ICMMA 2020 International Conference on
“Design of Comfortable Life using Mathematical Sciences"

Development of image-based tracking software for animal tracking (2)

YAMANAKA Osamu （Meiji University, MIMS）

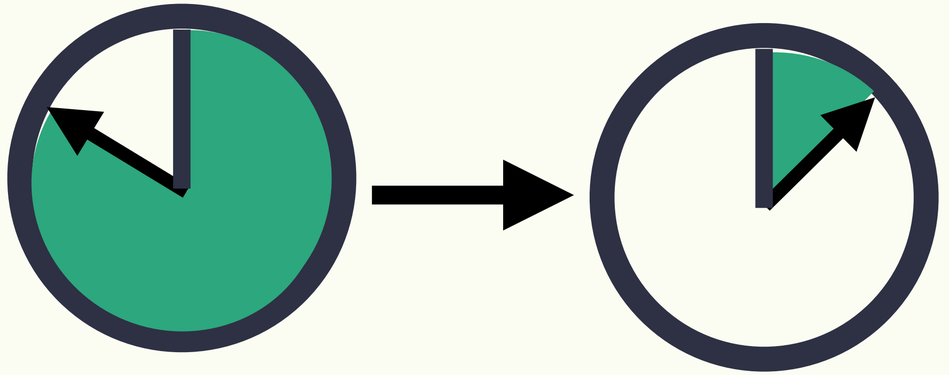
To quantitatively investigate the movement of animals, image-based tracking software are used as valuable tools. Ordinarily tracking software consist of manual tracking tool and automatic tracking tool. Manual tool is time-consuming for the operation, and fully automatic tracking tool strongly limits the experiment conditions. Thus, we developed a semi-automatic tracking software. In this poster, I will explain the features of our software and actual cases of use.

Project Webpage

UMATracker

http://ymnk13.github.io/UMATracker/

Improving the operation efficiency in the analysis of animal behavior.

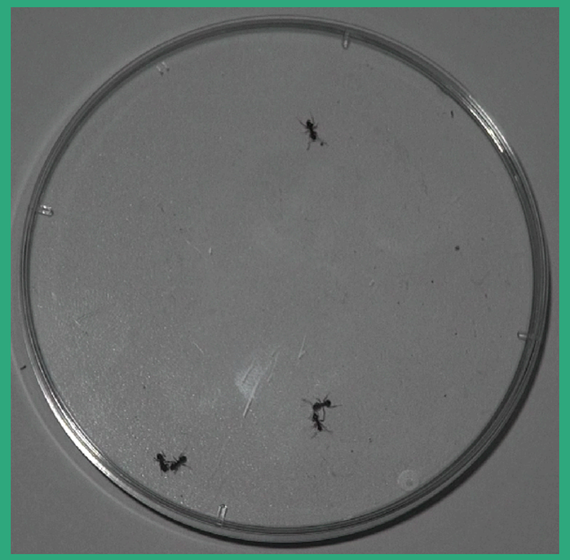


2 hours

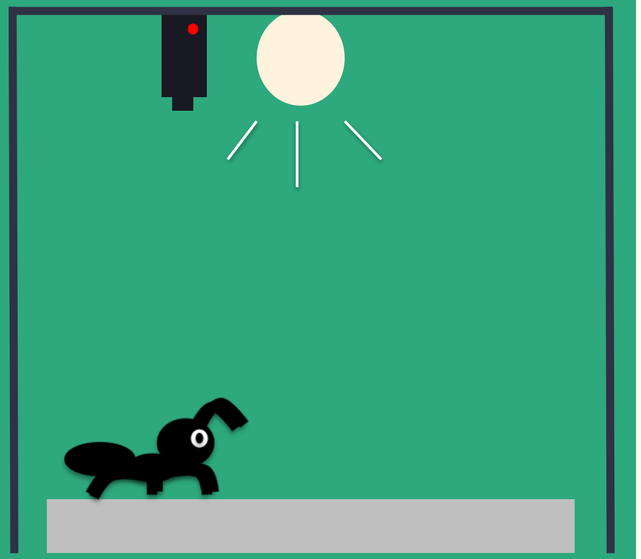
15 minutes

The operation can be accomplished in **a short time.**

Motivation



Experiment setup
Top view



Experiment setup
Side view

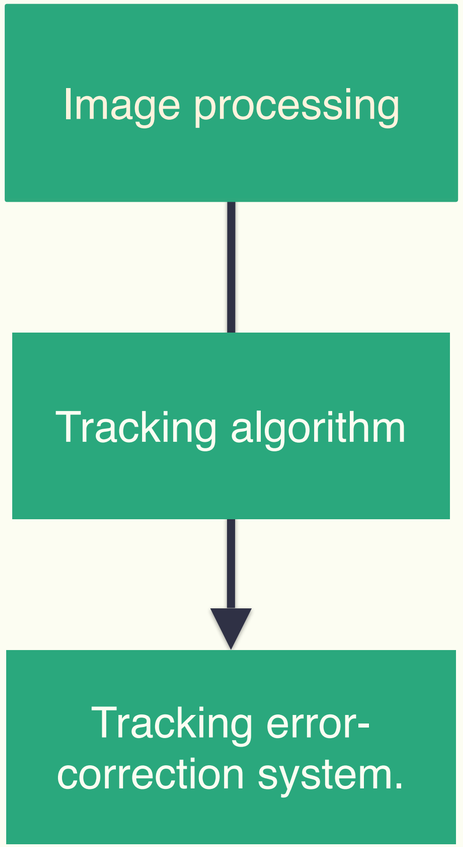
Problem

“It takes two hours to extract the position coordinate of animals in two minute videos.”

We developed the image-based tracking software.

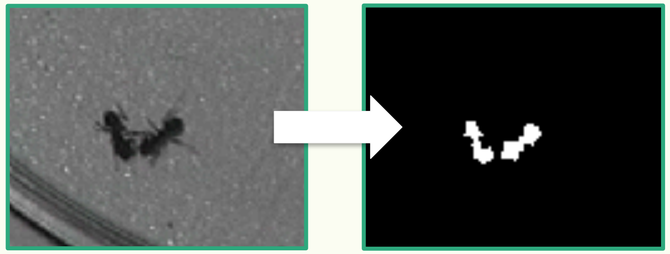
Our software accomplish the task in 15 minutes.

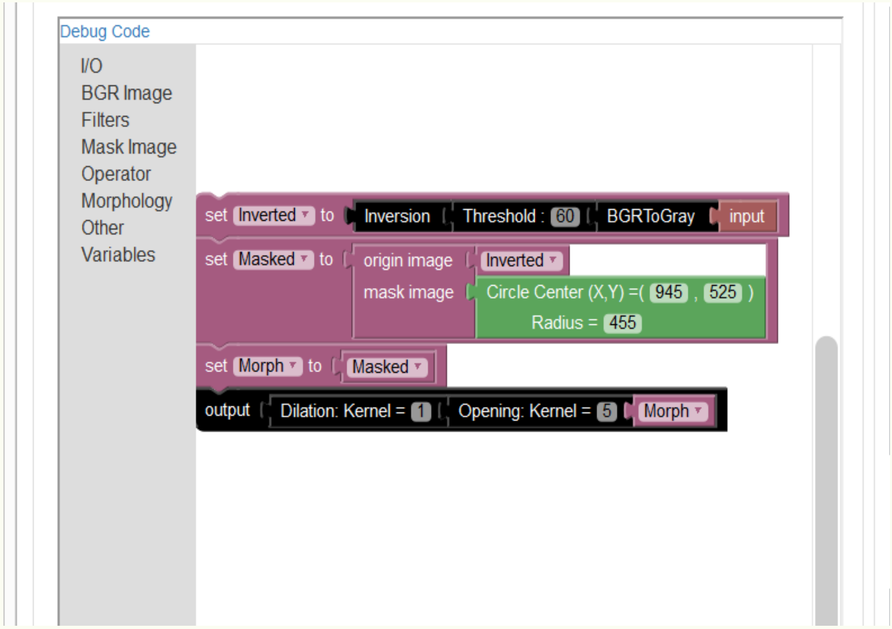
Our proposed approach



1. The user without expertise can be accomplish the task.
2. The tracking algorithm work without system error.
3. A user should be able to rectify tracking errors manually and directly when errors occur.

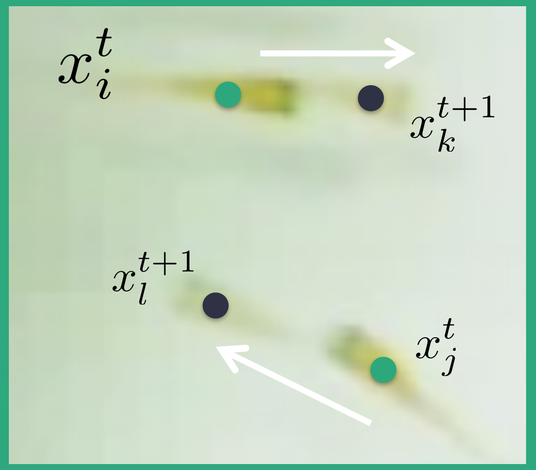
Image processing





The user design the image processing using the visual programming environment.

Tracking algorithm



The distances of two animals

$$\frac{1}{1+\|x_i^t - x_j^{t+1}\|}$$

The shape similarity

$$w_i^t = (\sigma_x, \sigma_y)$$

$$\frac{w_i^t \cap w_j^{t+1}}{w_i^t \cup w_j^{t+1}}$$

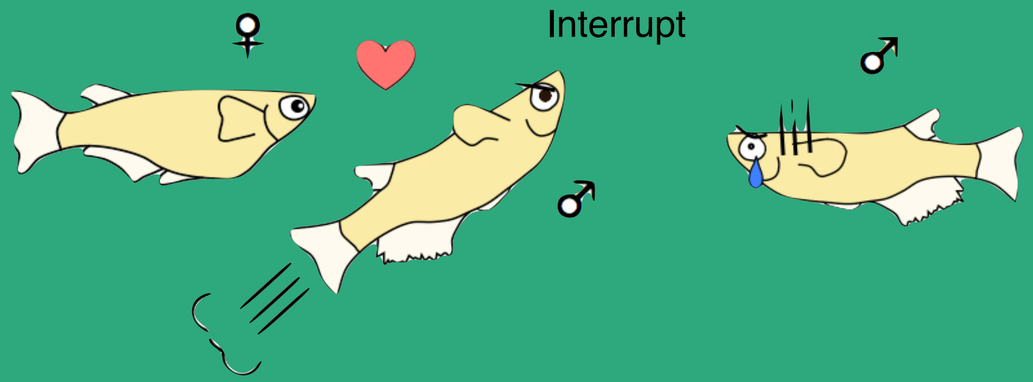
Based on the similarity of two index, the algorithm identify animals in each video frames.

Yoon, Ju Hong, et al. "Bayesian multi-object tracking using motion context from multiple objects." Applications of Computer Vision (WACV), 2015 IEEE Winter Conference on. IEEE, 2015.

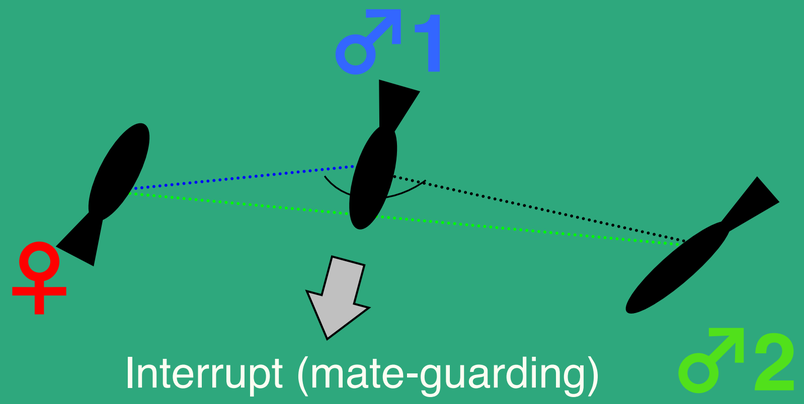
Tracking error-correction system

Analysis of Mate-guarding behavior

Mate-guarding behavior: they remain near a (potential) mating partner and repel their rival males.



https://www.s.u-tokyo.ac.jp/ja/press/2015/08.html



Yokoi, S., Okuyama, T., Kamei, Y., Naruse, K., Taniguchi, Y., Ansai, S., ... & Takeuchi, H. (2015). An Essential Role of the Arginine Vasotocin System in Mate-Guarding Behaviors in Triadic Relationships of Medaka Fish (Oryzias latipes). PLoS Genet, 11(2), e1005009.

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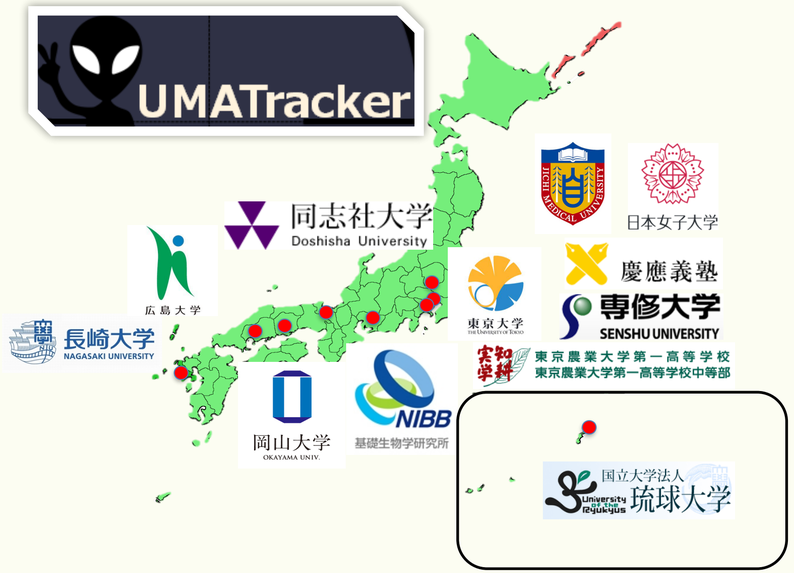
- T. Shinohara, Y. Takami, Functional diversity and trade–offs in divergent antipredator morphologies in herbivorous insects, **Ecology and Evolution**, 2020.

Users



Conclusion

The user accomplished the task in about 15 minutes to extract position coordinates of animals in 2 minutes video.

- Our software provides useful user interfaces.
- The users employ our software in various experiment environments.