Feature Matching: Handling Ambiguity in Matching

Course 3, Module 2, Lesson 3 – Part 2

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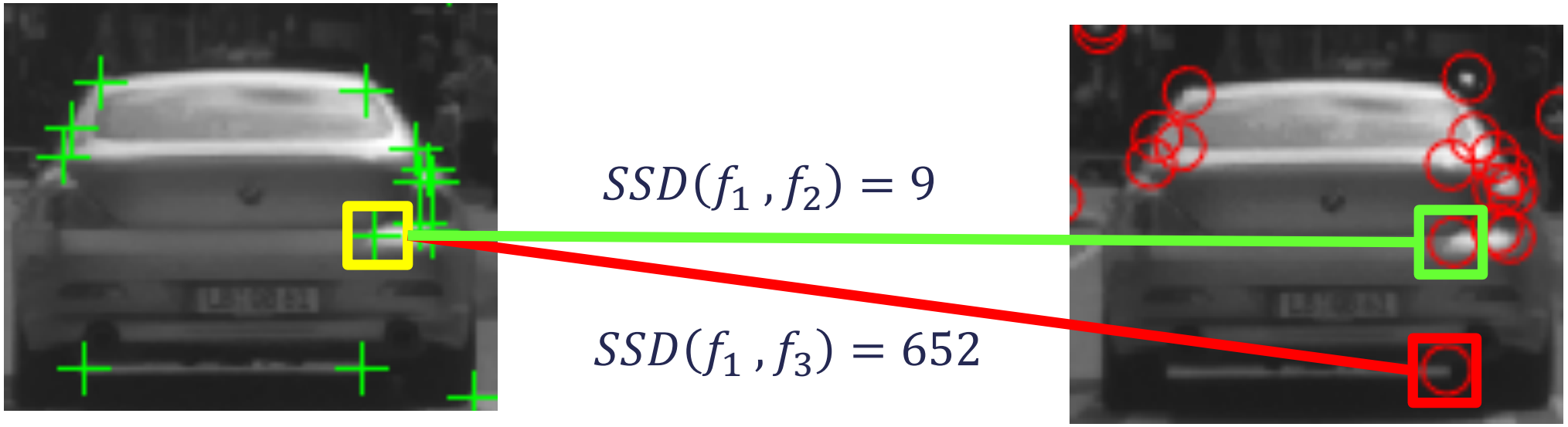
Learning Objectives

- Learn what consists an ambiguous match
- Learn how to handle ambiguous matches through the distance ratio

Brute Force Feature Matching: Case 1

$f_1 = [10, 34, 23, 55]$

$f_2 = [10, 37, 23, 55]$

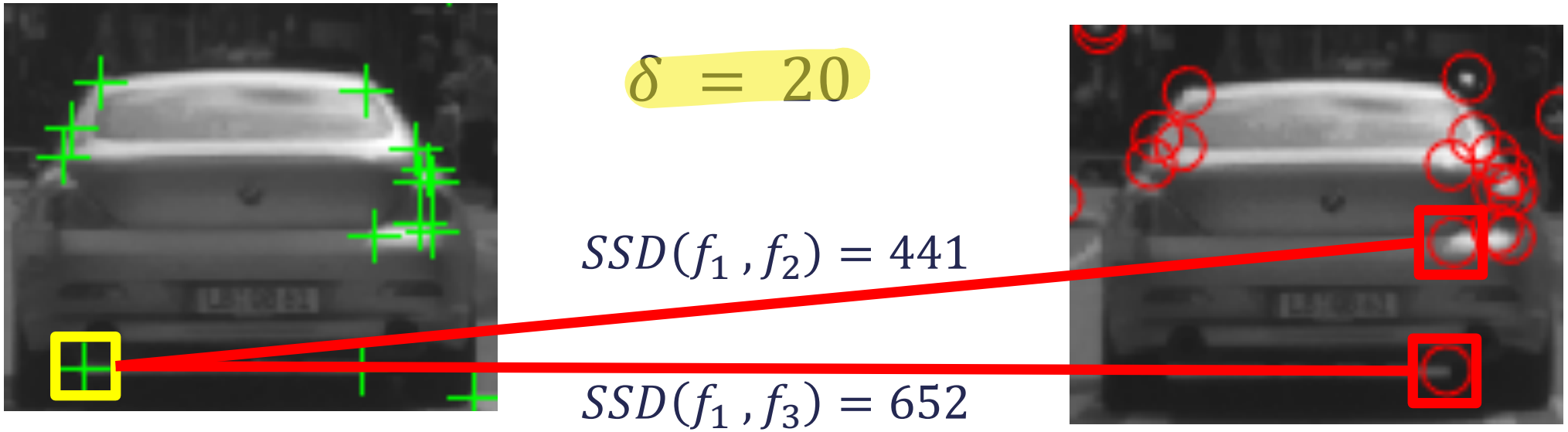


$f_3 = [9, 35, 12, 32]$

Brute Force Feature Matching: Case 2

$f_1 = [10, 34, 23, 55]$

$f_2 = [10, 13, 23, 55]$



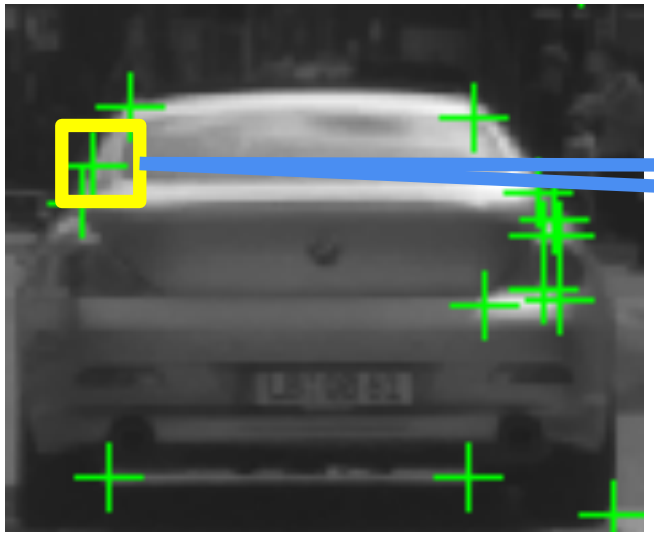
$f_3 = [9, 35, 12, 32]$

Brute Force Feature Matching: Case 3

$f_1 = [10, 34, 23, 55]$

$f_2 = [10, 31, 23, 55]$

$\delta = 20$



$SSD(f_1, f_2) = 9$

$SSD(f_1, f_3) = 9$

?

$f_3 = [7, 34, 23, 55]$

Distance Ratio [Lowe 1999]

1. Compute $d(f_i, f_j)$ for each feature, f_i, with all features, f_j, in image 2
2. Find the **closest** match f_c
3. Find the **second closest** match f_s
4. Find how **better** the closest match is than the second closest match. This can be done through **distance ratio**:

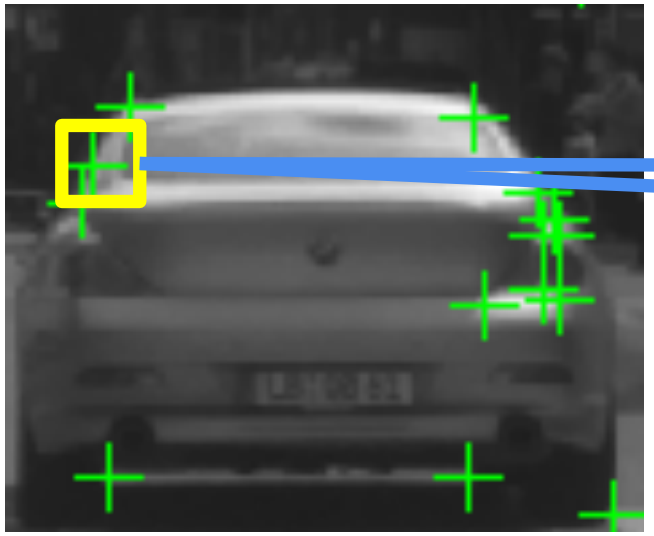
$$0 \leq \frac{d(f_i, f_c)}{d(f_i, f_s)} \leq 1$$

Brute Force Feature Matching: Updated

- Define a distance function $d(f_i, f_j)$ that compares the two descriptors
- Define distance ratio threshold $\boldsymbol{\rho}$
- For every feature f_i in Image 1:
  1. Compute $d(f_i, f_j)$ with all features f_j in image 2
  2. Find the closest match f_c and the second closest match f_s
  3. Compute the distance ratio $\frac{d(f_i, f_c)}{d(f_i, f_s)}$
  4. Keep matches with distance ratio $< \boldsymbol{\rho}$

Brute Force Feature Matching: Case 3

$f_1 = [10, 34, 23, 55]$ $\rho = 0.5$ $f_2 = [10, 31, 23, 55]$



$SSD(f_1, f_2) = 9$

$SSD(f_1, f_3) = 9$

$$Distance\ Ratio = \frac{SSD(f_1, f_2)}{SSD(f_1, f_3)} = 1$$

$f_3 = [7, 34, 23, 55]$

Summary

- Ambiguous matches are features in the first image that have a similar distance to two or more features in the second image.
- Ambiguous matches can be handled by computing a **distance ratio,** and making sure this ratio is lower than a predefined threshold for all of our matches.

- **Next: Outlier Rejection**