NMDL lunch seminar

Feature Extracting Properties of sRBM

NMDL intern
재료공학부 임혁준

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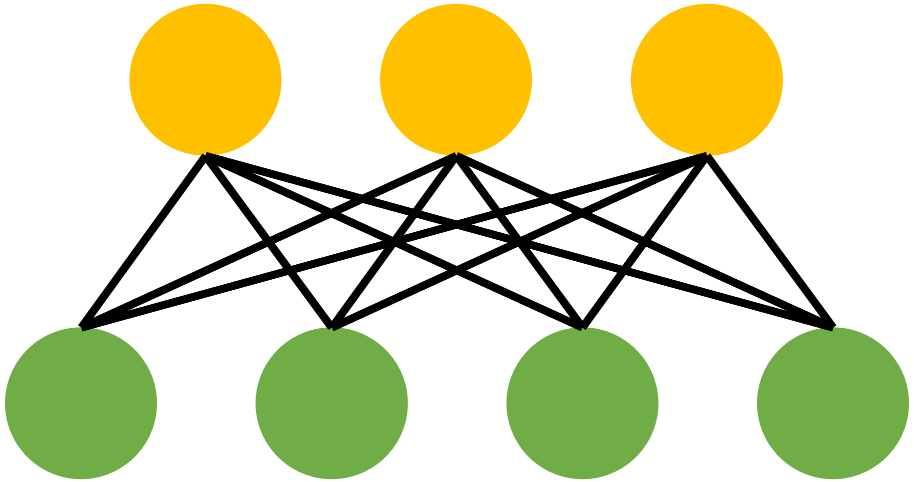
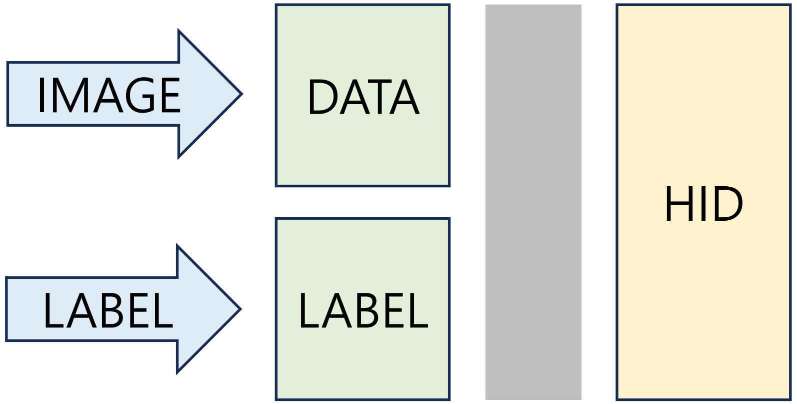
1. Outline

Extracting features from sRBM



structure of RBM



structure of sRBM

What is the goal of RBM?

- Input data ≈ Reconstruction
- **Extract Latent factor at hidden layer**

How is "RBM" employed in ANN?

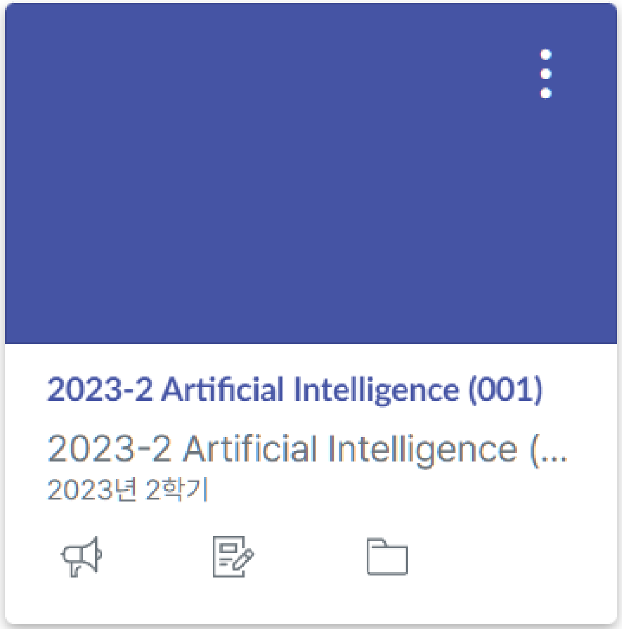
- pretraining DBN
- AutoEncoder

How to extract features from sRBM?

Count Spike!

1. Outline

Extracting features from sRBM

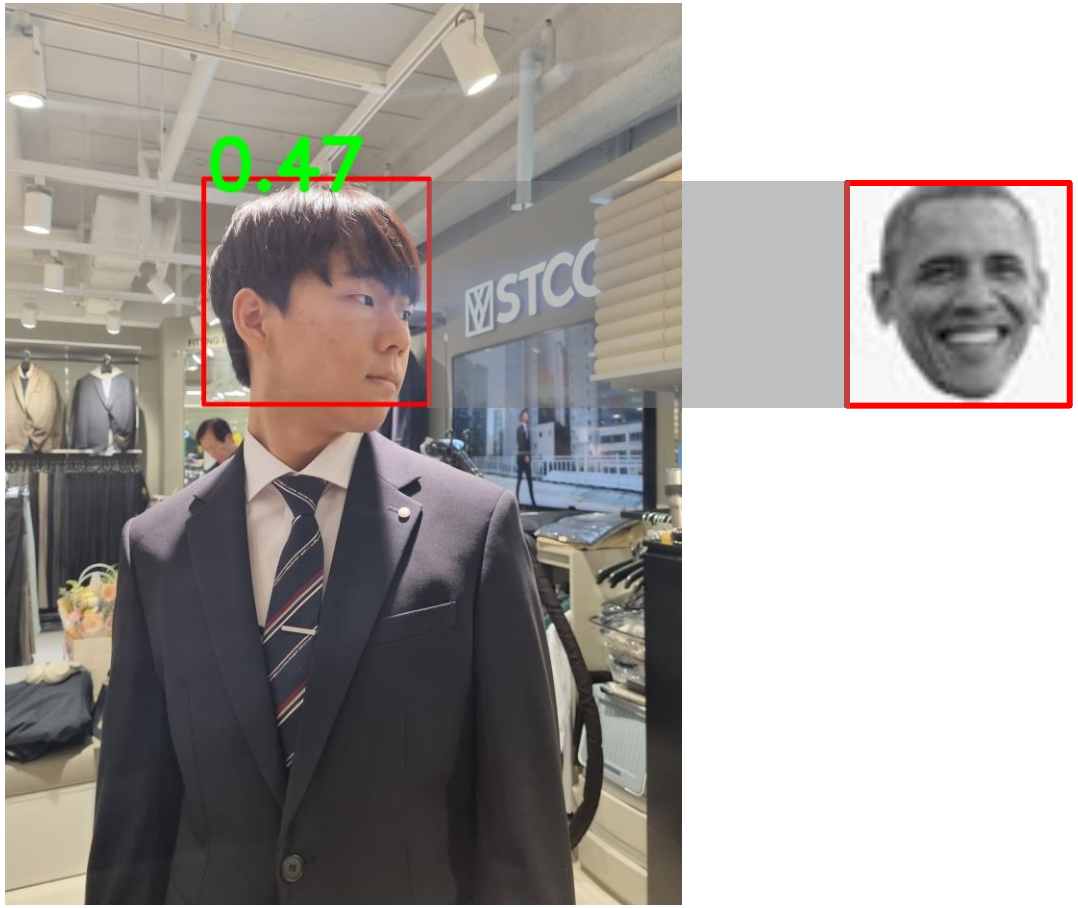


- Math for AI
- **Computer Vision**
- Machine Learning
- Deep Learning
- Natural Language Processing

2. HOG

Feature extractor for ANN

face recognition via HOG

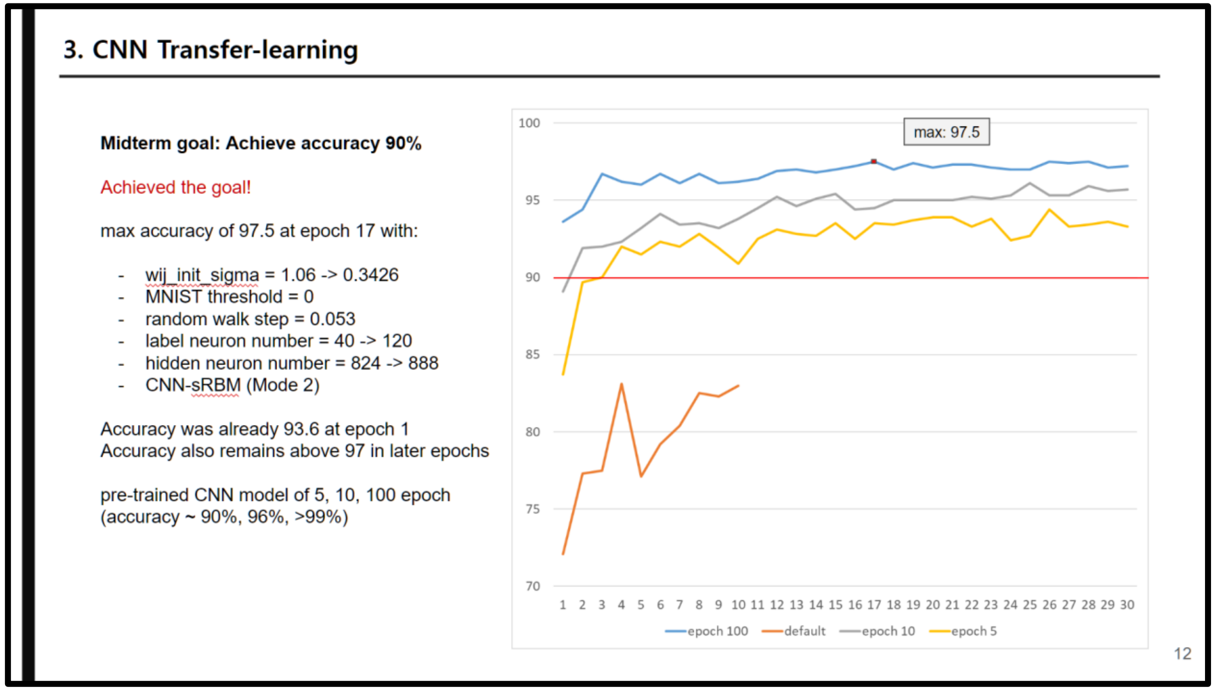


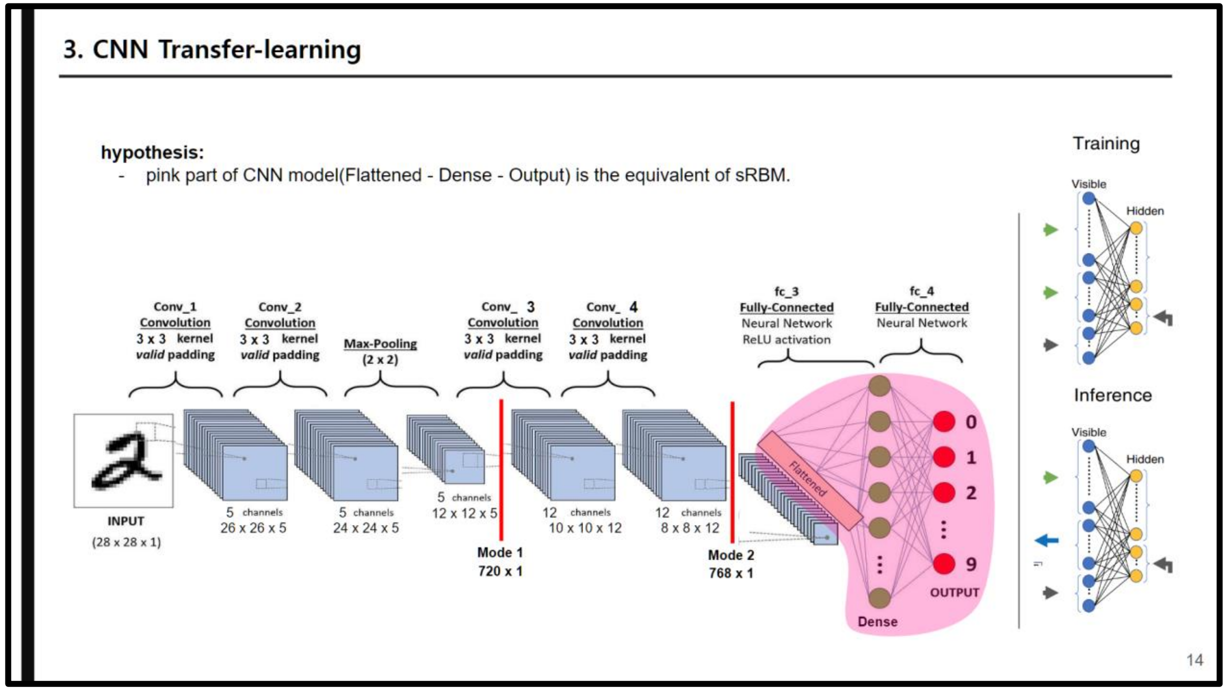
Feature Matters!

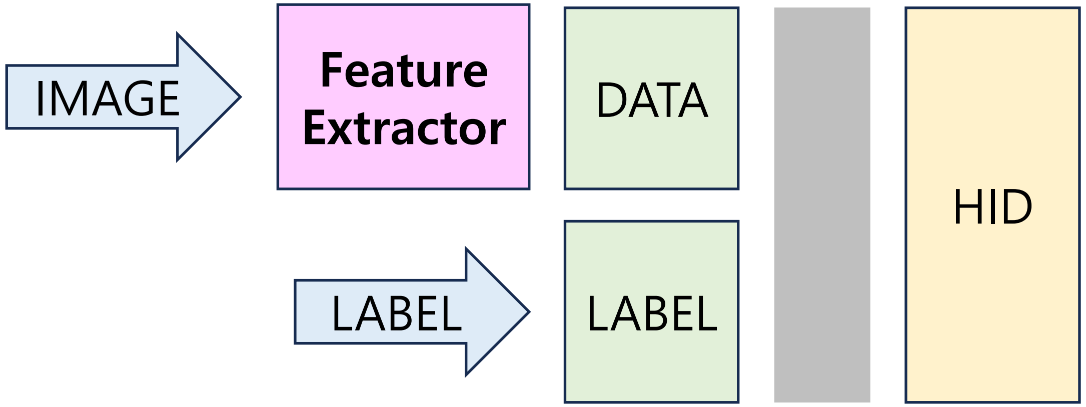
2. HOG

Feature extractor for ANN

Recap: 2023-S intern





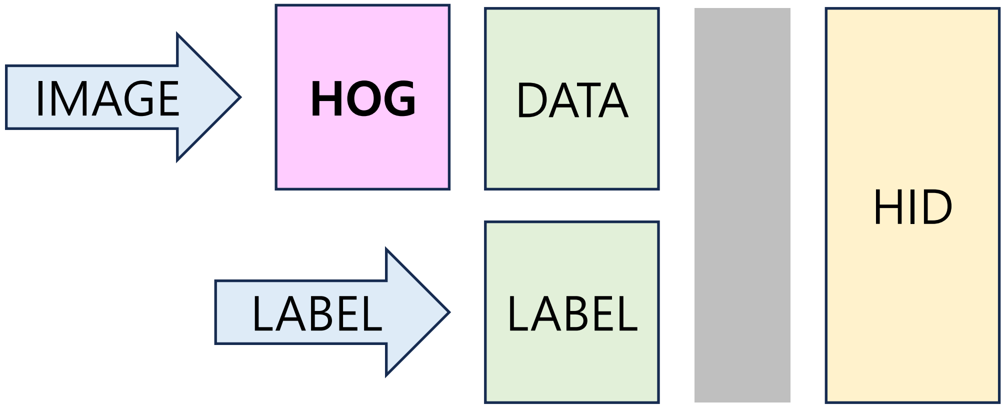


Trained sRBM with better feature

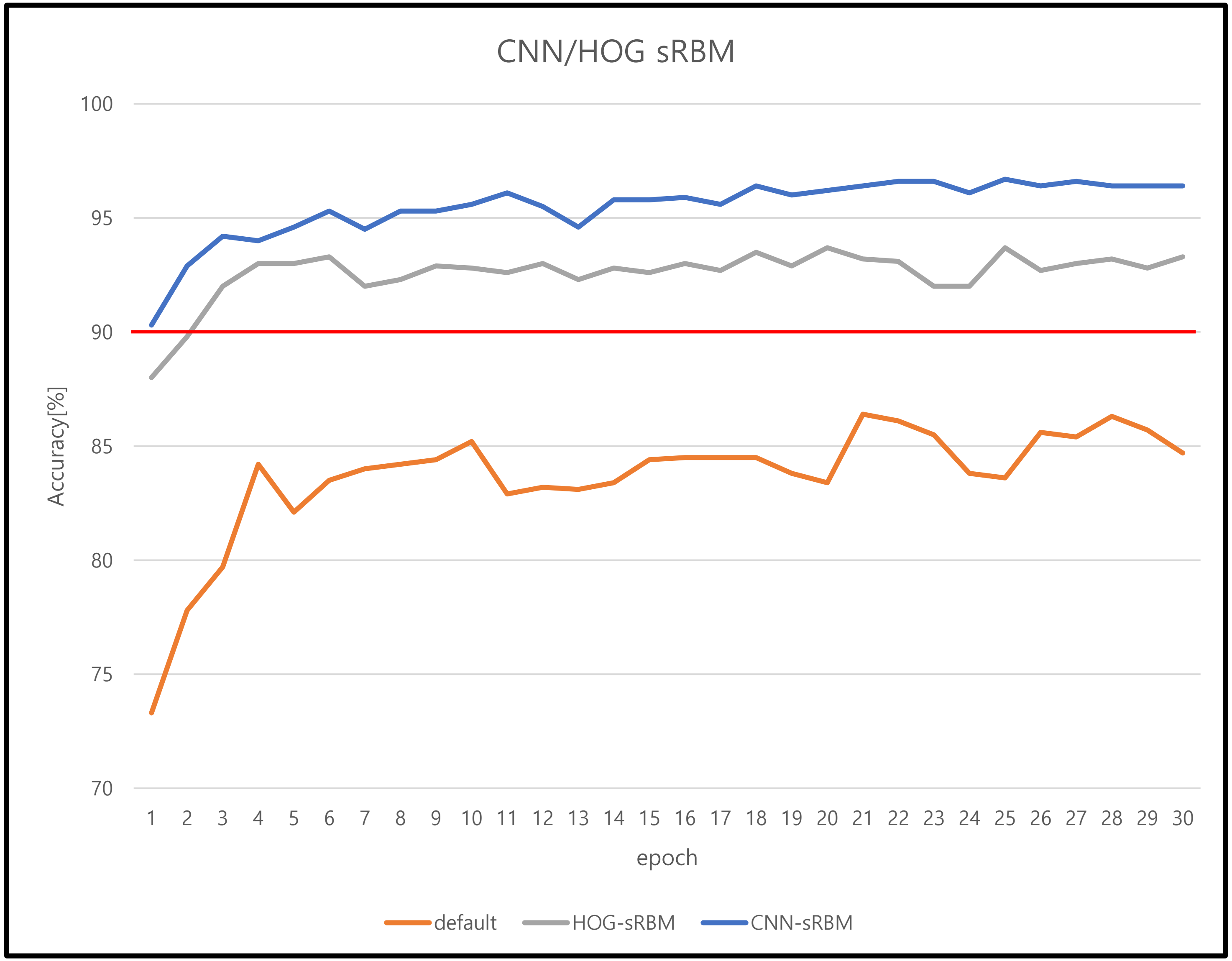
Feature Extractor : CNN

2. HOG

Feature extractor for ANN

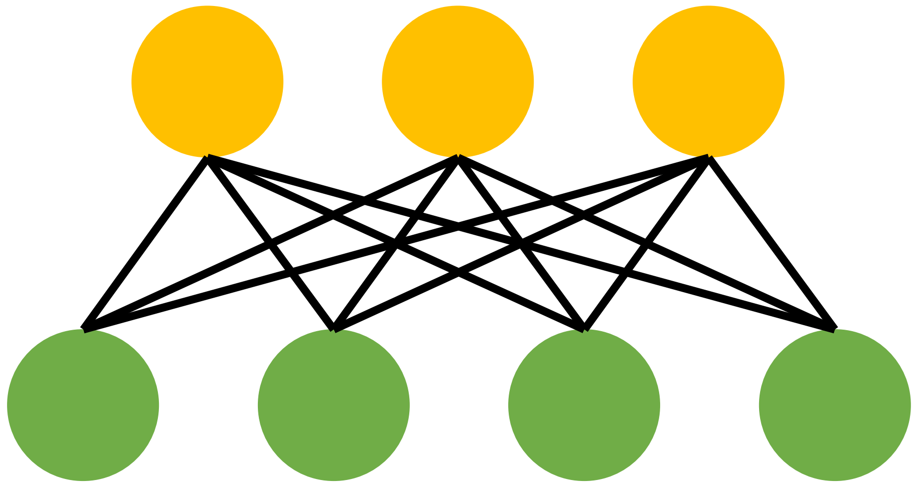


Again, Feature Matters!



3. Spike Counting

Reconstruction vs Feature Extraction

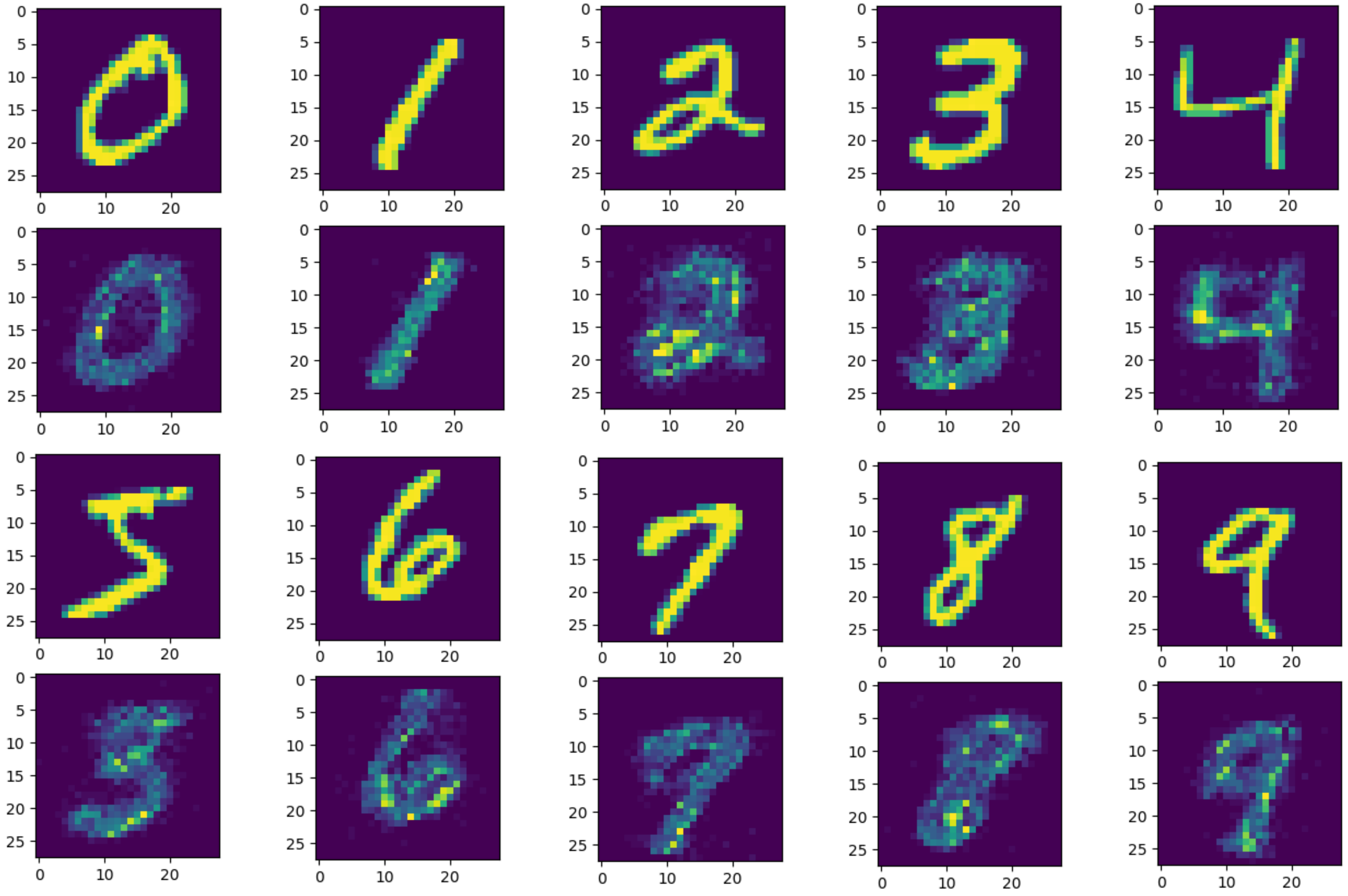

structure of RBM

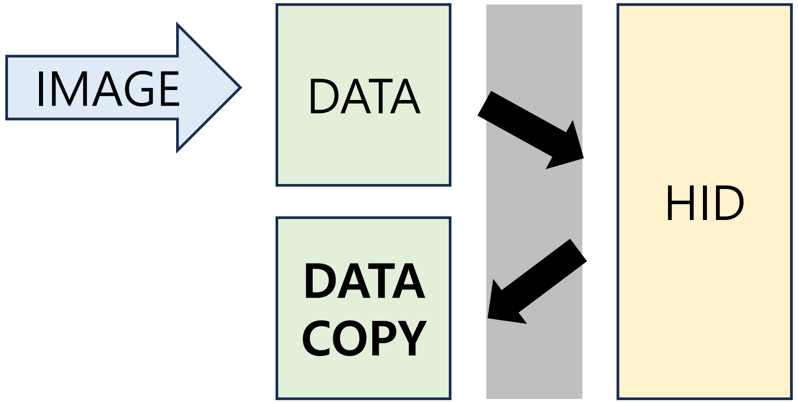
What to count?

Hidden ➡ **Feature extraction**

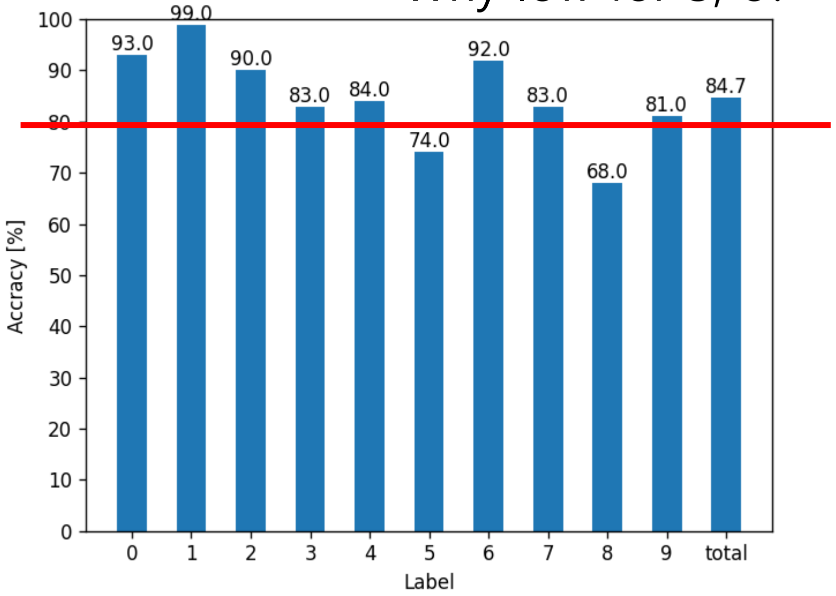
Visible ➡ **Reconstruction**

Reconstruction vs Feature Extraction





Why low for 5, 8?



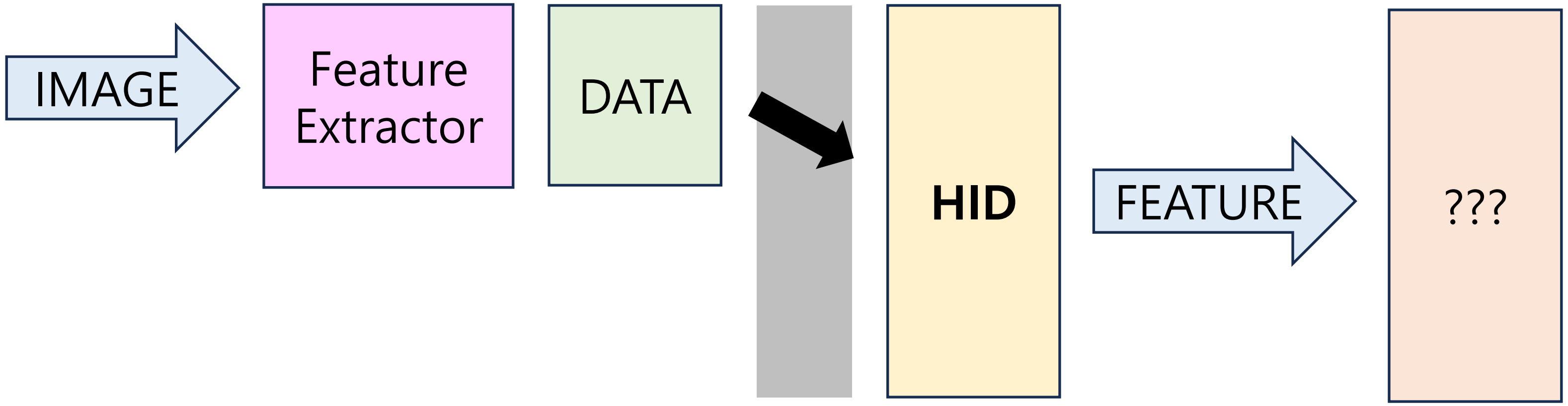
sRBM actually “sees” image like this!

3. Spike Counting

Reconstruction vs Feature Extraction

Where, How to use the feature?

- **SVM (Support Vector Machine)**
- **MLP (Multi-Layer Perceptron)**
- **new sRBM (Deep-sRBM)**



3. Spike Counting

Reconstruction vs Feature Extraction

33/824

0	0	0	0	0	0	0	0	0	0	0	0	8	32	0	0	0	0	0	0	0	0	0	16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0	0	0	38	0	0	0	0	0	0	0	0	0	0	0	0	0	46	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	45	0
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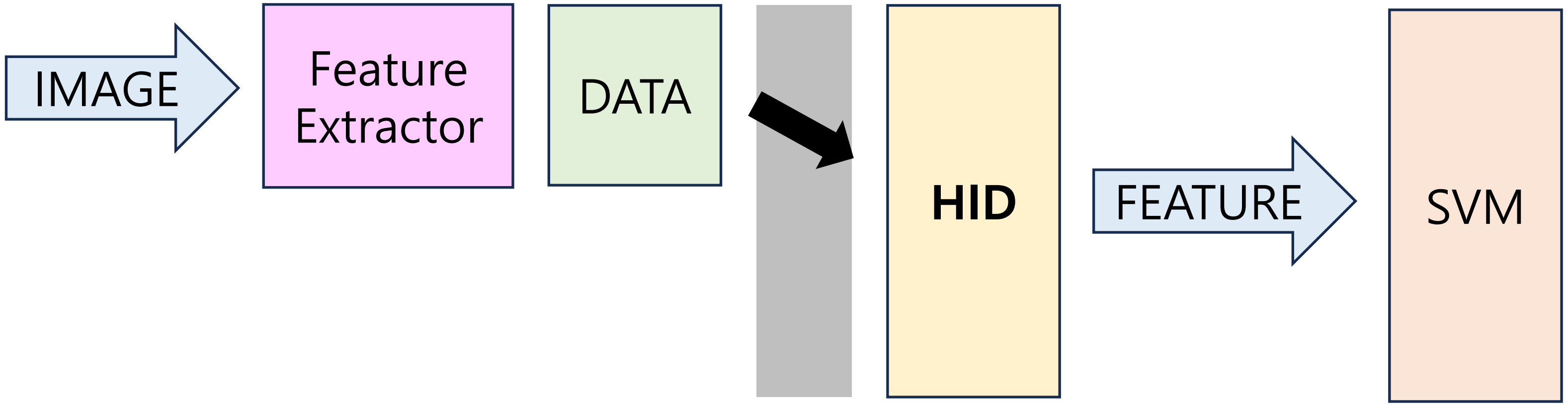
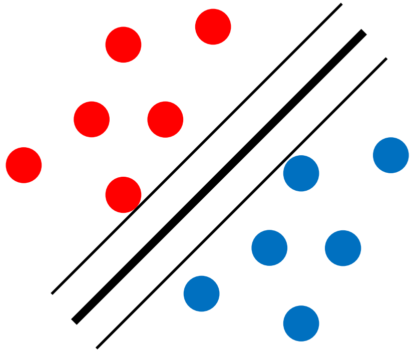
0	0	0	0	0	0	0	0	43	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0																

Some of them never fires...

Reconstruction vs Feature Extraction



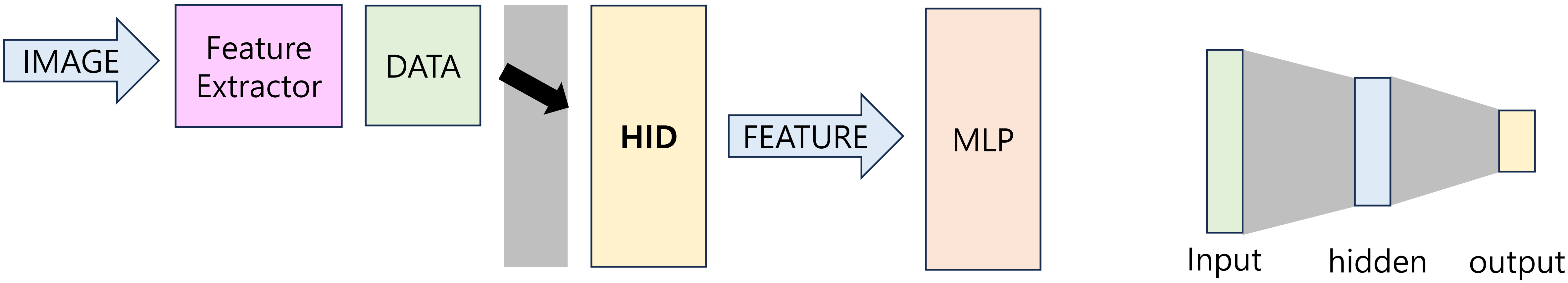


SVM (Train 5000 / Test 1000) [%]

feature extractor / data	Default	HOG	CNN (10epoch, 0.9817)
MNIST	88.7	96.2	
sRBM Feature	91.3	95.8	97.8

3. Spike Counting

Reconstruction vs Feature Extraction

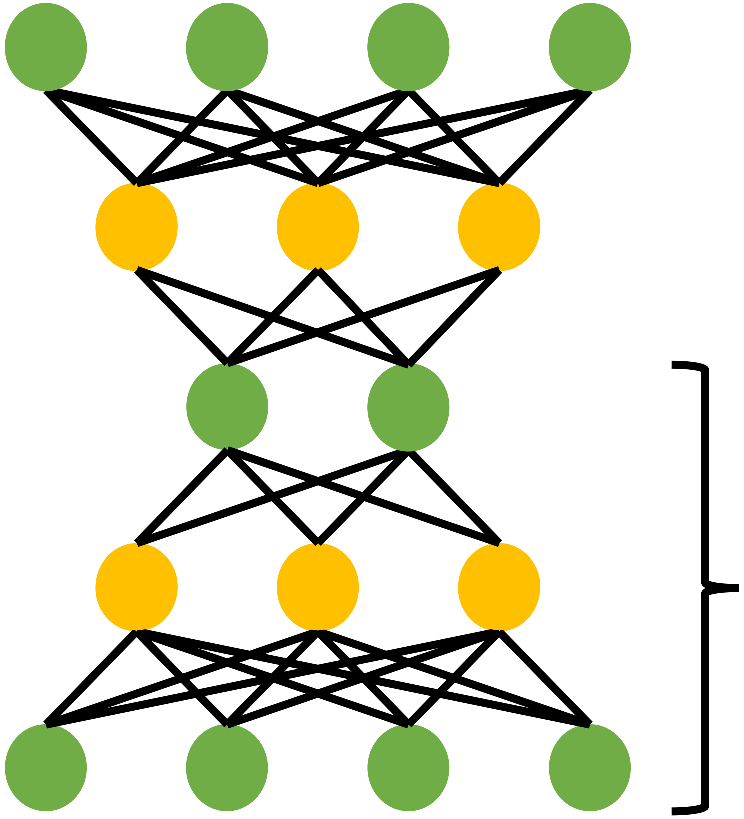


MLP (Train 5000 / Test 1000) [%]

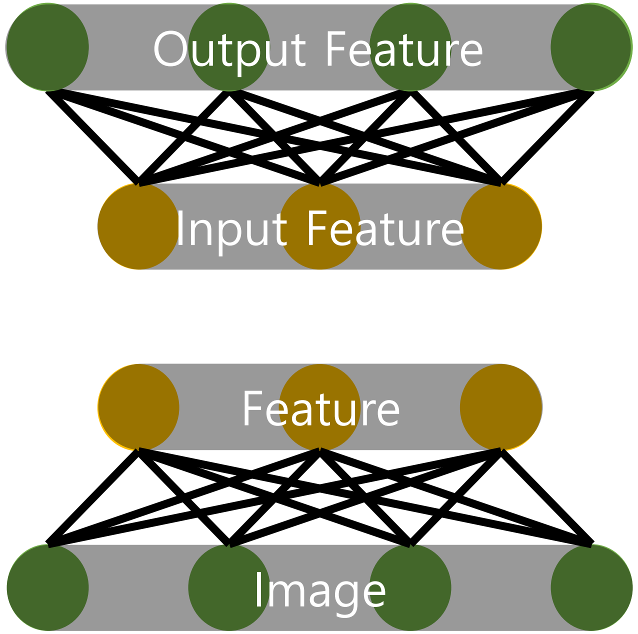
data \ feature extractor	**Default**	**HOG**	**CNN (10epoch, 0.9817)**
MNIST	93.2	97	98.17
sRBM Feature	90.8	96.4	97.3

4. Deep-sRBM

Learning from generated features



structure of DBN/Autoencoder



Recap

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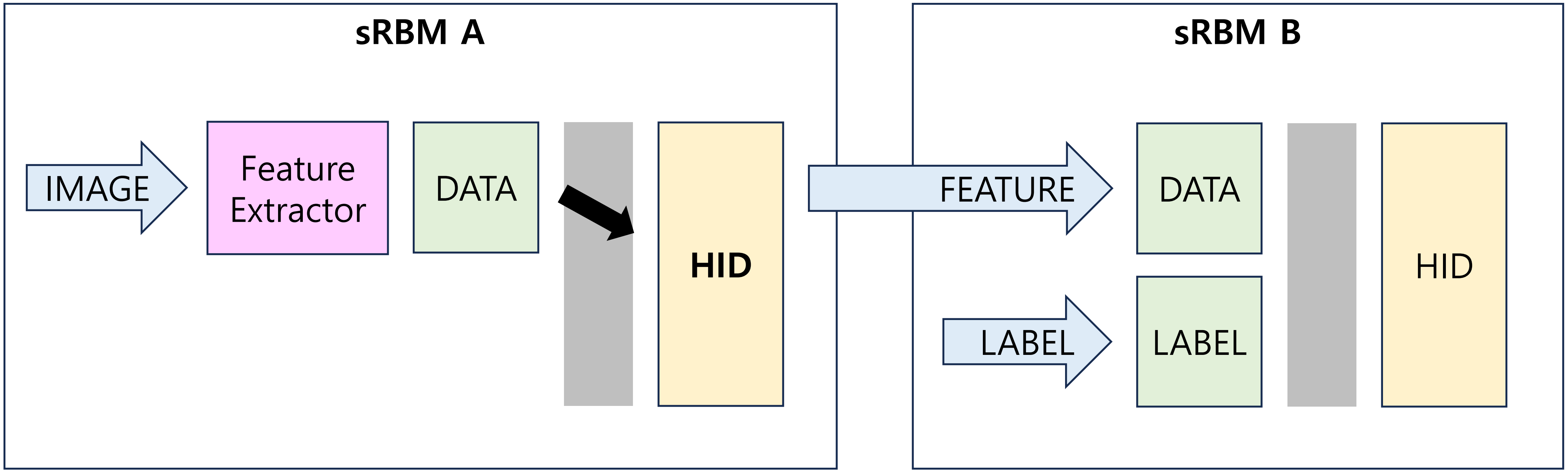

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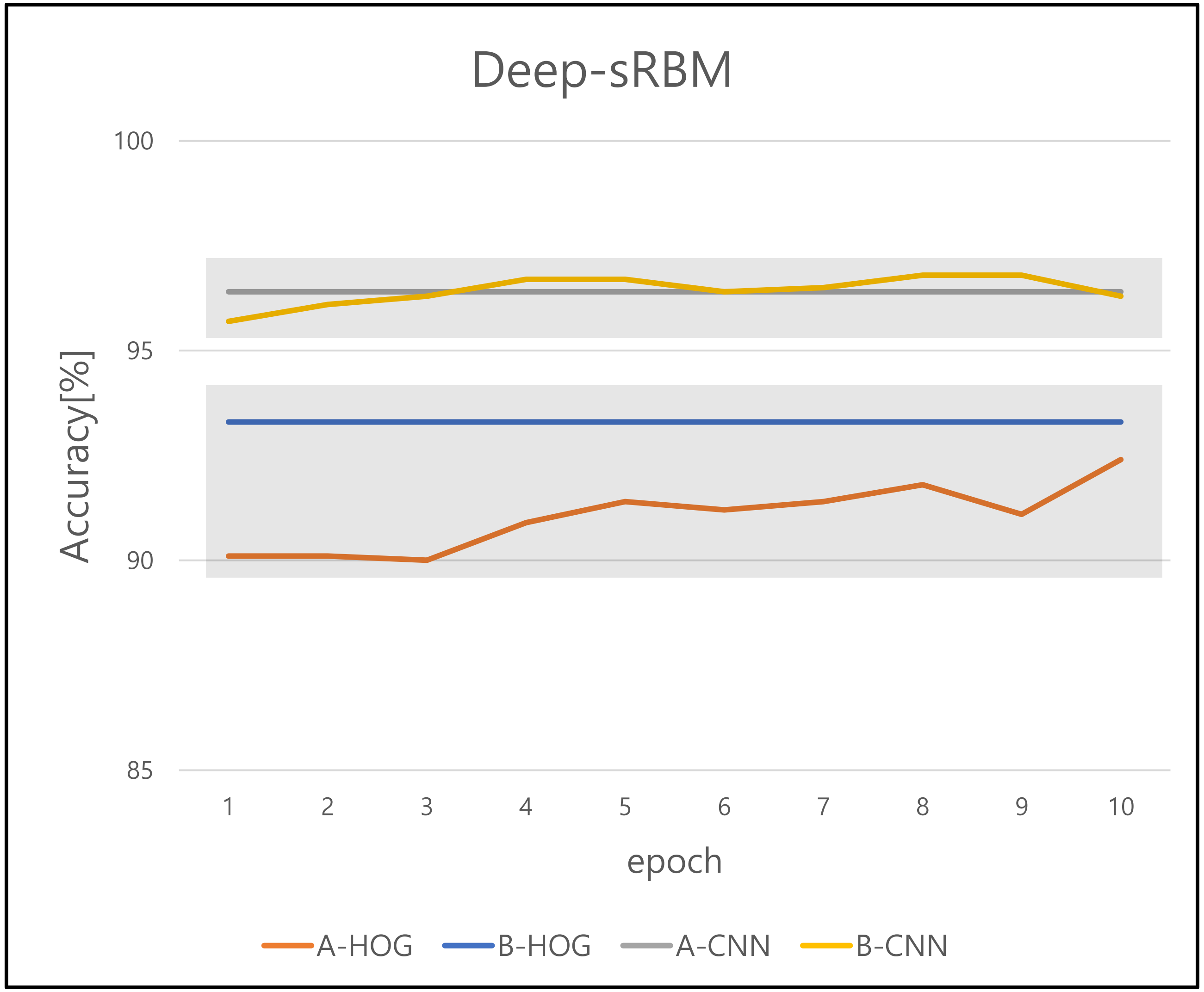
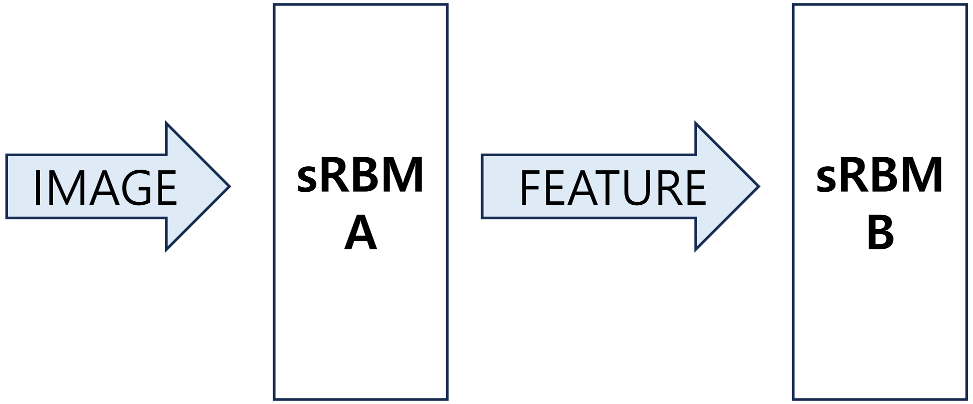
Learning from generated features





sRBM / feature extractor	A (freeze)	B
HOG	93.3	92.4
CNN	96.4	96.8

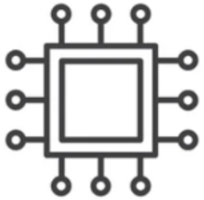
[%]

5. Future Work

Connecting Neuromorphic computing and AI

Neuromorphic Simulation

Neuromorphic?



Simulation?

5. Future Work

Connecting Neuromorphic computing and AI

Computing Platform

A new computing processor that mimics the human brain

Neuromorphic Processor

With AI, machine learning, and blockchain demanding greater computation, we are engaged in fundamental breakthroughs. One such advance is through the development of neuromorphic processors inspired by the human brain. The goal of this approach is to emulate the brain’s dynamic learning capability and power efficiency.

At SAIT, we are actively researching near/in memory computing, asynchronous spiking neural networks, and other concepts to create a brain-like processor. Our interests include brain-inspired learning and inference algorithms, low-power mixed signal computing architectures, and new synaptic memories.

SAIT collaborates with the Business Units to develop and verify technologies using the latest logic and memory fabrication.

https://www.sait.samsung.co.kr/saithome/

Thank you