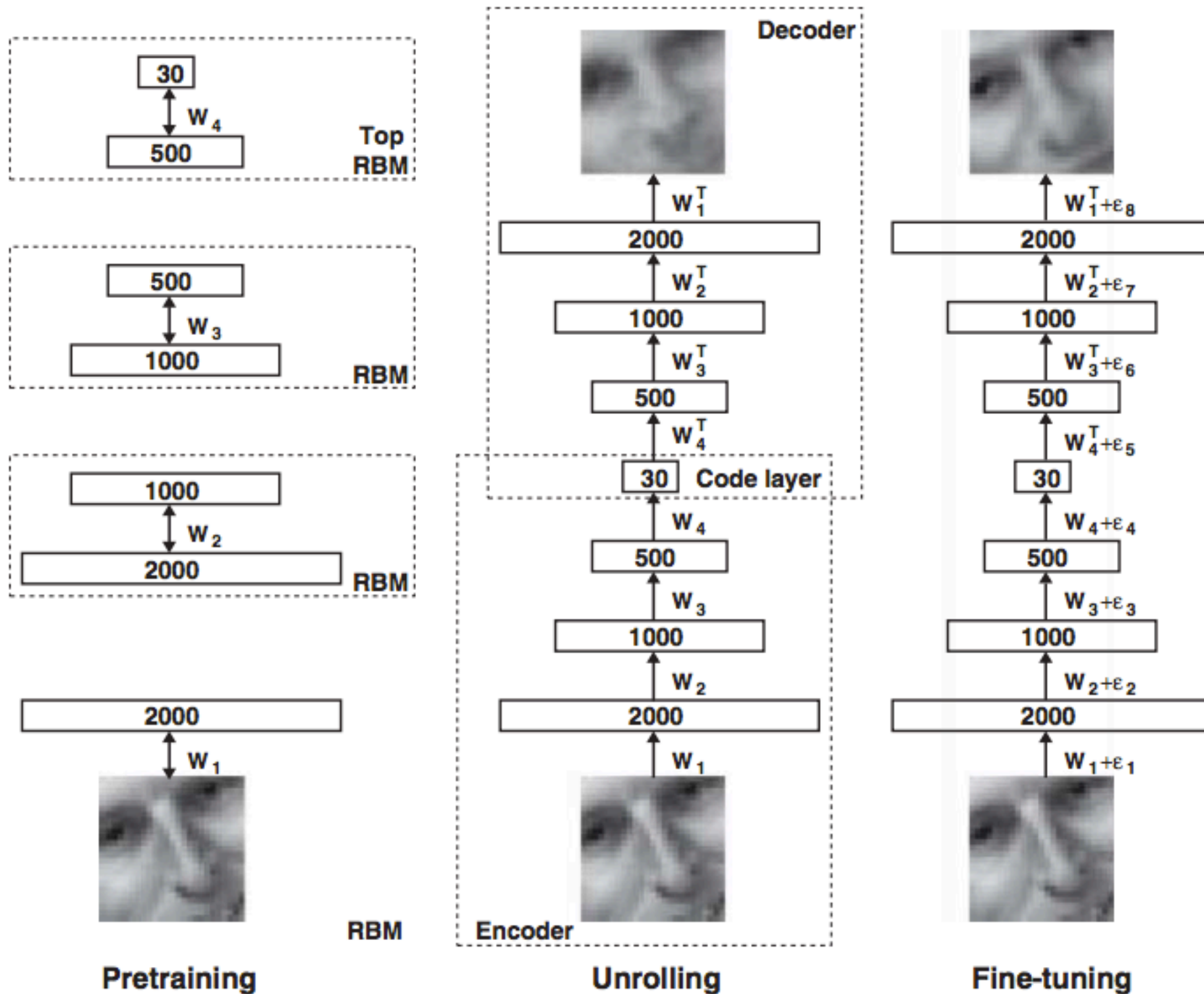# Reducing the Dimensionality of Data with Neural Networks

G. E. Hinton* and R. R. Salakhutdinov
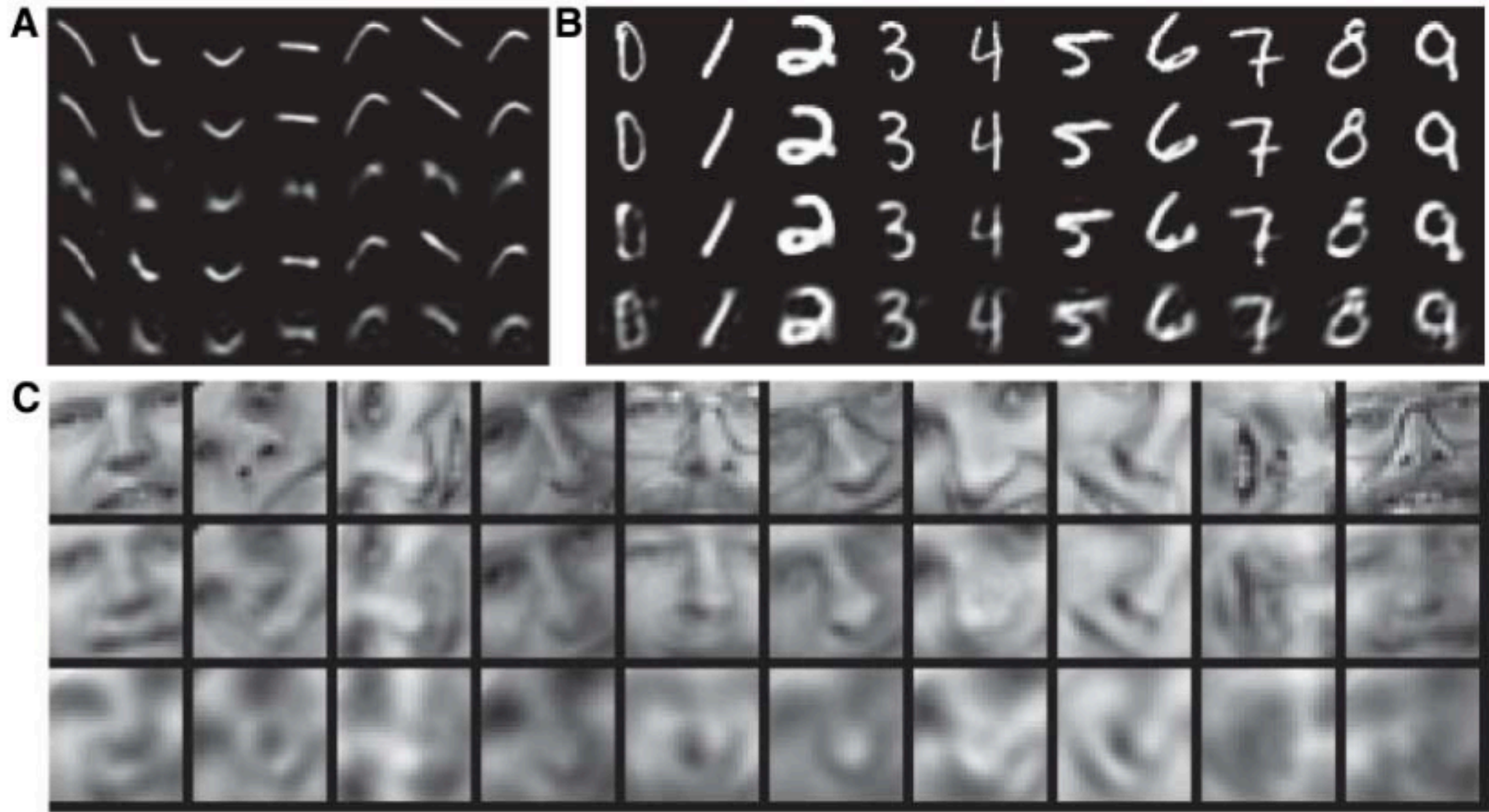In Science Vol 313, Issue 5786 28 July 2006

Introduction

- Convert high-dimensional data to low-dimensional codes

- Train a multilayer neural network with a small central layer to reconstruct high-dimensional input vectors

- Describe an effective way of initializing the weights that allows deep autoencoder networks to learn low-dimensional codes that work much better than principal components analysis (PCA) as a tool to reduce the dimensionality of data
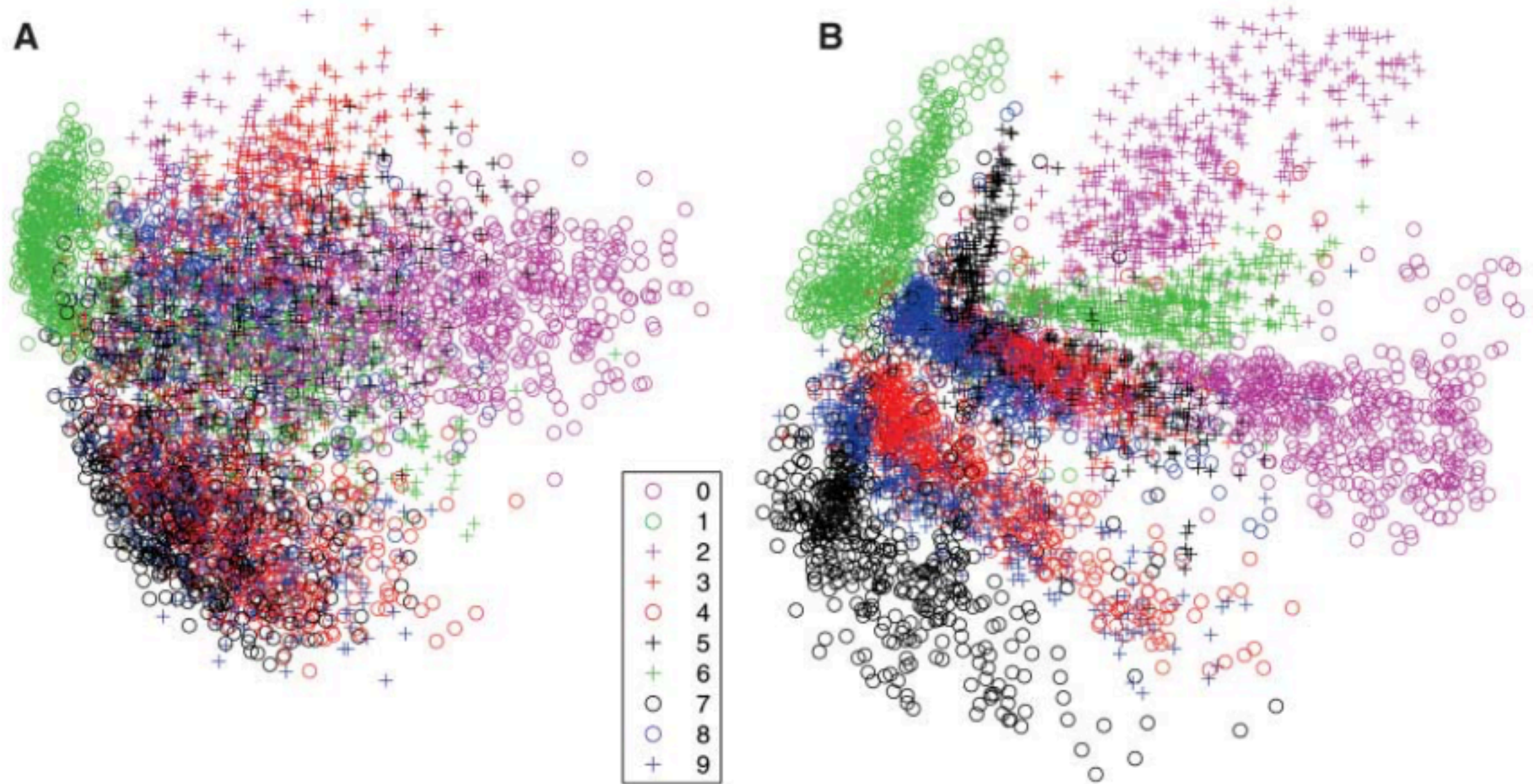
Architecture

Pretraining

Top RBM: 30, W_4, 500

RBM: 500, W_3, 1000

RBM: 1000, W_2, 2000

RBM: 2000, W_1

Unrolling

Decoder: 2000, W_1^T, 1000, W_2^T, 500, W_3^T, 30 Code layer, W_4^T

Encoder: 30, 500, W_4, 1000, W_3, 2000, W_2, W_1

Fine-tuning

2000, $W_1^T+\varepsilon_8$, 1000, $W_2^T+\varepsilon_7$, 500, $W_3^T+\varepsilon_6$, 30, $W_4^T+\varepsilon_5$, 500, $W_4+\varepsilon_4$, 1000, $W_3+\varepsilon_3$, 2000, $W_2+\varepsilon_2$, $W_1+\varepsilon_1$

Result

Result

○	0
○	1
+	2
+	3
○	4
+	5
+	6
○	7
○	8
+	9

Result