Machine Learning Final Proposal

隊名 : NTU_r07921015_機器學習機械學習

組員 : 司福民　r07921015

陳俊翰　r07522814

陳振豪　r07522811

許晉豪　r07921014

主題 : Deep Q - Small Data Training for Medical Images

Problem study(1) Unsupervised Pre-training

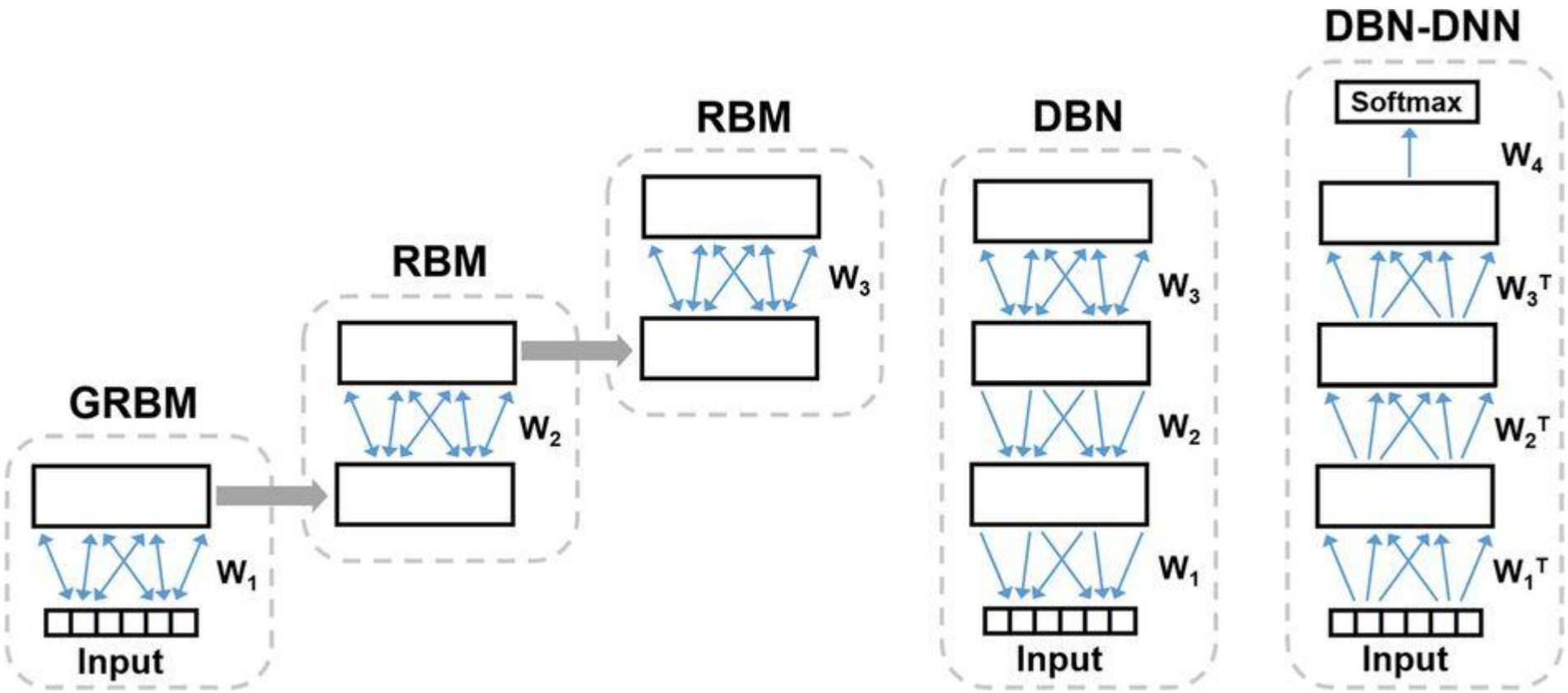
Method : Deep Belief Networks

- Basis of a greedy, layer-wise unsupervised learning phase
- Using unlabeled data pre-train and use labeled data fine-tuned.

Loss function: $\mathrm{f}(\mathrm{h}^{\mathrm{N}}(\mathrm{x}), \mathrm{y}) = 1/\mathrm{C} \sum_{k=1}^{C} e^{-h_k{}^{N}(x) y_k}$

To maximize the separability of the labeled data

DBN Model



Pre-train

fine-tuned

Problem study(2) Unsupervised Pre-training

Method : DeepCluster

- Pre-trained convolutional neural networks with ImageNet
- Use k-means algorithm to cluster
- Use Pseudo-labels for backpropagation

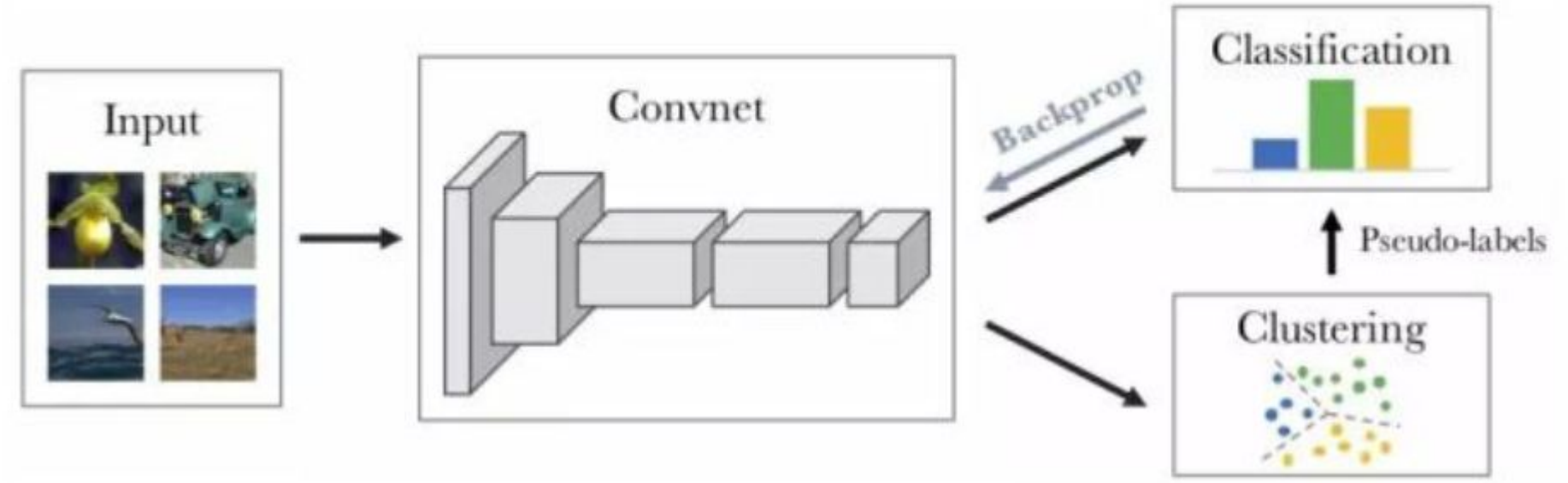
$$\min_{\theta,W} \frac{1}{N} \sum_{n=1}^{N} \ell\left(g_W\left(f_\theta(x_n)\right), y_n\right)$$

Use for backpropagation to compute the gradient

$$\min_{C \in \mathbb{R}^{d \times k}} \frac{1}{N} \sum_{n=1}^{N} \min_{y_n \in \{0,1\}^k} \|f_\theta(x_n) - C y_n\|_2^2 \quad \text{such that} \quad y_n^\top 1_k = 1.$$

Use for producing Pseudo-labels

DeepCluster Model



Problem study(3) Supervised training

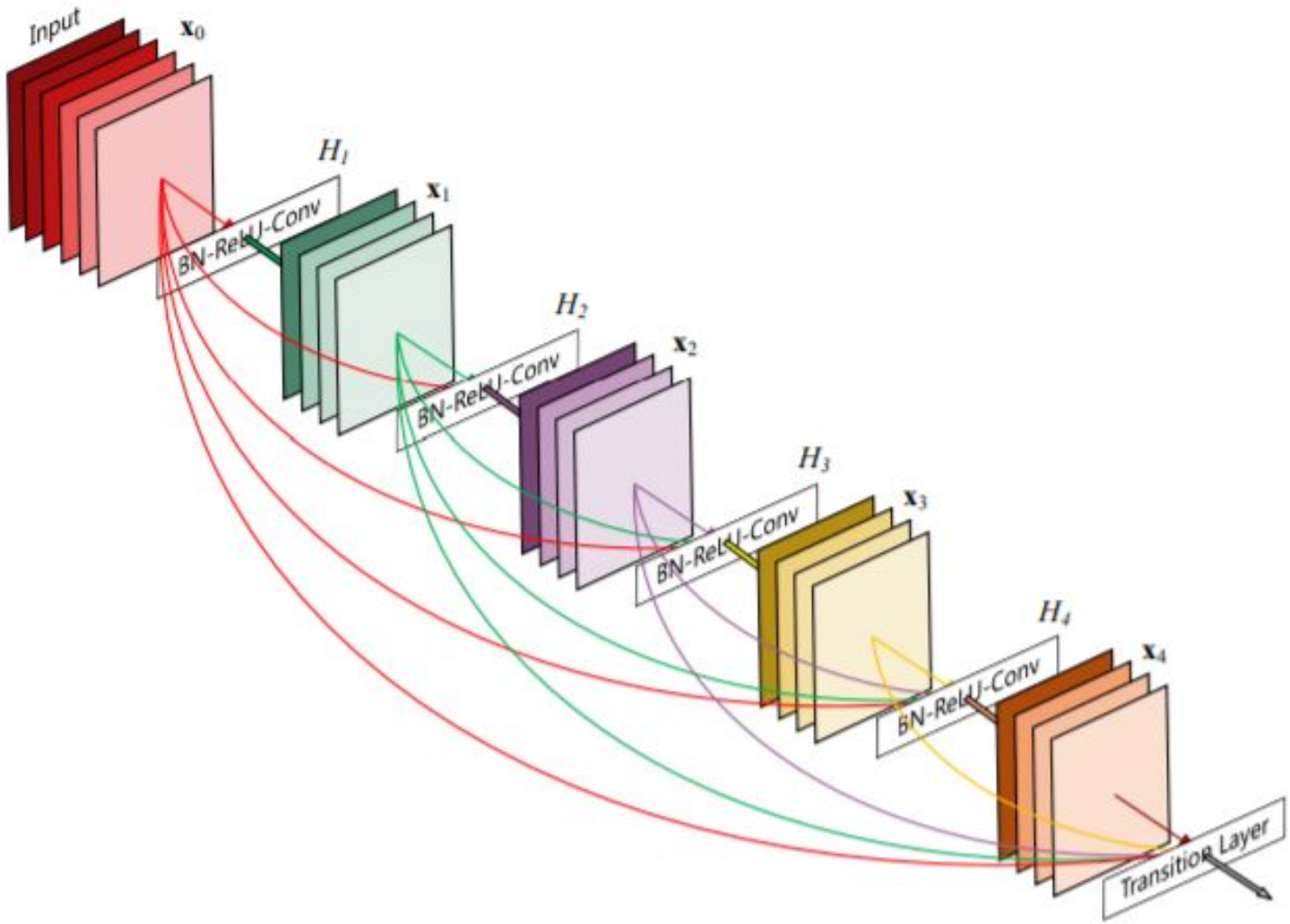
Method : DenseNet

- L layer receives the feature-maps of all preceding layers
- Define H as a composite function of three consecutive operations: batch normalization (BN) , linear unit (ReLU) and a 3×3 convolution (Conv)

$$\mathbf{x}_\ell = H_\ell([\mathbf{x}_0, \mathbf{x}_1, \ldots, \mathbf{x}_{\ell-1}])$$

$\mathbf{x}_0, \ldots, \mathbf{x}_{\ell-1}$, as input:

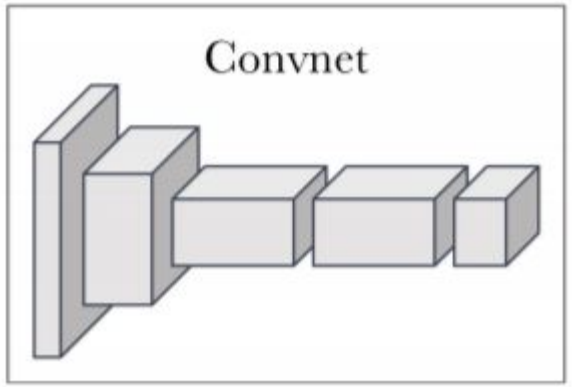
DenseNet Model

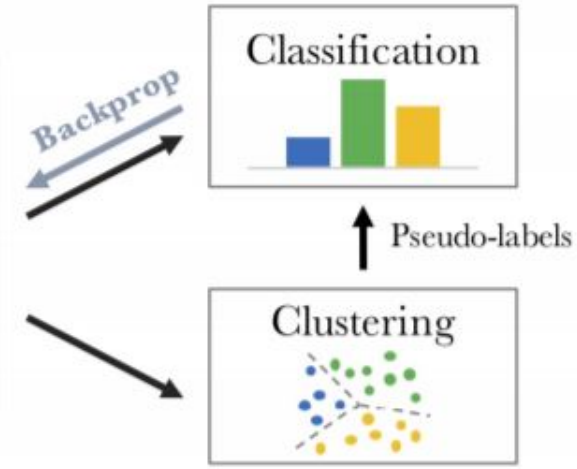


Proposed Method

Unlabeled Medical Images

Feature Extractor & Cluster (DeepCluster)





Weight Initialize

Feature Extractor & Classifier (DenseNet)

Convolution → Dense Block → Convolution → Pooling → Dense Block → Pooling → Linear → Sigmoid → Labels

Reference

[1] Self-supervised learning model for skin cancer diagnosis Ammara Masood, Adel Al- Jumaily, Khairul Anam 2015 7th International IEEE/EMBS Conference on Neural Engineering

[2]Caron, Mathilde, et al. "Deep clustering for unsupervised learning of visual features." arXiv preprint arXiv:1807.05520 3 (2018).

[3]Huang, Gao, et al. "Densely connected convolutional networks." CVPR. Vol. 1. No. 2. 2017.