

Particle filter based template matching

谢翠芳

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1. Experiment condition

The aim of this experiment is to make sure the idea of combining particle filter and template matching is possible. 'Possible' means we can match the template with targets in limited number of points and iterations. All we have is a target's template and an image. The template is curved directly from the image. And the image includes the target because of the experiment aim.

We tested the above method in two couples of templates and images. One image has size of 960*448, the other has the size of 360*240. And the result of the 960*448 sized image will be discussed in detail.

2. Method

1. Sample points in the image, and calculate the feature for the certain number of sampled points.
2. Arrange weights for the sampled points according to the distance between features of the template and the points.
3. Re-sample same number of points according to the points' weights.
4. Repeat the above steps several times(the iteration depends on the number of sampled points).

The complexity of the method mainly depends on the number of sampled points and the iteration times. While the iteration times depend on the number of sampled points.

3. Results of the 960*448 image

The matching feature is color histogram for all experiments.

When iteration is 5, do the same experiment for 10 times. The number of right-matching versus with number of sampled points.

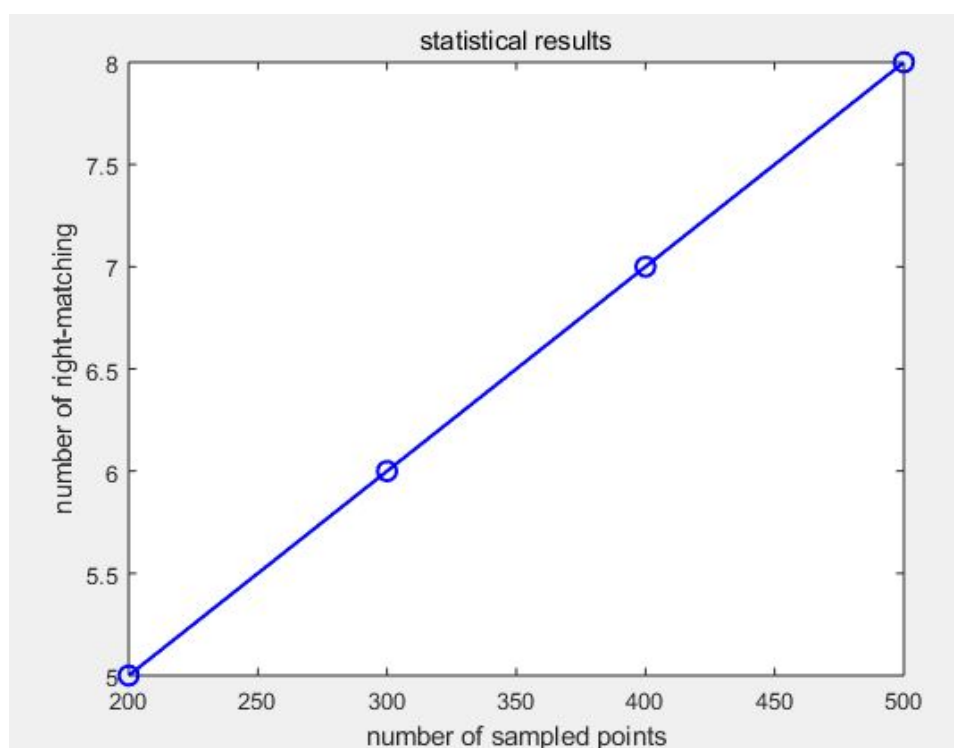


Figure 1: right-matching versus number of points

From figure 1, it is obvious that the number of right matching increases along with the number of sampled points.

When number of sampled points is 300, do the same experiment for 10 times. The number of right-matching versus with number of iteration.

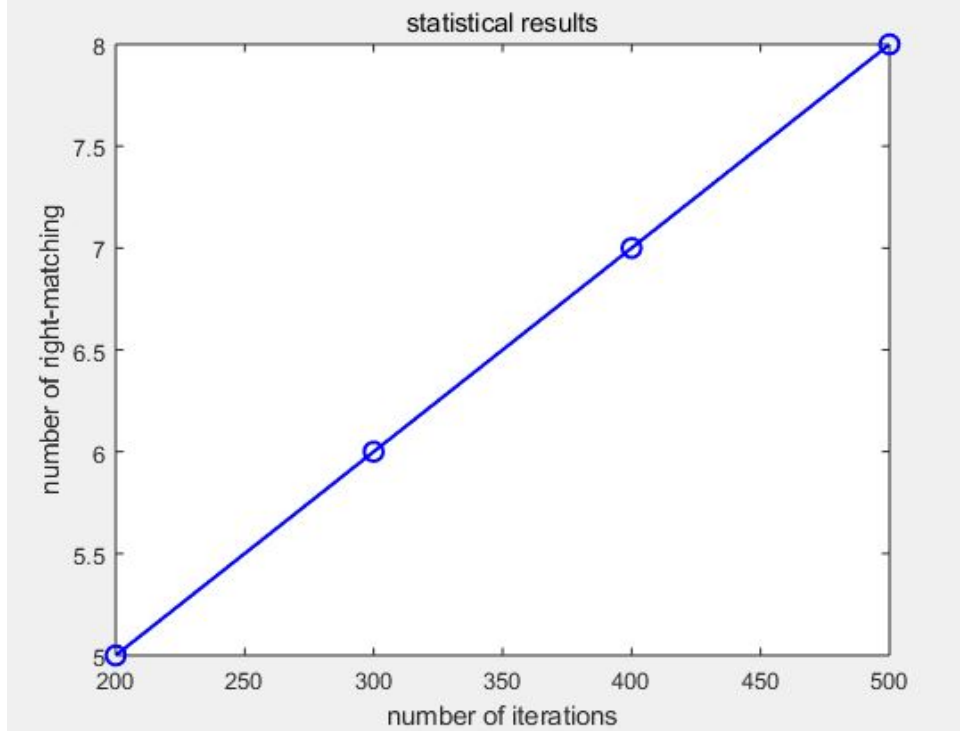


Figure 2: right-matching versus number of iteration

Figure 2 shows that the number of right matching increases if iteration times increase.

Figure 1 and figure 2 show like the number of right matching and the number of sampled points(or iterations) are proportional. And when the number of sampled points is large enough, the probability of right-matching is high.

The raw results are in the appendix.

4. Unsolved problems

1. The size of template and image target should be similar in the experiment. Next step, different size template and preprocessing of images should be considered. And preprocessing
2. How to decide the number of particles? After solving the 'size problem', particle number will be considered. Especially the relationship with the size of template and size of images.
3. Threshold of judging whether there is a target is not discussed in this experiment.

4. Feature used for calculating the distance between template and image is capable to be chosen. So the influence of features should also be discussed in following experiments.

5. Appendix

The details of the image match are enlarged.

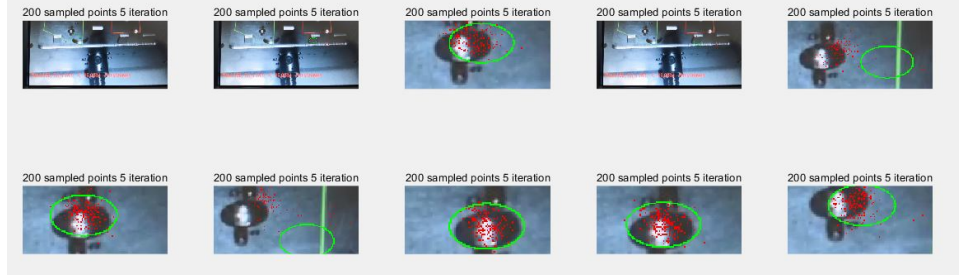


Figure 3: number of right matching with 200 particles and 5 iterations

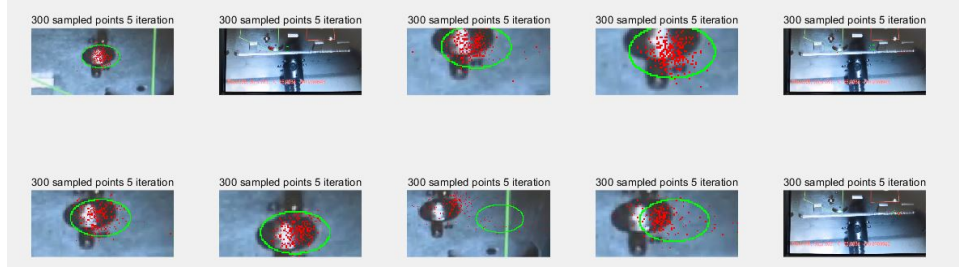


Figure 4: number of right matching with 300 particles and 5 iterations

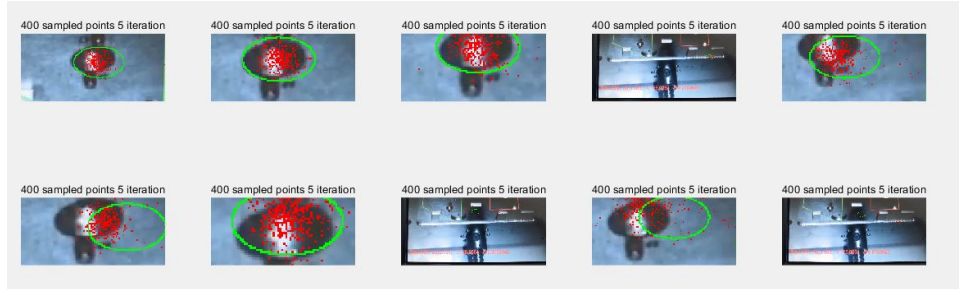


Figure 5: number of right matching with 400 particles and 5 iterations

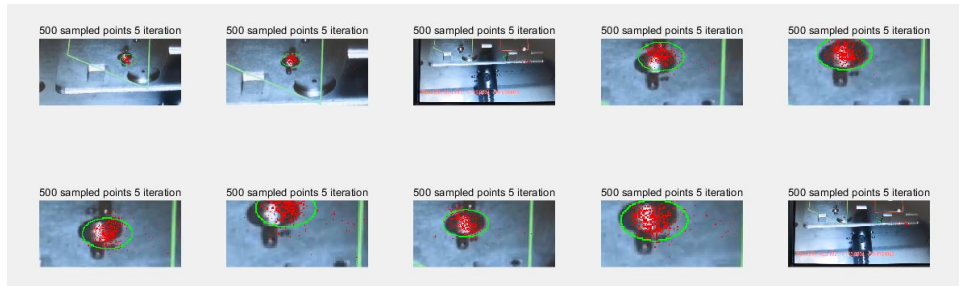


Figure 6: number of right matching with 500 particles and 5 iterations

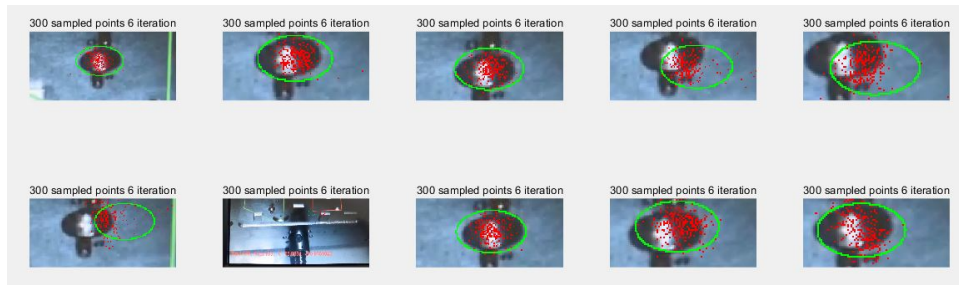


Figure 7: number of right matching with 300 particles and 6 iterations

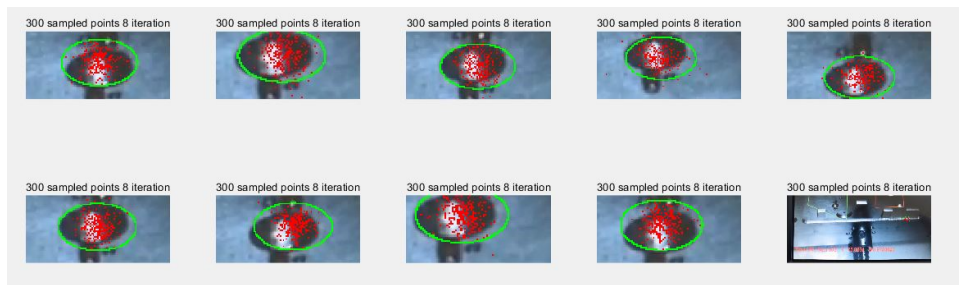


Figure 8: number of right matching with 300 particles and 8 iterations

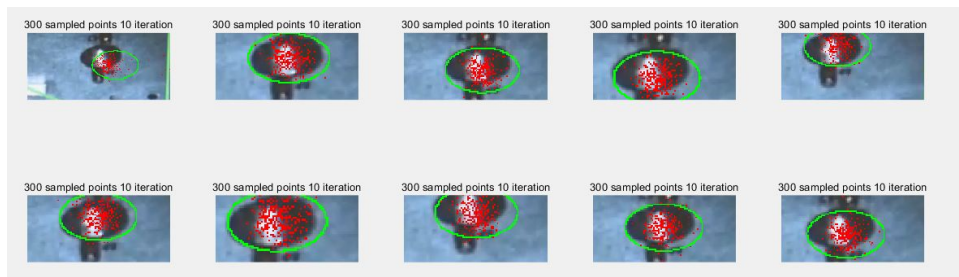


Figure 9: number of right matching with 300 particles and 10 iterations