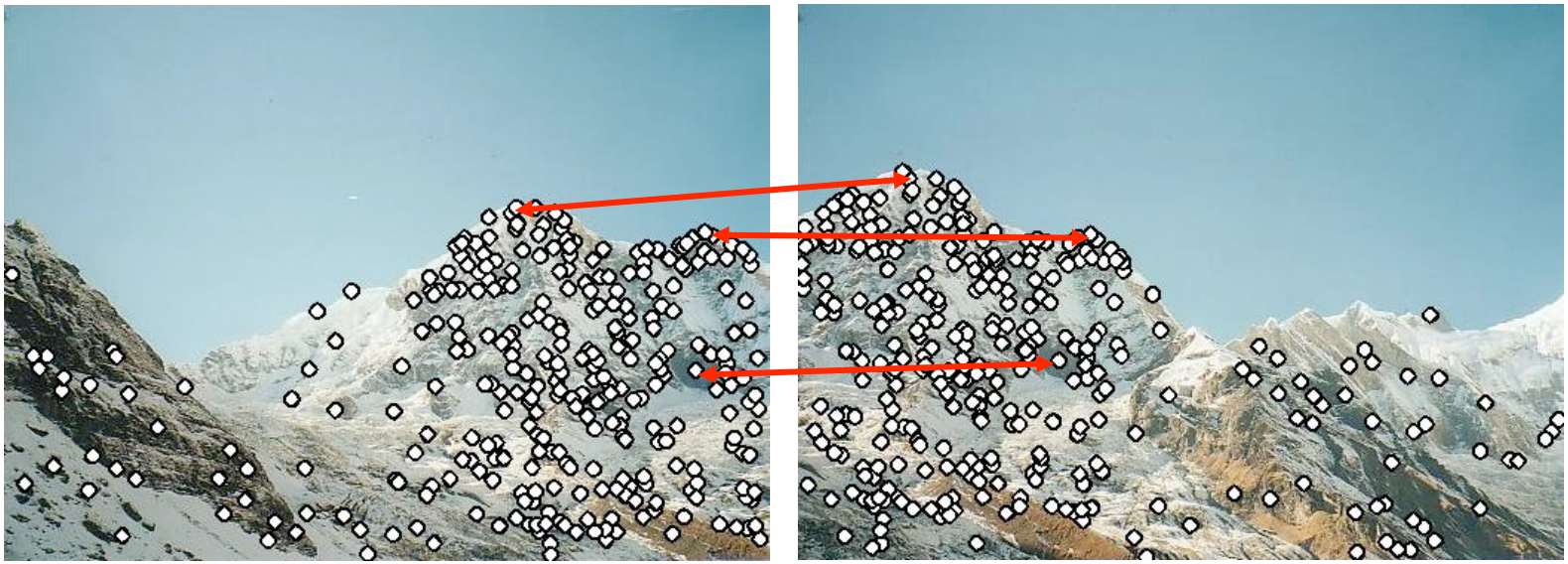
Feature-based alignment outline



- Extract features
- Compute *putative matches*

Source: L. Lazebnik

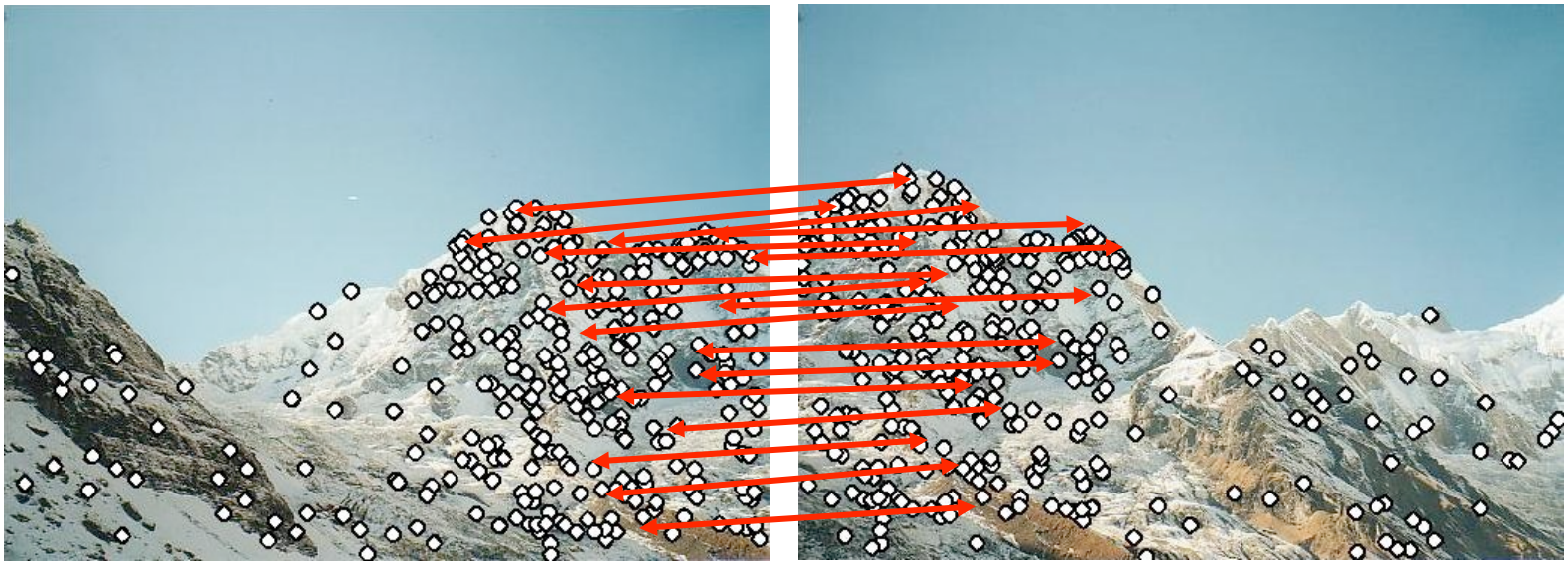
Feature-based alignment outline



- Extract features
- Compute *putative matches*
- Loop:
  - *Hypothesize* transformation *T* (small group of putative matches that are related by *T*)

Source: L. Lazebnik

Feature-based alignment outline



- Extract features
- Compute *putative matches*
- Loop:
  - *Hypothesize* transformation *T* (small group of putative matches that are related by *T*)
  - *Verify* transformation (search for other matches consistent with *T*)

Source: L. Lazebnik

Feature-based alignment outline

- Extract features
- Compute *putative matches*
- Loop:
  - *Hypothesize* transformation *T* (small group of putative matches that are related by *T*)
  - *Verify* transformation (search for other matches consistent with *T*)

Source: L. Lazebnik