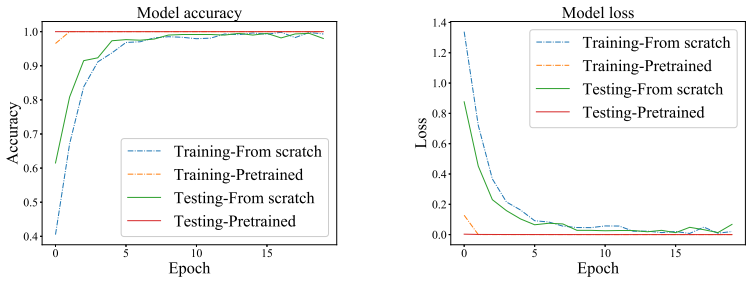
Highly-Accurate Machine Fault Diagnosis Using Deep Transfer Learning Supplementary Material

I. Experimental Verification Results

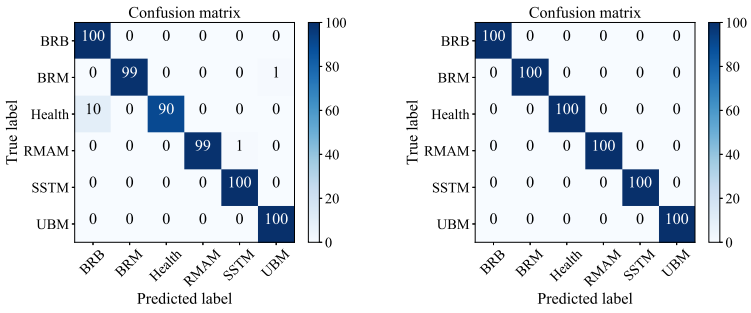
A. Induction Motor Dataset

Experimental results on induction motor dataset are shown in Figures 1 and 2, including classification accuracy and loss during training procedure, and confusion matrix of test dataset. Comparison between designed CNN model that is trained from scratch and the proposed method is given.



(a) Accuracy (b) Loss

Fig. 1: Classification accuracy and loss of verification experiments on induction motor dataset

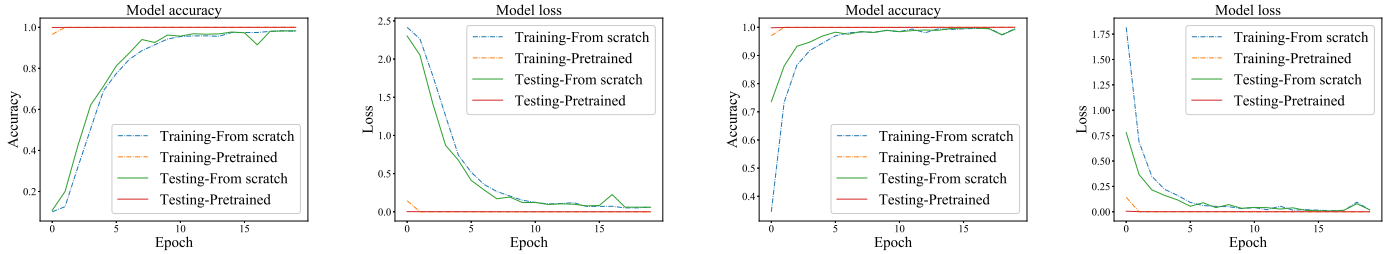


(a) Trained from scratch (b) Pretrained and fine tuned

Fig. 2: Confusion matrix of (a) designed CNN model trained from scratch and (b) deep transfer learning model on induction motor dataset

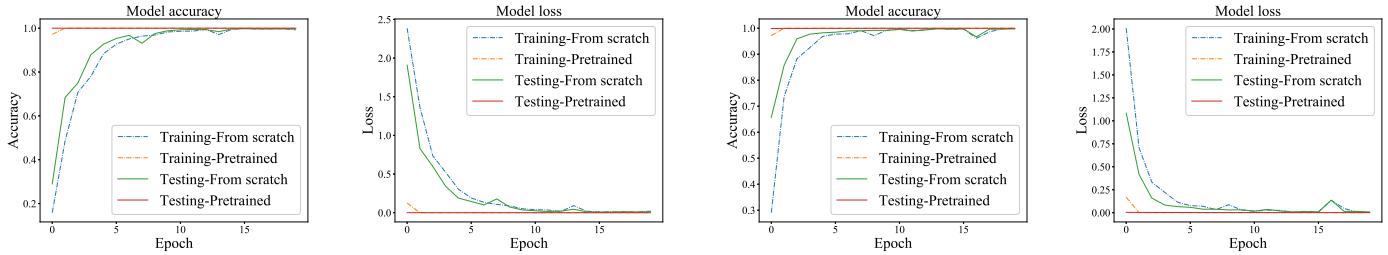
B. Bearings Dataset

Figures 3 and 4 show the results of verification experiment on bearings dataset. Results from 6 different sub-datasets are shown separately, including classification accuracy and loss during training procedure, and confusion matrix of test dataset. Performances from designed CNN model and the proposed method are shown.



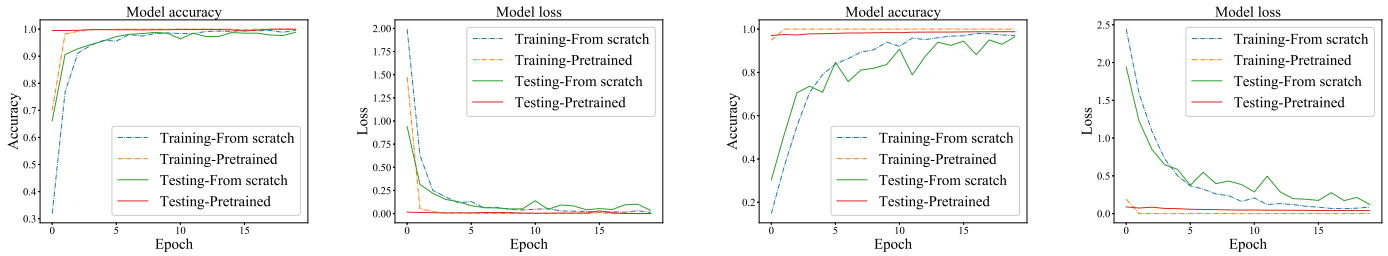
(a) Accuracy and loss of sub-dataset A

(b) Accuracy and loss of sub-dataset B



(c) Accuracy and loss of sub-dataset C

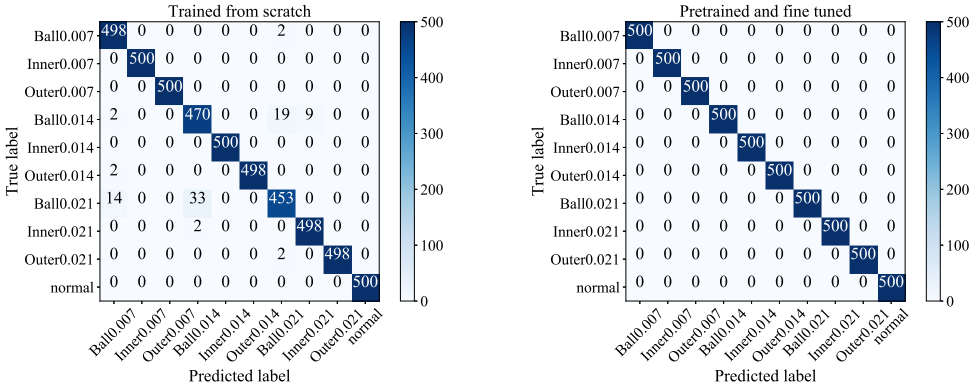
(d) Accuracy and loss of sub-dataset D



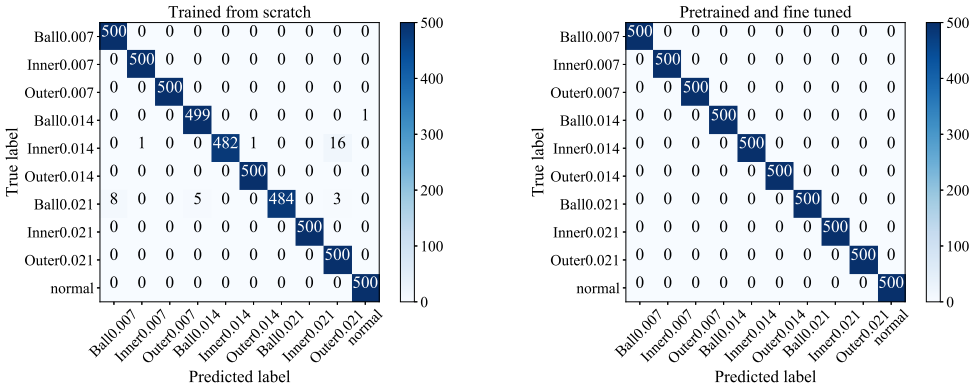
(e) Accuracy and loss of sub-dataset E

(f) Accuracy and loss of sub-dataset F

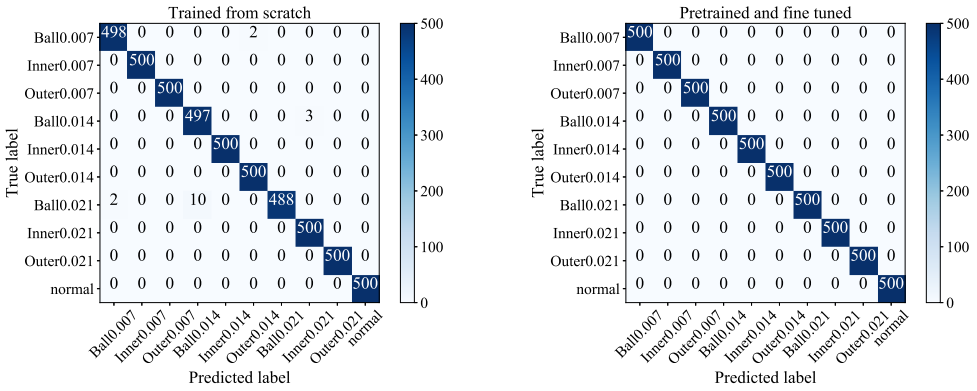
Fig. 3: Classification accuracy and loss of verification experiments on bearing dataset



(a) Confusion matrix of sub-dataset A

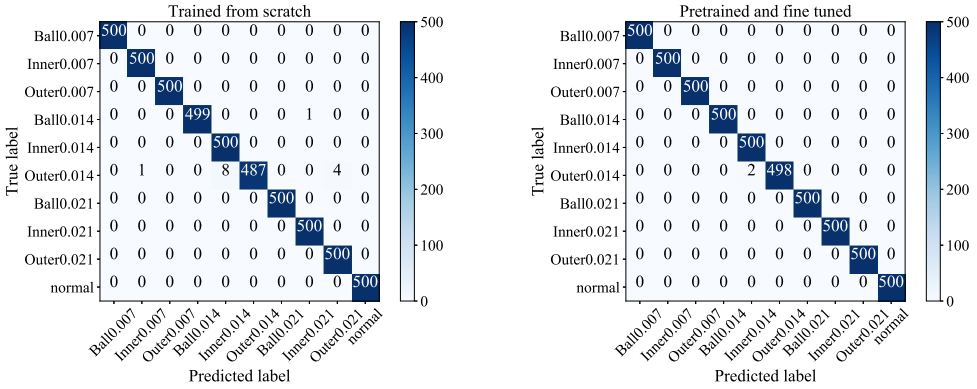


(b) Confusion matrix of sub-dataset B

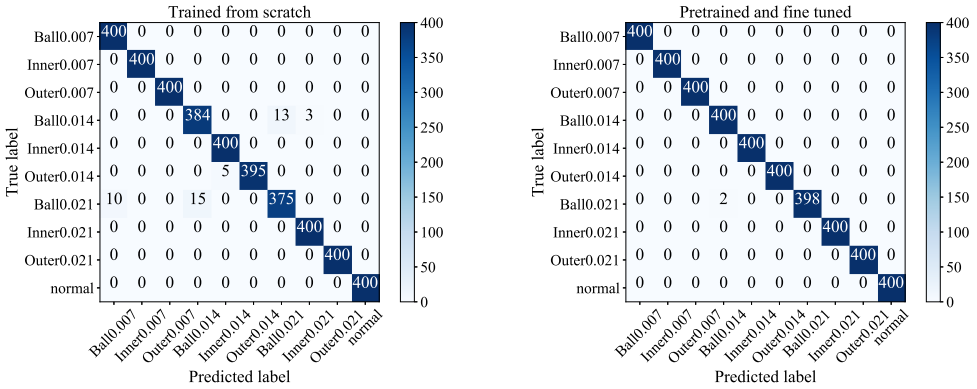


(c) Confusion matrix of sub-dataset C

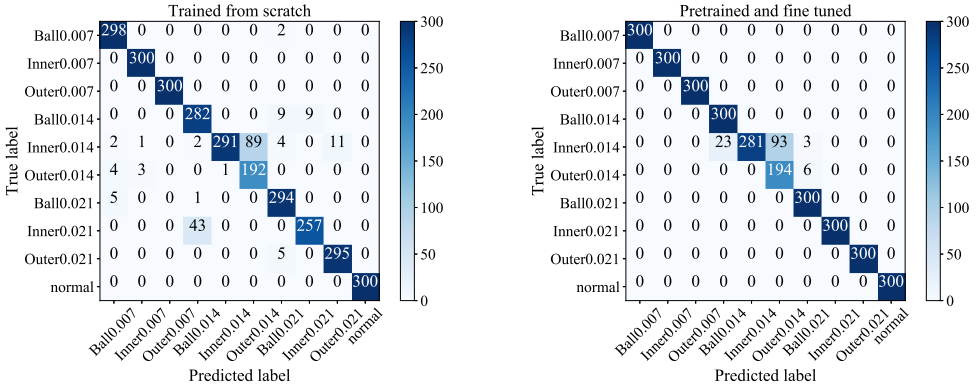
Fig. 4: Confusion matrix of designed CNN model trained from scratch and deep transfer learning model on bearing dataset



(d) Confusion matrix of sub-dataset D



(e) Confusion matrix of sub-dataset E

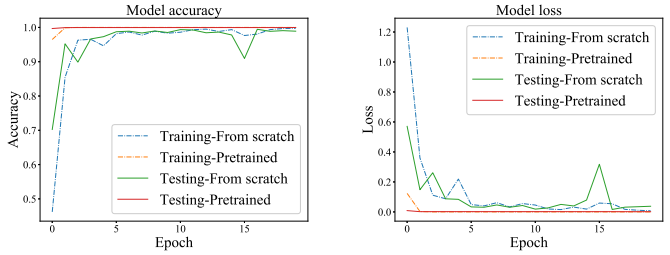


(f) Confusion matrix of sub-dataset F

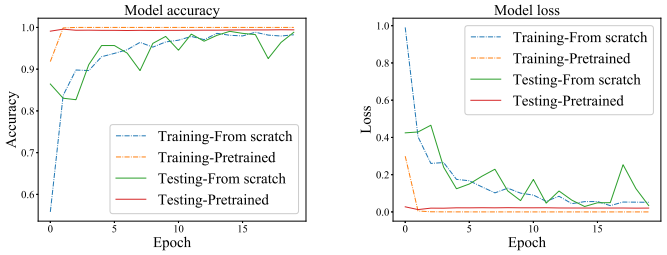
Fig. 4: Confusion matrix of designed CNN model trained from scratch and deep transfer learning model on bearing dataset

C. Gearbox dataset

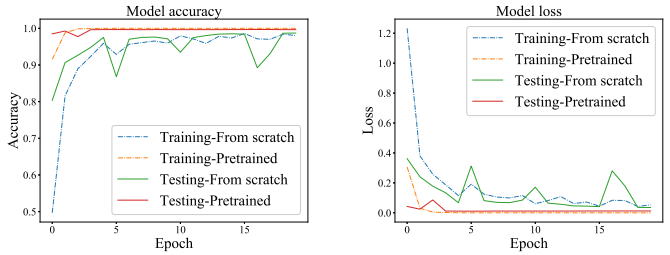
Figures 5 and 6 show the results on gearbox dataset. Classification accuracy and loss during training procedure, and confusion matrix of test dataset are shown. Both designed CNN model and the proposed method are investigated.



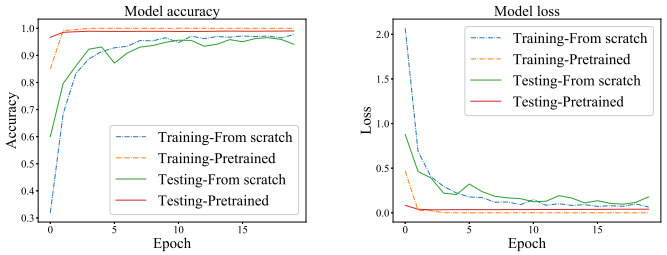
(a) 20_0 Bearing accuracy and loss



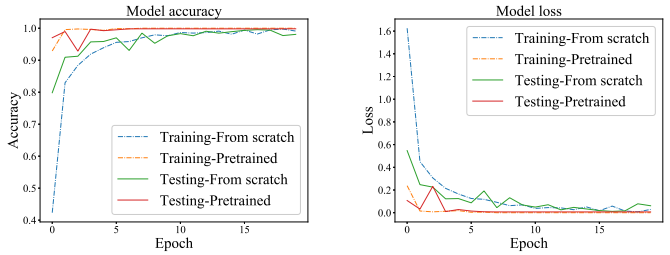
(b) 30_2 Bearing accuracy and loss



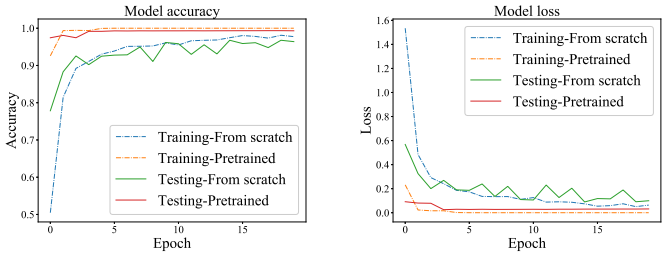
(c) 20_0 Gear accuracy and loss



(d) 30_2 Gear accuracy and loss

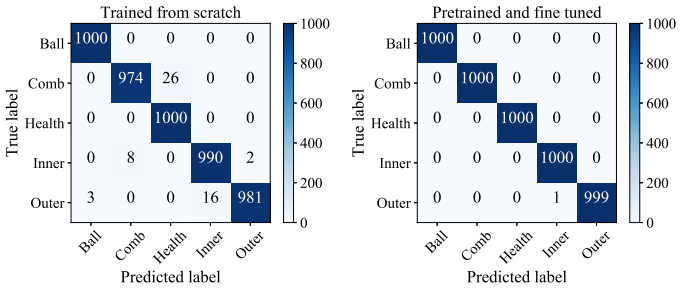


(e) 20_0 Mixture accuracy and loss

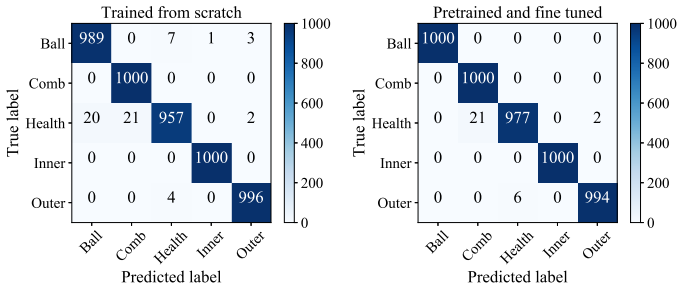


(f) 30_2 Mixture accuracy and loss

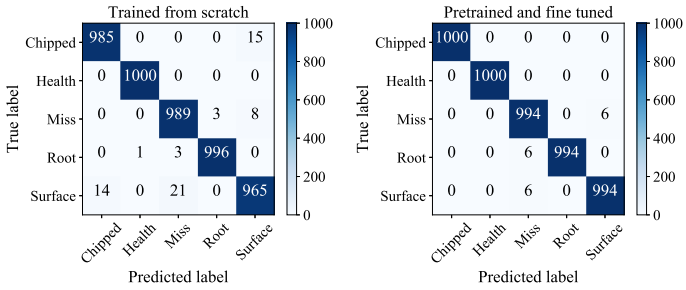
Fig. 5: Classification accuracy and loss of verification experiments on gearbox dataset



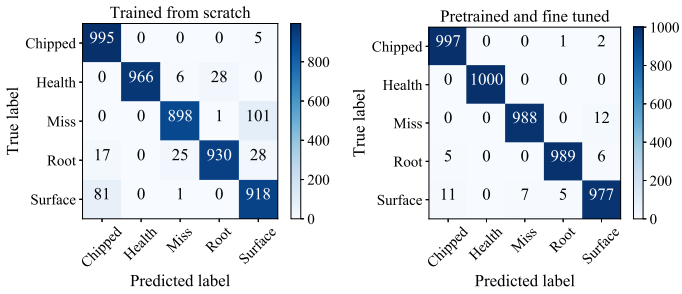
(a) Confusion matrix of 20_0 Bearing



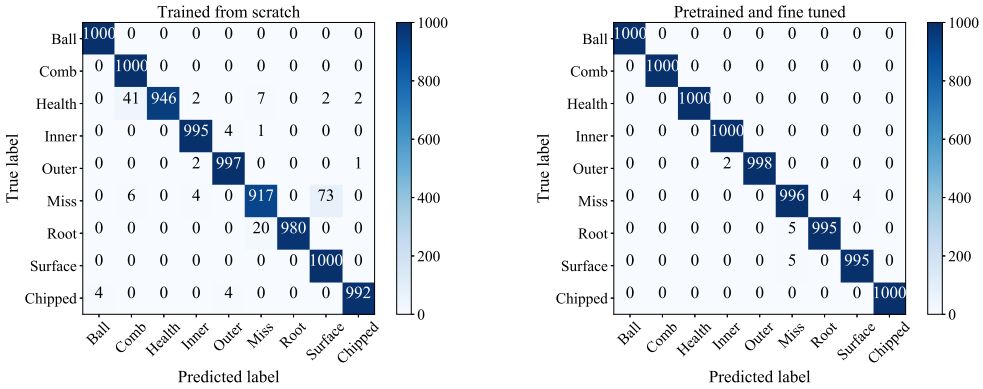
(b) Confusion matrix of 30_2 Bearing



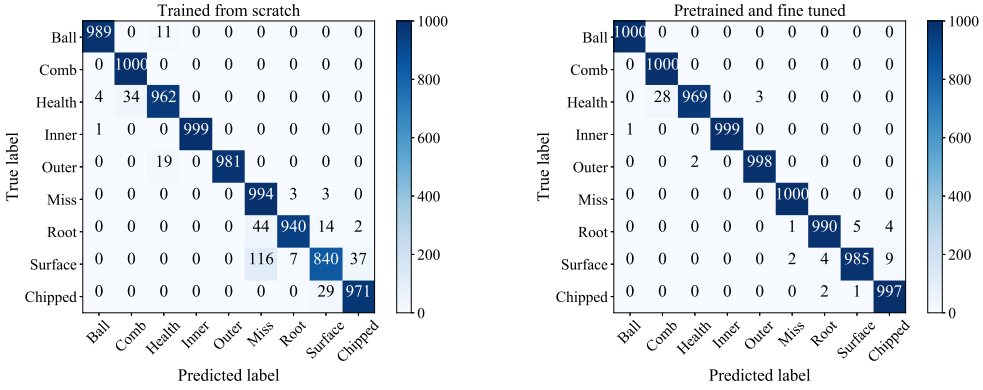
(c) Confusion matrix of 20_0 Gear



(d) Confusion matrix of 30_2 Gear



(e) Confusion matrix of 20_0 Mixture



(f) Confusion matrix of 30_2 Mixture

Fig. 6: Confusion matrix of designed CNN model trained from scratch and deep transfer learning model on gearbox dataset