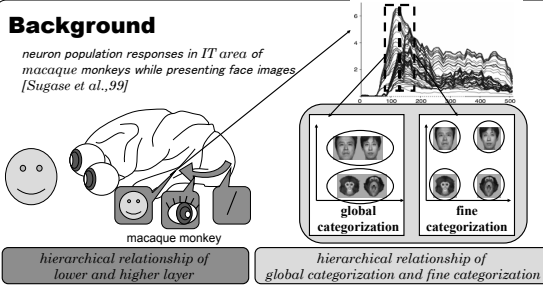


### Abstract

Sugase et al. found that the global categorization of species was represented in the earlier part of the neuron population responses, while the fine categorization of individual identity or emotional state was represented in the later part of the neuron population responses. In this study, the hierarchical relationship of the categorization is modeled, based on the hierarchical neural network. The results are similar to the analytical results of the neuron population responses of the monkeys.

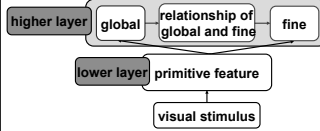
### Background

neuron population responses in IT area of macaque monkeys while presenting face images [Sugase et al.,99]



The neuronal mechanism of the information processing on the categorization is not clear

### Proposed model



The hierarchical relationship of the categorization is formed in the self-organized manner, considering the interaction of higher and lower layer

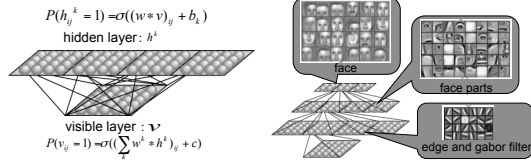
### Related Works

attractor network is used for hierarchical discrete representation [Matsumoto et al.,05]

The representation was given, the interaction of higher and lower layer wasn't considered

### CRBM [Lee et al.,09]

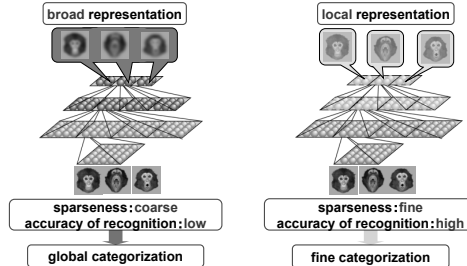
(Convolutional Restricted Boltzmann Machine)



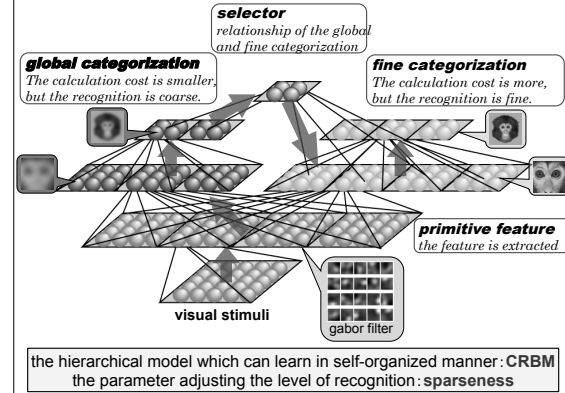
The feature of visible layer is extracted to hidden layer in the self-organized manner

The CRBM can learn from lower-order to higher-order representation

### Sparseness and Categorization

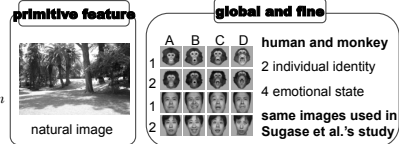


### Hierarchical Recognition Model



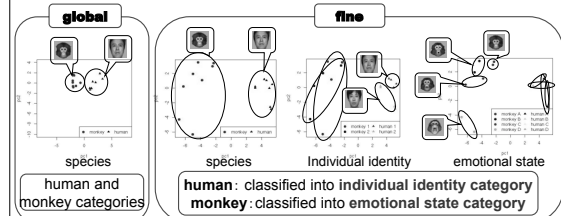
### Experiment

The model was learned using the human and monkey face images. Then, the categorization was analyzed.



### Result

The neuron population responses of the global categorization and the fine categorization were analyzed by PCA.



### Conclusion

- The categorizations, formed only by changing the sparseness considering the hierarchical relationship of the lower and higher layer, are similar to the analytical results of the neuron population responses of the monkeys
- The hierarchical relationship of the categorization contributes to the improvement of the recognition speed.
- In future work, we would like to model temporal changes in the categorization.

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