Recognition of panorama parts using OpenCV

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Task

- The task from contest Yandex Internet Mathematics 2011
- Development in C++

Input data

series of 5 panoramic images JPG, 300x300 px colored

6000 sets

Output

list of inappropriate images for each series

Series processing

- Evaluation of 'similarity metric' for each pair of images in the series → similarity matrix
- 2 similarity metrics
- Using similarity matrix to distinguish the images that belong to one panorama

- Images are loaded as grayscale
- Multithreaded series processing

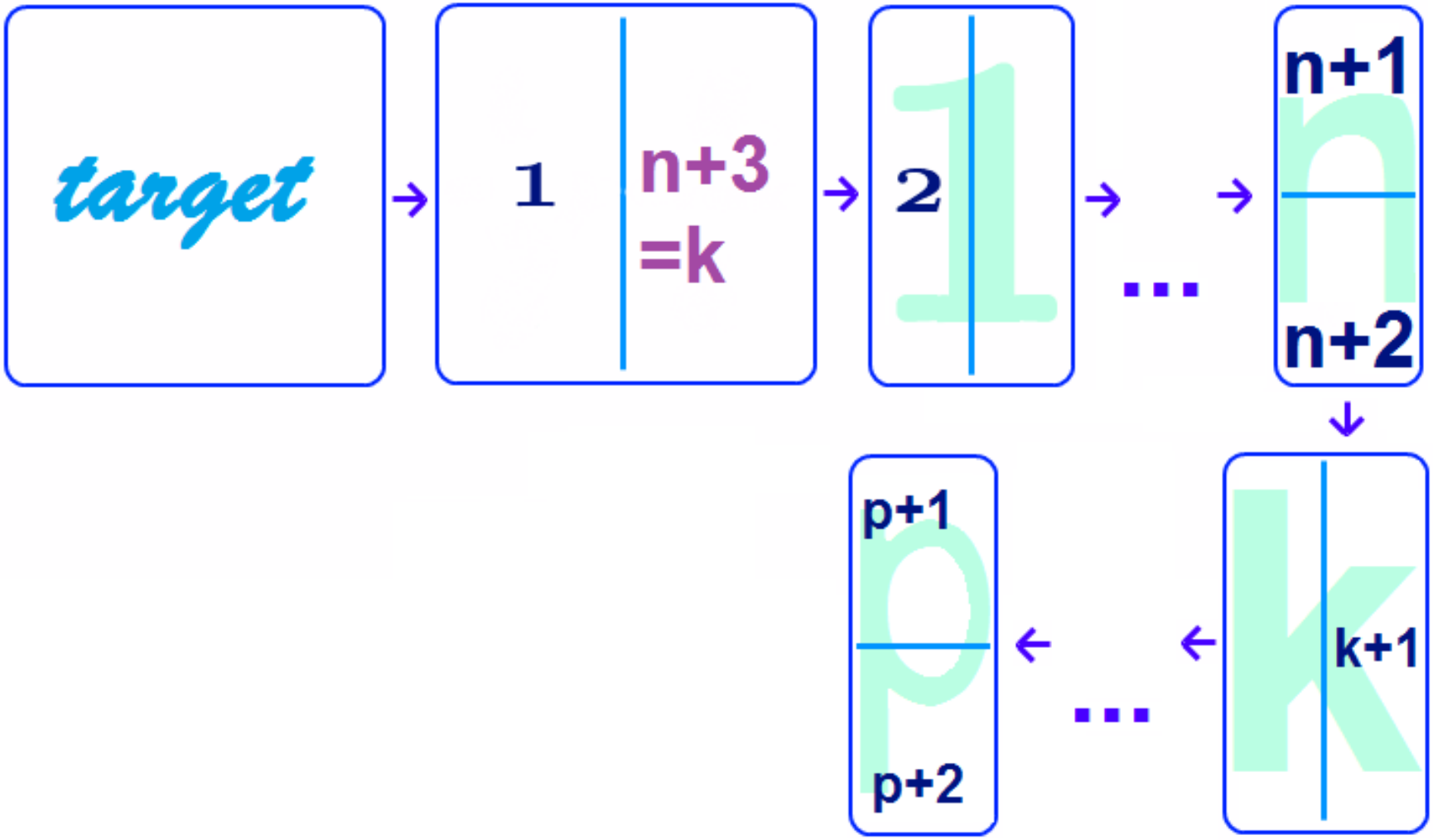
Metric 1: Template matching

- Evaluation of similarity % for each pair (image1 := source, image2 := target)
- The segments of target are searched in the source
- Similarity coefficient K(source, target)

$$K(source, target) = \sum_{segments} S_i \cdot K(source, segment_i)$$

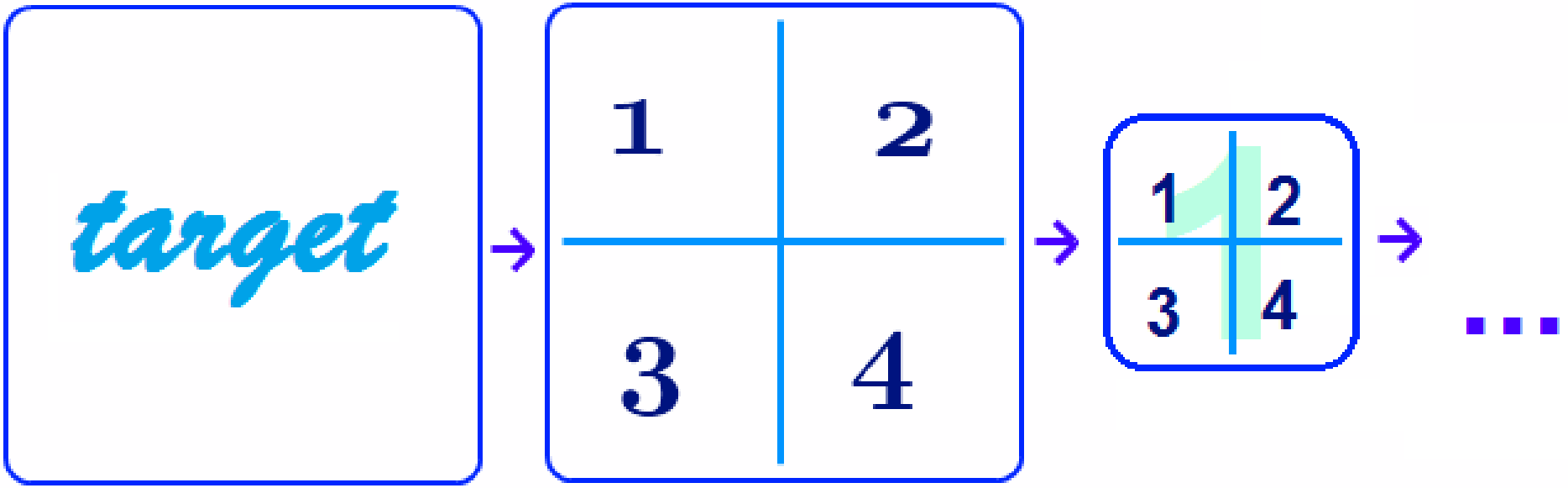
- K(source, segment) is evaluated with OpenCV::matchTemplate
- 2 approaches for target-into-segments division

Approach 1

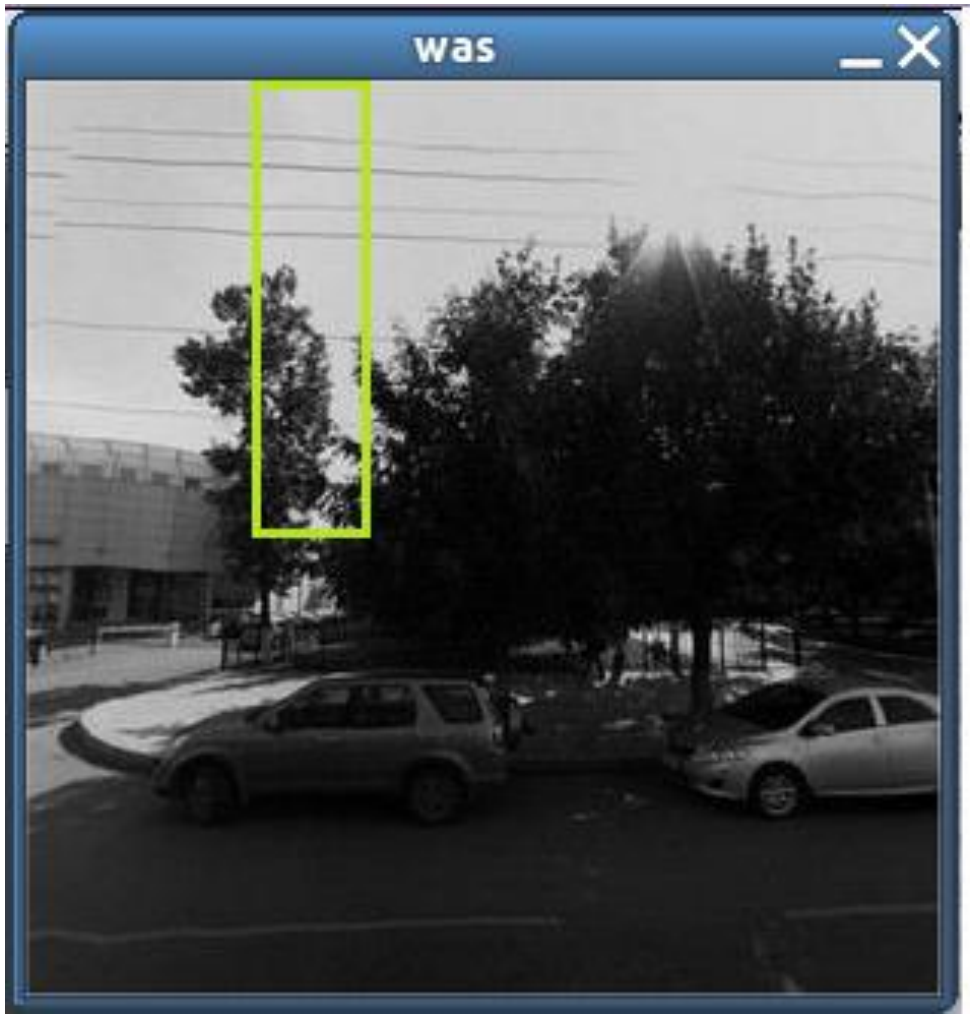


Outstanding sets

Approach 2



OpenCV::matchTemplate faults



Fragments match 80.36%

Solution

K (lefts) = 50.31%
K (rights) = 49.86%

< 75%

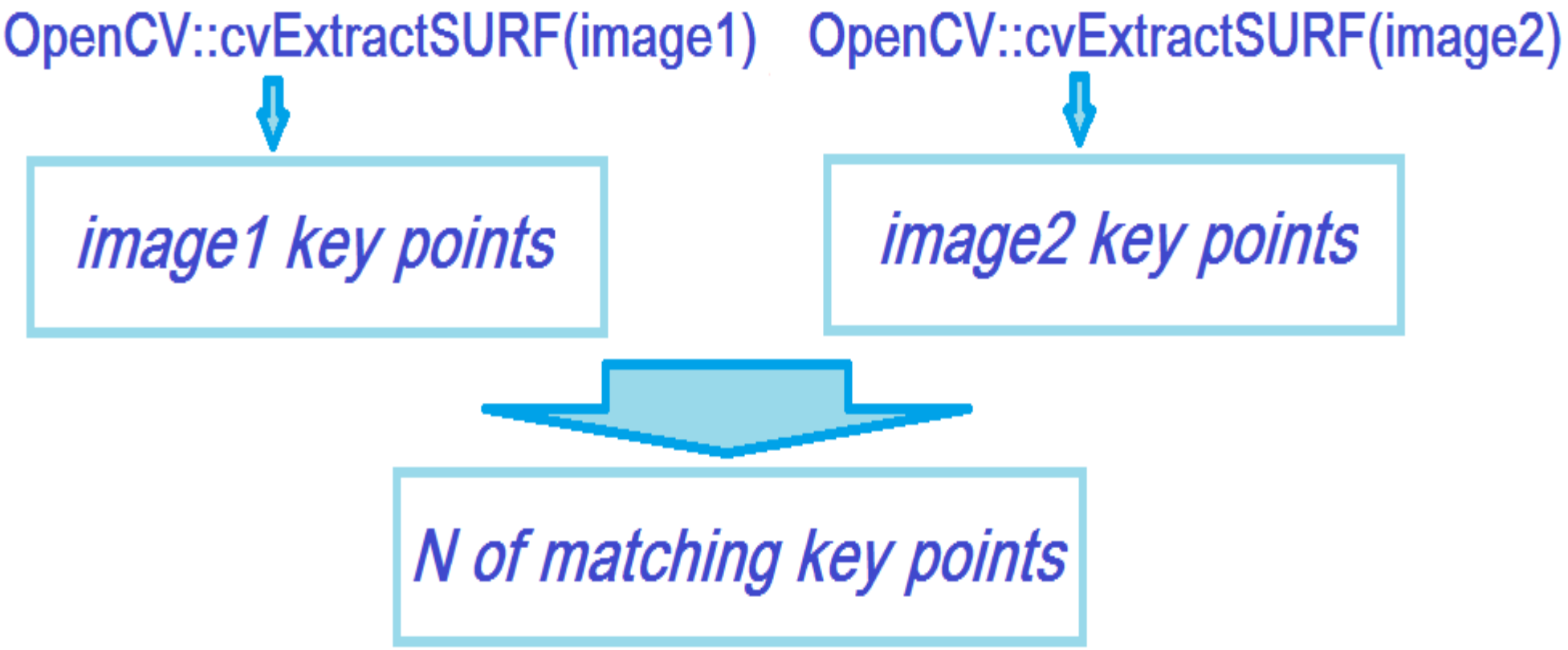
Shortcomings

- Asymmetry of similarity matrix: $K(i, j) \neq K(j, i)$
- High sensitivity to noise objects
- High sensitivity to perspective transformation

Metric 2 : SURF

Speeded Up Robust Features

matching key points on images



Shortcomings

- Different objects→ different key points
- High sensitivity to point of view change
- High sensitivity to illumination level

Classification

Matrix
m 5x5

metrics values

*map<int, vector<int>> **matches***
for each image -
vector of matching to it

*vector<int> **passValue***
metrics pass value for each image

the 1st series = a group of matches with max passValue

Processing of images, not included in 1st series:

check: can the j image be added
to the series containing i image

m[i][j]>passValue[i]
AND
m[i][j]>passValue[j] ?

Results

- Classification using template matching
  - 86.1%
- Classification using SURF
  - 92.6%

Future development

- Use a combination of approaches
- Metric based on color fingerprint

Thank you!

Q&A