

## Lab 6 - Reflections on transfer Learning

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### Introduction

The Boat data classification problem is solved using a fine-tuned Resnet50 model and using an SVM which uses the extracted features from Resnet50. The performance of both approaches are noted.

## 1 Transfer Learning

### 1.1 Finetuning

A pretrained Resnet50 is fine tuned by replacing the last fully connected layer with one with a different number of features. All the other layers are frozen( the weights are not updated during training). As we are using a pretrained Resnet50 on a different dataset we modify the last layer to make the output dimensions correct. Other layer are frozen because training them again using this small dataset may cause overfitting and it can take a long time to train.The model is trained for 10 epochs and a learning rate of 0.0001 is used. The model classification report is given in table 1.

Table 1: Model 1 classification report.

class	precision	recall	f1-score	support
0	0.500	0.105	0.174	19.000
1	1.000	0.182	0.308	22.000
2	1.000	0.039	0.075	51.000
3	0.000	0.000	0.000	3.000
4	0.000	0.000	0.000	7.000
5	1.000	0.017	0.033	59.000
6	0.000	0.000	0.000	3.000
7	0.000	0.000	0.000	1.000
8	0.539	0.938	0.684	274.000
9	0.400	0.270	0.323	74.000
10	0.000	0.000	0.000	15.000
11	1.000	0.105	0.190	19.000
12	0.000	0.000	0.000	3.000
13	0.000	0.000	0.000	29.000
14	0.929	1.000	0.963	325.000
15	0.871	0.900	0.885	420.000
accuracy	0.748	0.748	0.748	0.748
macro avg	0.452	0.222	0.227	1324.000
weighted avg	0.759	0.748	0.692	1324.000

Table 2: Model 2 classification report.

class	precision	recall	f1-score	support
0	0.905	1.000	0.950	19.000
1	0.818	0.818	0.818	22.000
2	0.765	0.255	0.382	51.000
3	1.000	0.667	0.800	3.000
4	0.000	0.000	0.000	7.000
5	0.818	0.305	0.444	59.000
6	1.000	1.000	1.000	3.000
7	0.000	0.000	0.000	1.000
8	0.818	0.985	0.894	274.000
9	0.411	0.838	0.551	74.000
10	0.667	0.133	0.222	15.000
11	1.000	0.737	0.848	19.000
12	0.000	0.000	0.000	3.000
13	0.000	0.000	0.000	29.000
14	0.991	1.000	0.995	325.000
15	0.993	0.971	0.982	420.000
accuracy	0.872	0.872	0.872	0.872
macro avg	0.637	0.544	0.556	1324.000
weighted avg	0.869	0.872	0.852	1324.000

### 1.2 Reflect on the two different approaches

The second approach extracts features from the pretrained resnet and passes them to a Support vector machine for training. The model classification report is given in Table 2. The second model performs better than the first model in both classwise and overall performance. The training is also faster for model 2. Deep nueral networks require a good amount of data to perform well, since we have a small dataset model 2 which uses SVM classifier performs better.