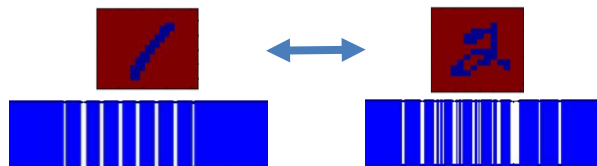


Optimizing Neural Networks with *STABILIZED* Bidirectional Associative Memory

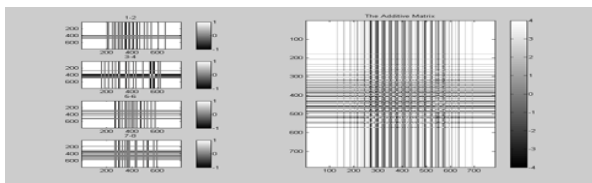
Principles in Independent Component Analysis and Null Space (PICANS)

We stabilized the Bidirectional Associative Memory (BAM) algorithm utilizing the singular value decomposition (SVD), Independent Component Analysis (ICA), and Nullspace (NS). Demonstrated with two applications: (1) Utilizing a simple **one-layer association** used for text ID given by Bart Kosko (1982), and (2) utilizing **multiple layers of associations** in a convolutional neural network modeling the ventral pathways used for computer vision. Work performed September 2011-November 2012

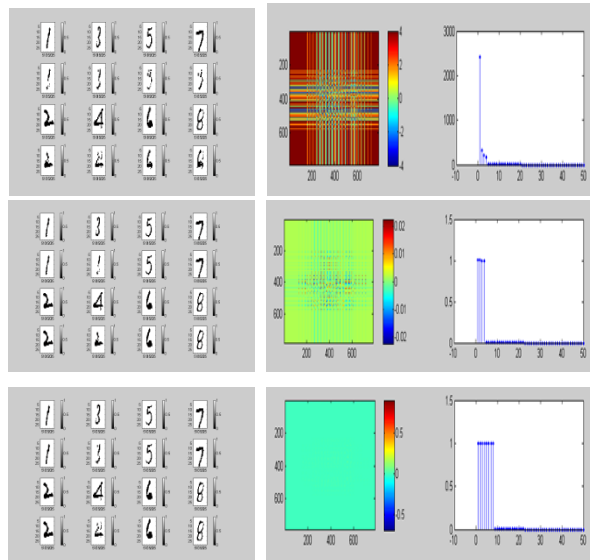
Example(1) Text Association



$$M = X_1 \times X_2^T + X_3 \times X_4^T + X_5 \times X_6^T + X_7 \times X_8^T$$



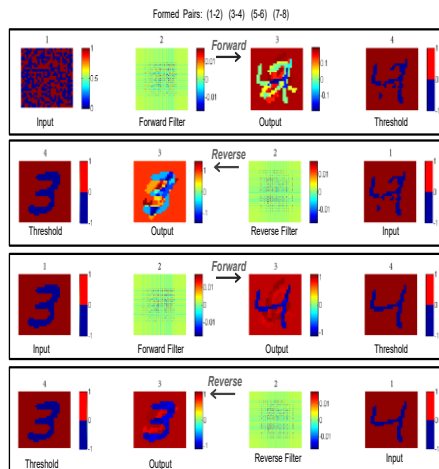
$$\sum_{i=1}^4 U_i S_i V_i^T \approx M$$



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Bidirectional Associative Memory



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Cognition and Decision Program

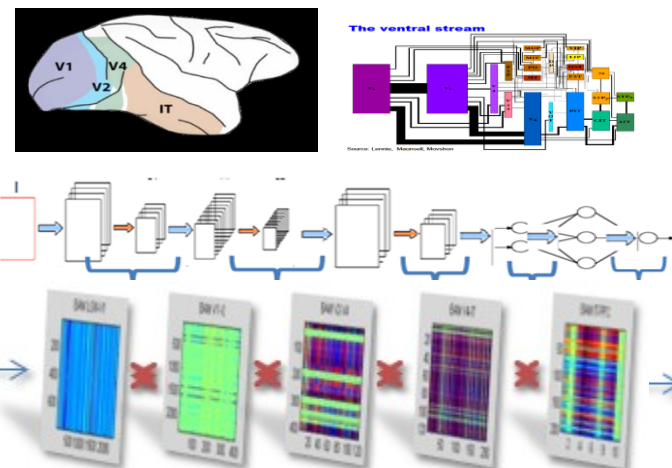
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DARPA VMR

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Example(2) CNN and BAM in Forward Mode



Single CNN Layer

Associative Memory

Image IN	1936 points	Image IN	1936 points
1. 12 KV1 Filters		1. FAM LGN-V1	1936x5808
2. 2D Convolution			
3. Tanh compress			
4. Down sample by 4			
5. Multiply by weights			
6. Add biases			
7. Tanh compress			
V1 OUT	5808 points	V1 OUT	5808 points

0.0855 Seconds/Five layers

0.0031 Seconds/Five Layers

Test: (1) Ideal (2) CNN (3) BAM Unstable (4) BAM Stable

