# 16824 Assignment 1
# Surface Normal Estimation

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## 1 Section D

We cannot directly apply "Reshape" or "View" layer because 40 is the second dimension of the tensor. If the tensor we want to reshape has dimension (batchsize, 16, 16, 40) then we could apply "reshape" or "view" layer directly, that's why we need to use transpose layer first.

### 1.1 Loss

The loss for training pre-trained mode is in Figure 1. The learning rate is 0.001. Total number of training epochs is 37. Other parameters keep the default parameter.

### 1.2 Evaluation

The final number obtained from evaluation is as follows,

| Epoch | Mean | Median | RMSE | 11.25 | 22.50 | 30.00 | 45.00 |
|---|---|---|---|---|---|---|---|
| 5 | 50.472 | 49.262 | 59.117 | 11.348 | 24.547 | 32.319 | 46.271 |
| 10 | 50.407 | 49.354 | 59.091 | 11.402 | 24.888 | 32.725 | 46.329 |

### 1.3 Visualization

The conv1 feature is in Figure 2 and prediction result is in Figure 3.

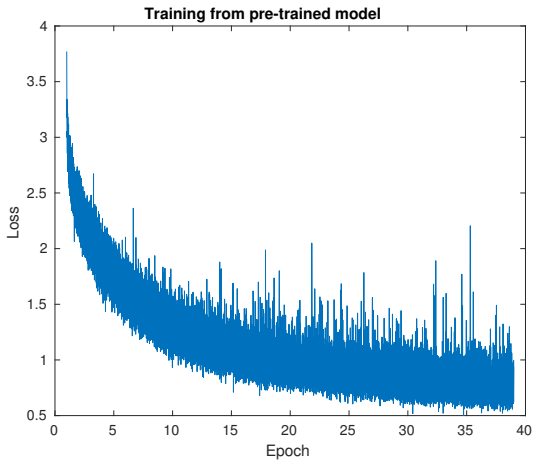


Figure 1: Loss for pre-trained model.

Figure 2: Visualization of conv1 feature for pre-trained model.

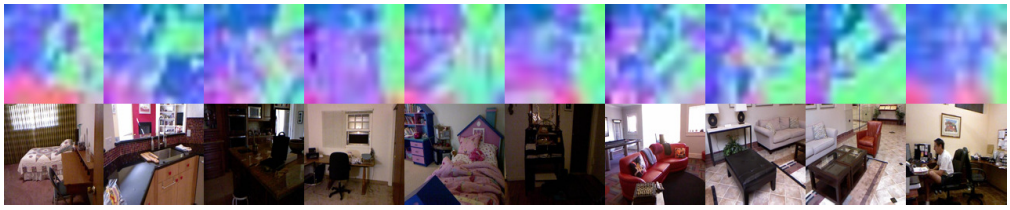

Figure 3: Visualization of prediction result for pre-trained model.

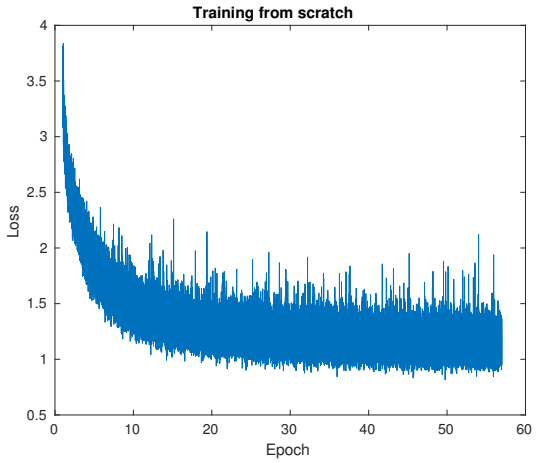


Figure 4: Loss for model from scratch.

## 2 Section E

### 2.1 Loss

The loss for training pre-trained mode is in Figure 4. The learning rate is 0.01. Total number of training epochs is 56. Other parameters keep the default parameter.

### 2.2 Evaluation

The final number obtained from evaluation is as follows,

| Epoch | Mean | Median | RMSE | 11.25 | 22.50 | 30.00 | 45.00 |
|---|---|---|---|---|---|---|---|
| 5 | 52.059 | 51.915 | 61.112 | 12.069 | 24.842 | 31.984 | 44.546 |
| 15 | 51.274 | 50.737 | 60.121 | 11.820 | 24.792 | 32.162 | 45.496 |
| 30 | 50.984 | 50.433 | 59.893 | 12.093 | 25.340 | 32.768 | 45.642 |

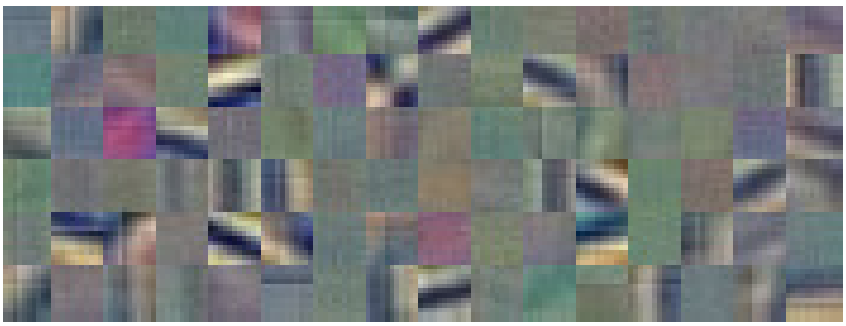

Figure 5: Visualization of conv1 feature for model from scratch.

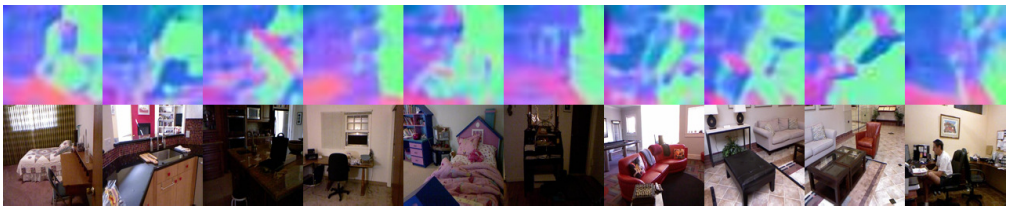

Figure 6: Visualization of prediction result for model from scratch.

### 2.3 Visualization

The conv1 feature is in Figure 5 and prediction result is in Figure 6.