

Acquiring New Category by Self Data Gathering With Bayesian Batter Model

Tatsuya Otsuhi
Osaka University
Japan

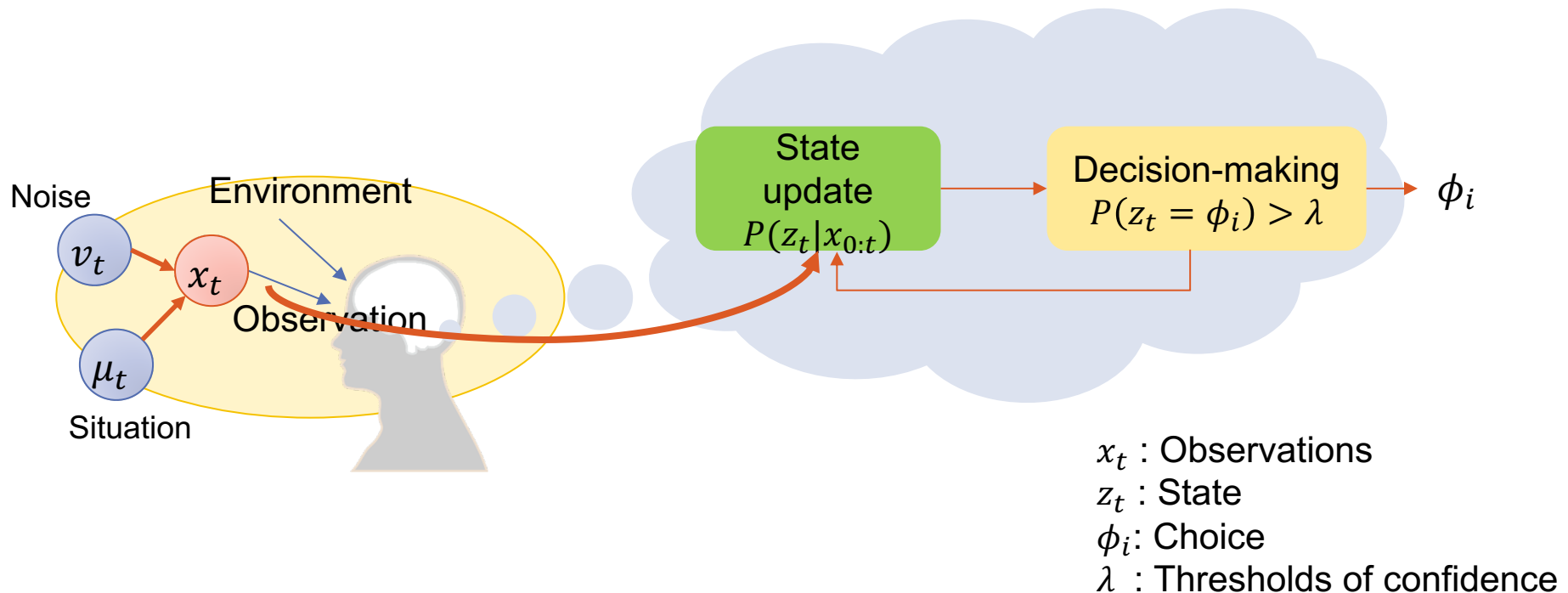
Challenge of Category Acquisition

- AI applications are usually in dynamic environment
 - e.g. moving or removing IoT devices
 - Automatic new category acquisition is desirable
- Semi-supervised approaches suffer from noise
 - Noise makes it hard to distinct new and known category

Noise tolerant category acquisition is required

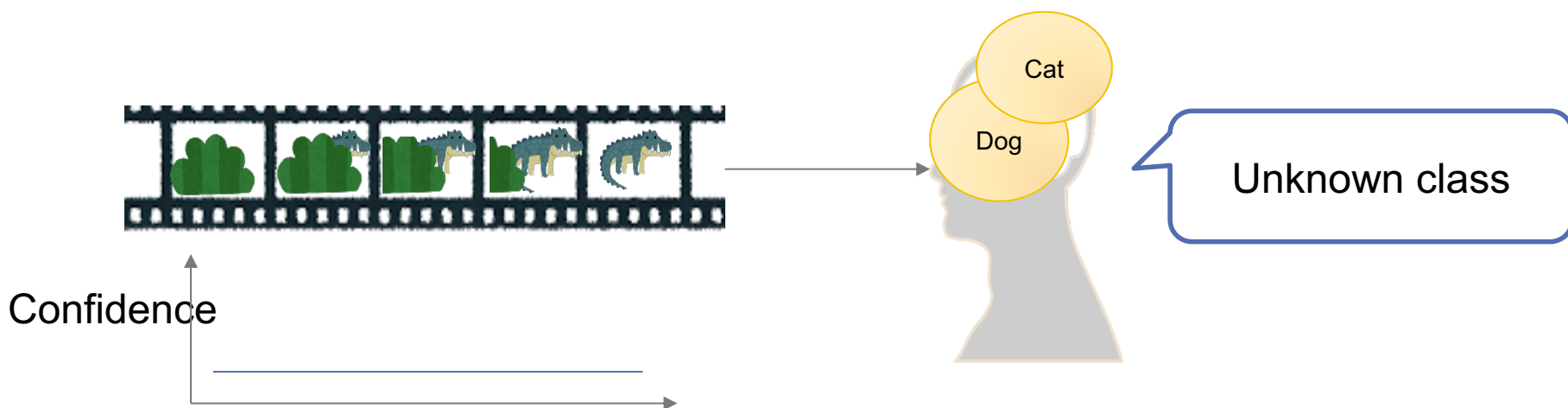
Bayesian Attractor Model(BAM)^[2]

- A cognitive model for decision making under uncertainty
- Confidence is accumulated with noisy input
- A category is expressed by a representative value



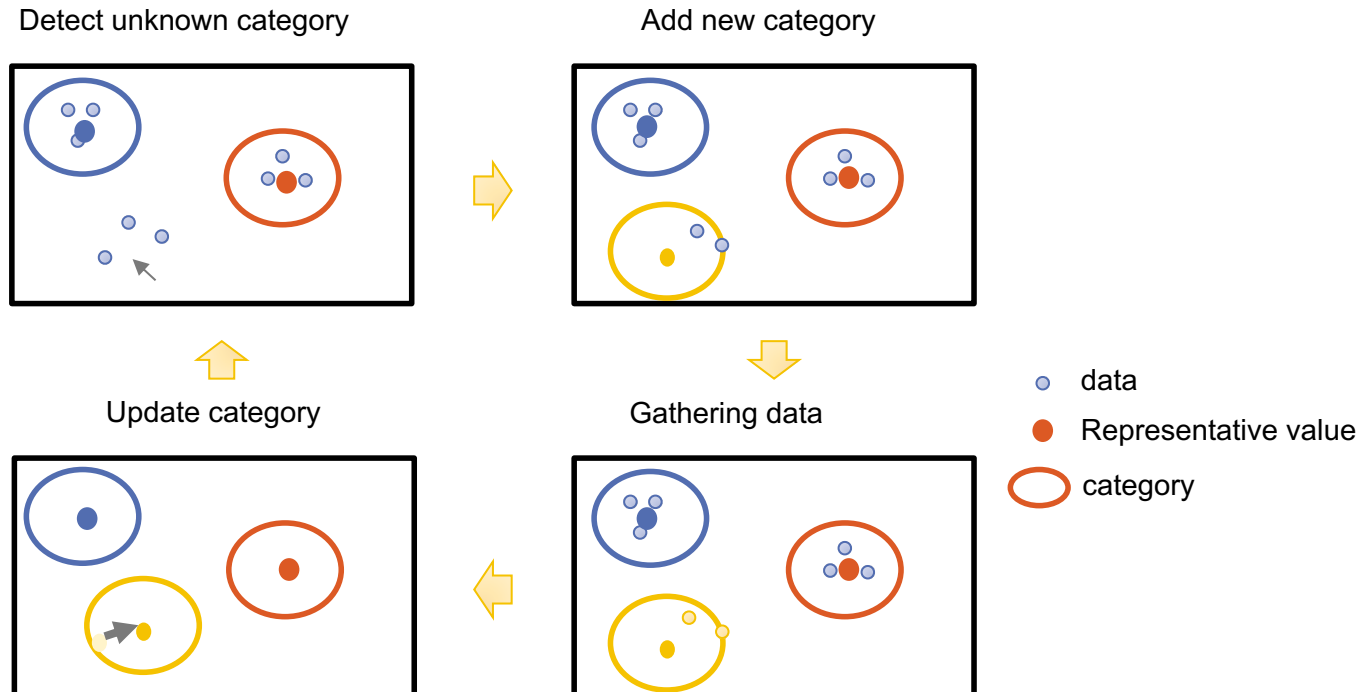
BAM : Unknown Category Detection

- BAM calculates the confidence of known categories
- Confidence is low when new category arrives
- Unknown category detected by the continuous low confidence



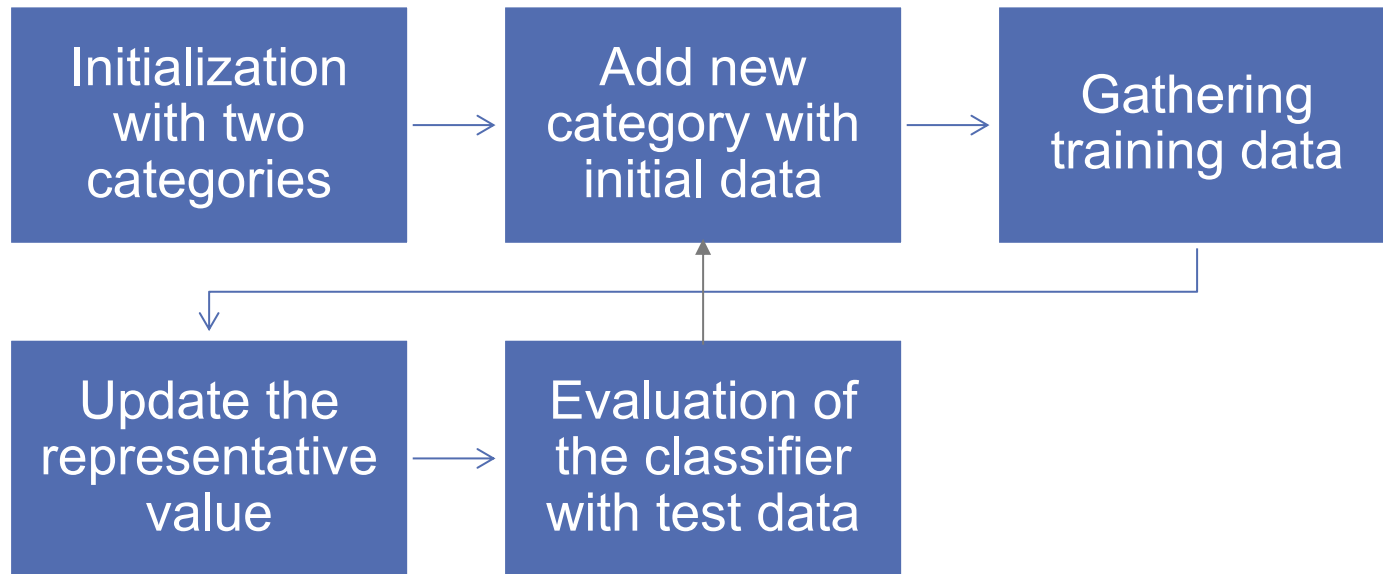
New Category Acquisition Process

1. Detect unknown category
2. Add new category with initial data
3. Gathering training data
4. Update the category



Evaluation

- Evaluation Flows

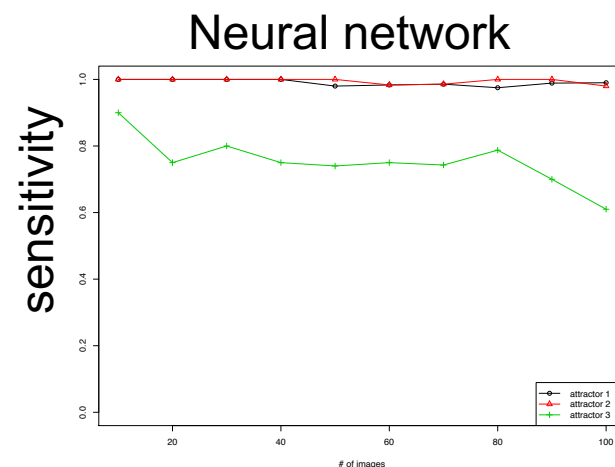
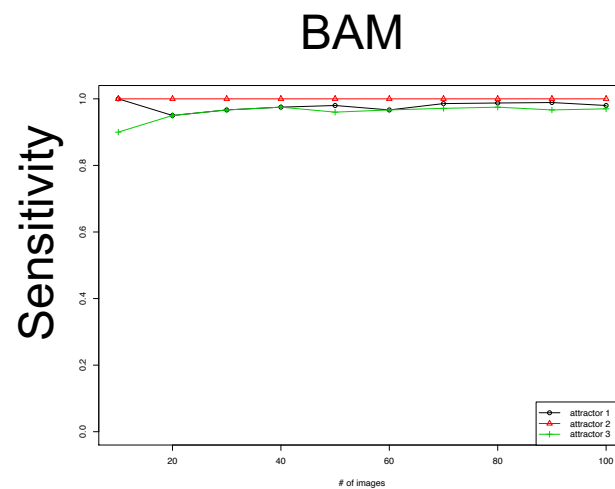
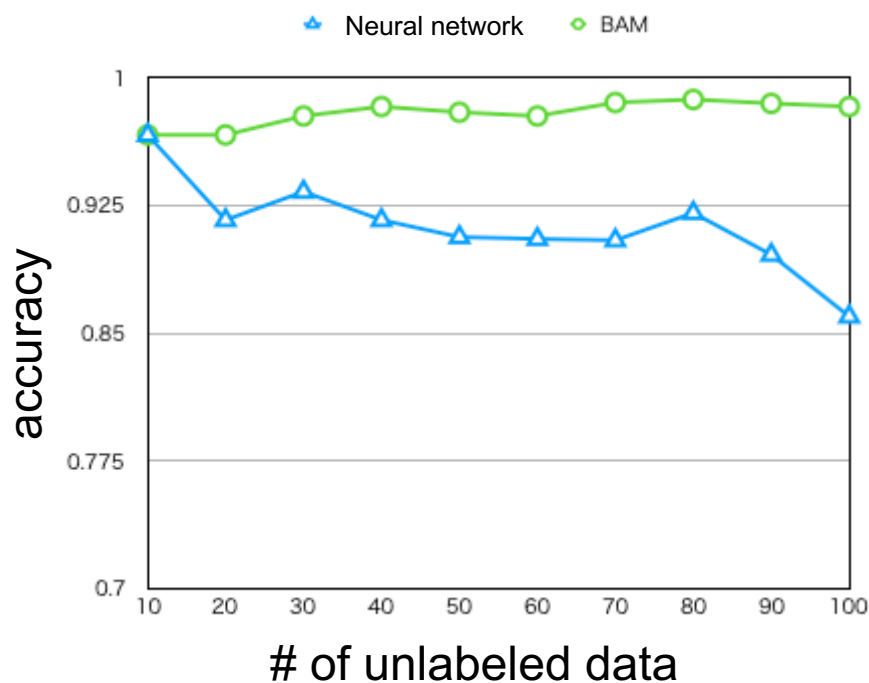


- Metrics

- Accuracy : $\frac{\# \text{ of collect result}}{\# \text{ of test data}}$
- Sensitivity: $\frac{\# \text{ of data labeled as category } X}{\# \text{ of test data from category } X}$

Numerical simulation result

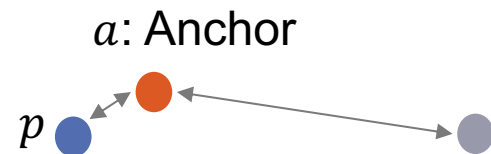
- Result of third-category acquisition
- Compared with simple neural network
 - 3-layered full connection



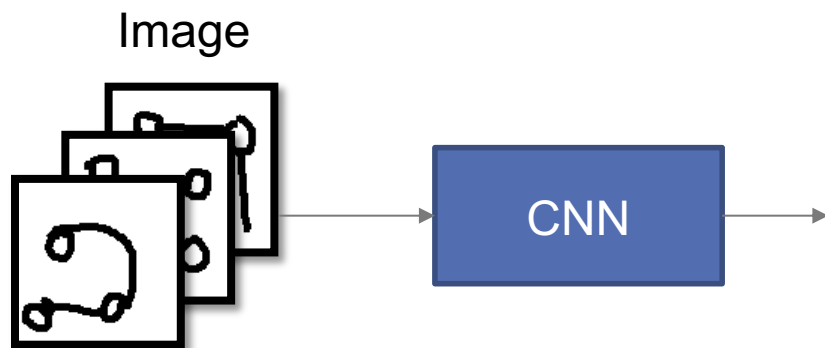
Evaluation with hand-written character

- Data: omniglot
- Feature extraction
 - Simple convolutional neural network (CNN)
 - Minimizing Triplet Loss

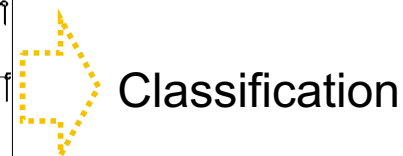
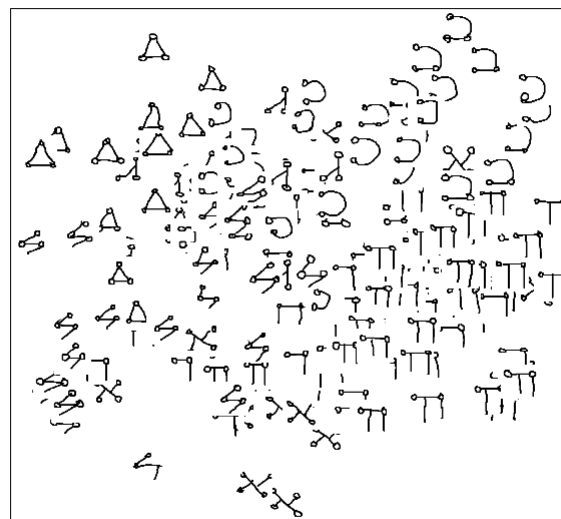
$$L = \sum_i \left[\|f_i^a - f_i^p\|^2 - \|f_i^a - f_i^n\| \right]$$



f_i^a : Anchor's features
 f_i^p : positive feature
 f_i^n : negative feature

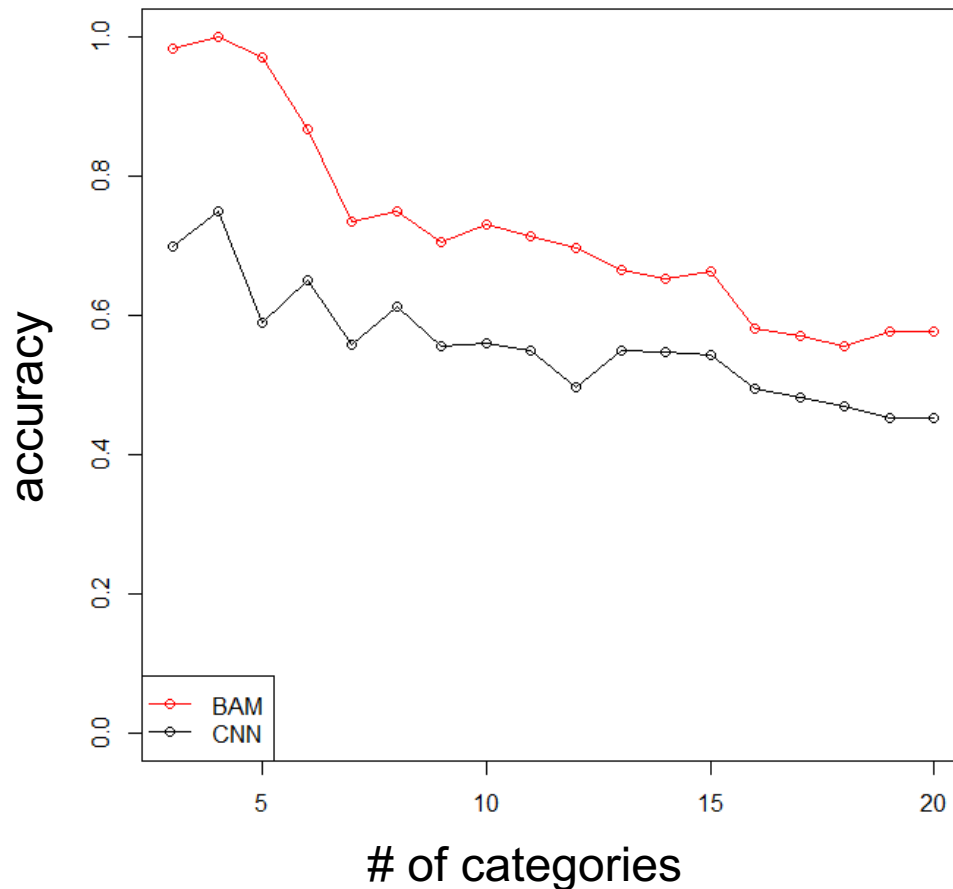


Feature space



Omniglot result

- Using BAM is better than using the neural network as classifier
- BAM can roughly learn category with single data point



Summary

- Summary
 - Proposing the procedure to acquire new category
 - Constructing the temporal classifier with initial data from unknown category
 - Automatically gathering the training data from new category
 - Updating the temporal classifier with gathered data
- Future work
 - more flexible management of the categories
 - e.g. deletion, integration, and separation