

Intelligent Transportation Systems

Driving posture recognition by convolutional neural networks

李万里
李仁发教授
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Outline

- Introduction
- System
- Experiments
- Discussions

Introduction

- IDAS
- Approaches
 - vehicle-oriented; driver-oriented; **vision-based**
- **Deep learning**
- **CNN**
- The Work

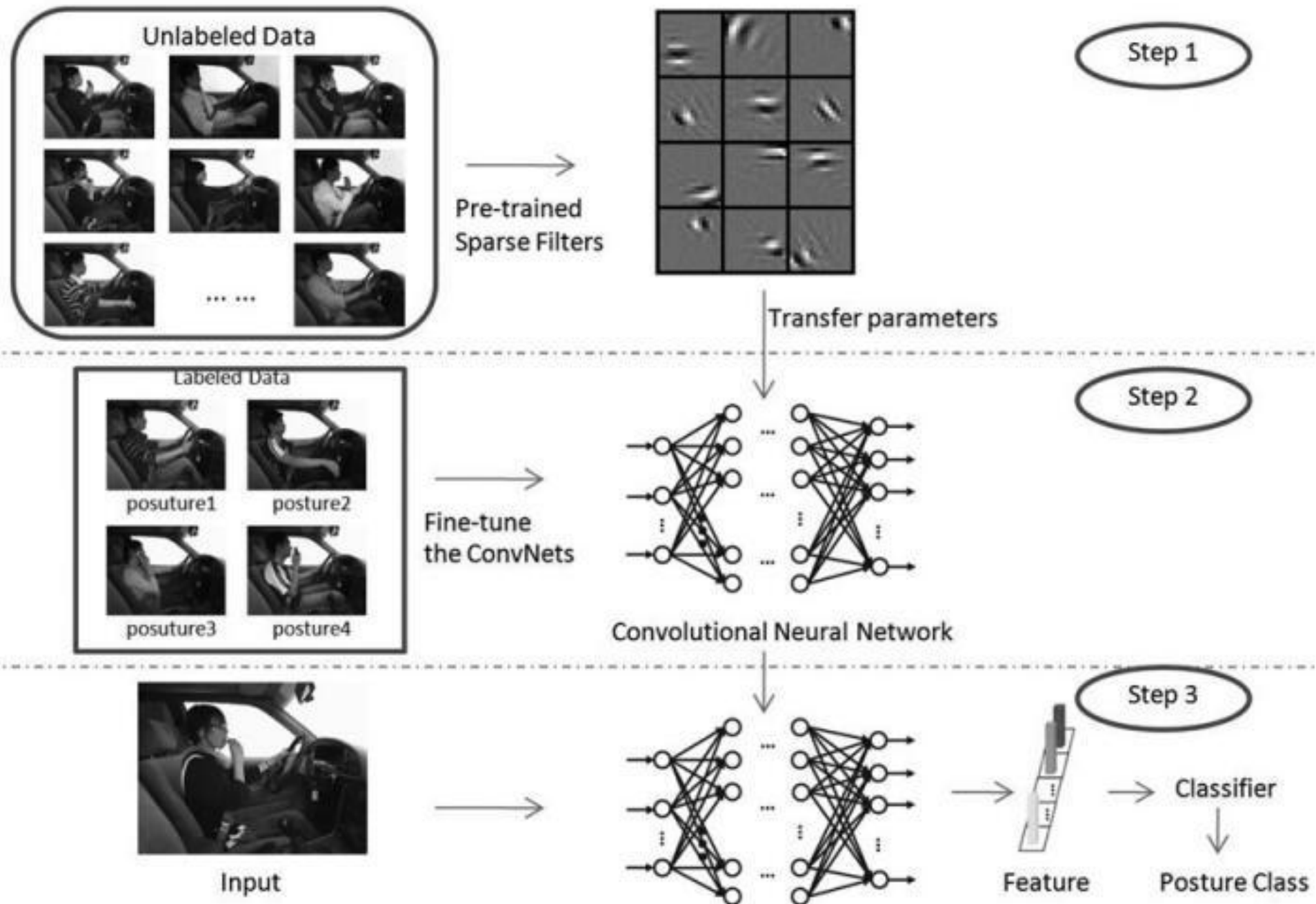
Introduction

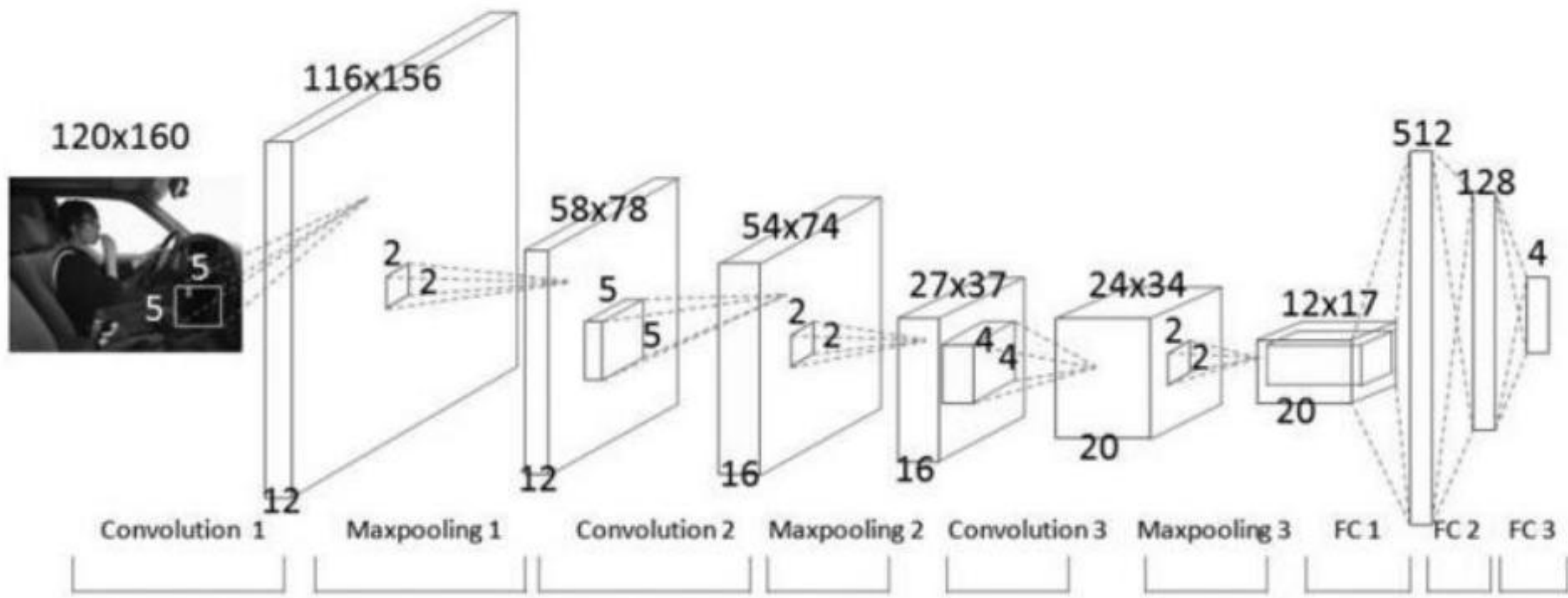
Contributions

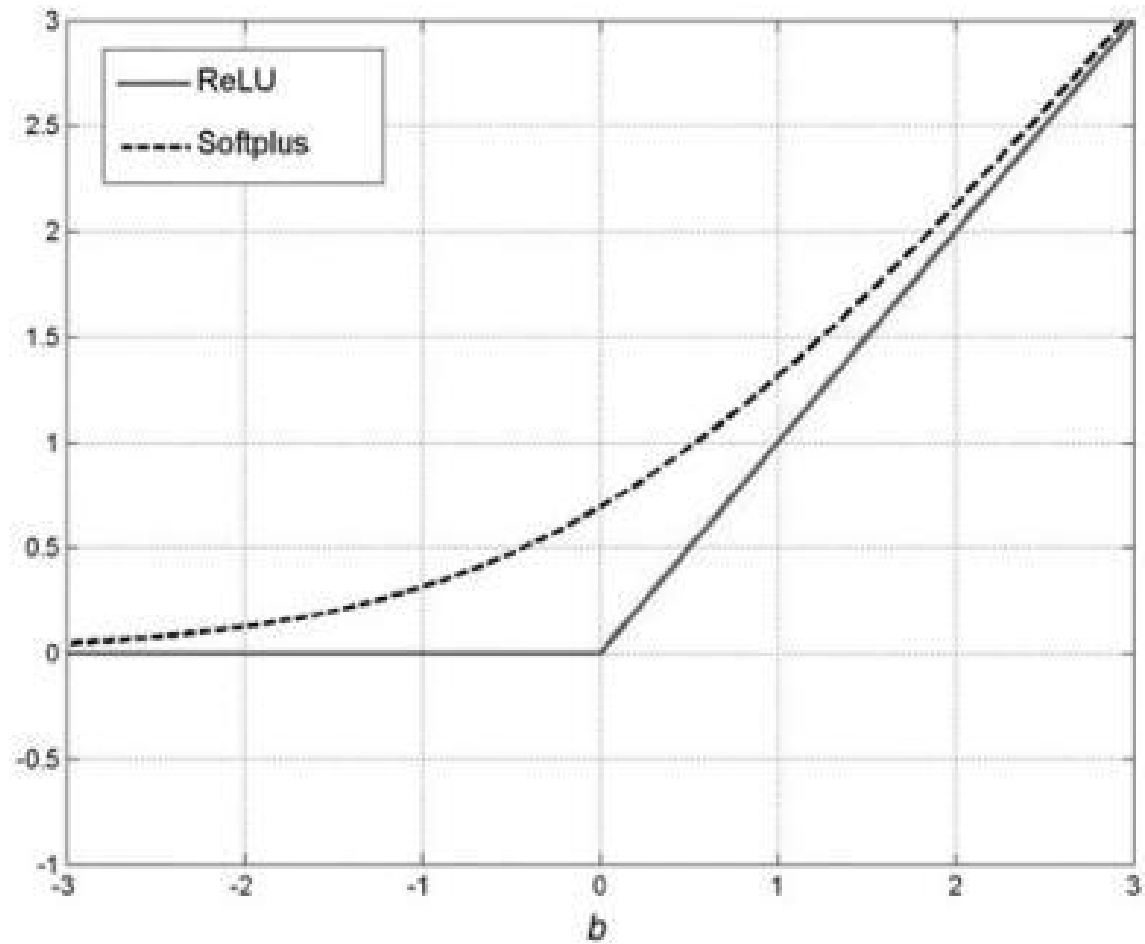
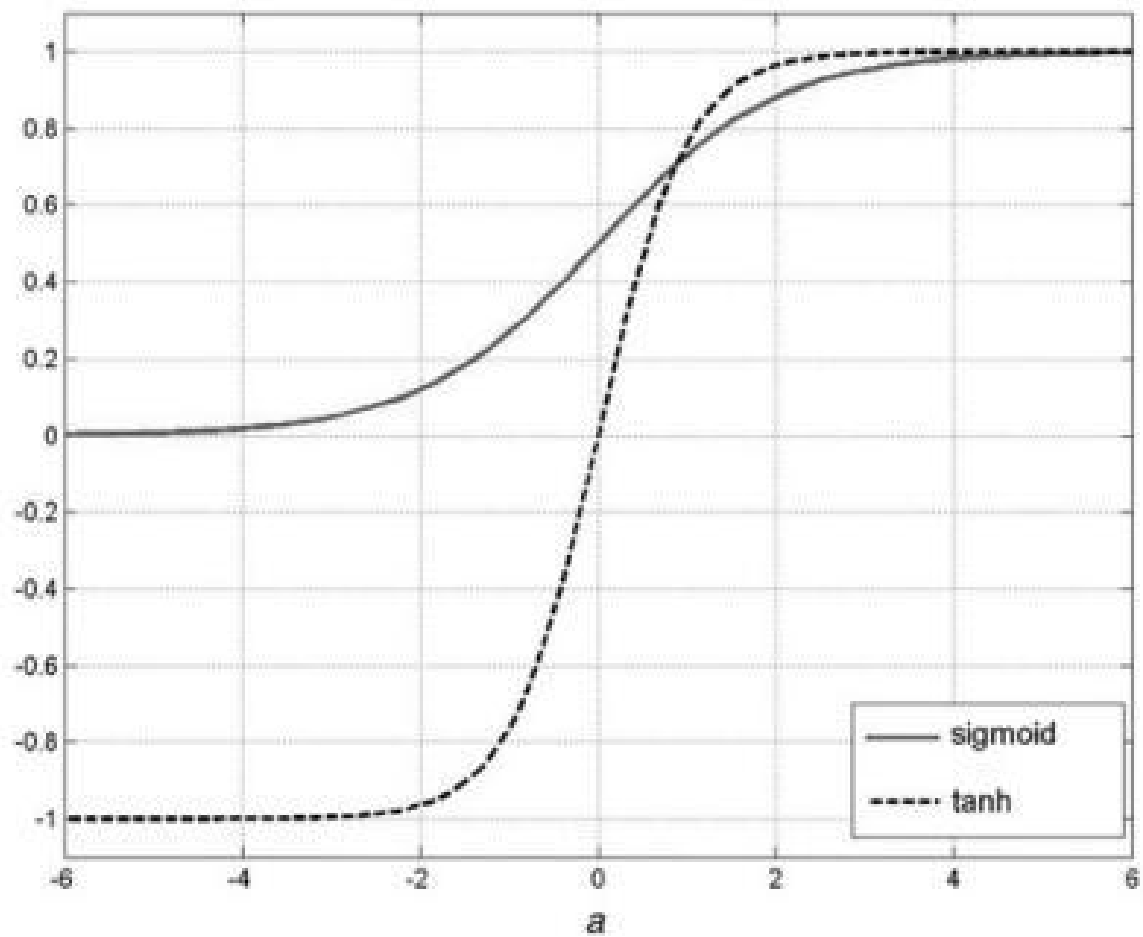
- (1) deep CNN -> to automatically explore salient features
- (2) sparse filter -> pre-train the filters
 - rectifier linear unit (ReLU) -- activation function
 - max-pooling -- pooling method
- (3) evaluation on the SEU driving posture dataset...

System

- System overview
 - pre-trained sparse filters
 - fine-tune the ConvNets
 - Classifier
- Architecture of CNN network
 - C - convolutional layer
 - A - non-linear activation layer
 - N - local response normalisation layers
 - P - max-pooling layer







Experiments

- Datasets
- Pre-train
- Activation function & pooling method
- Experiments on datasets



At night

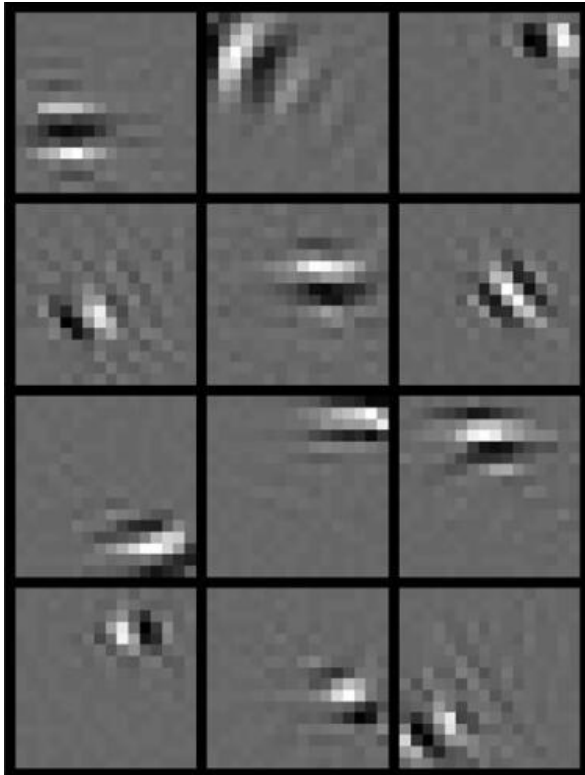


in real

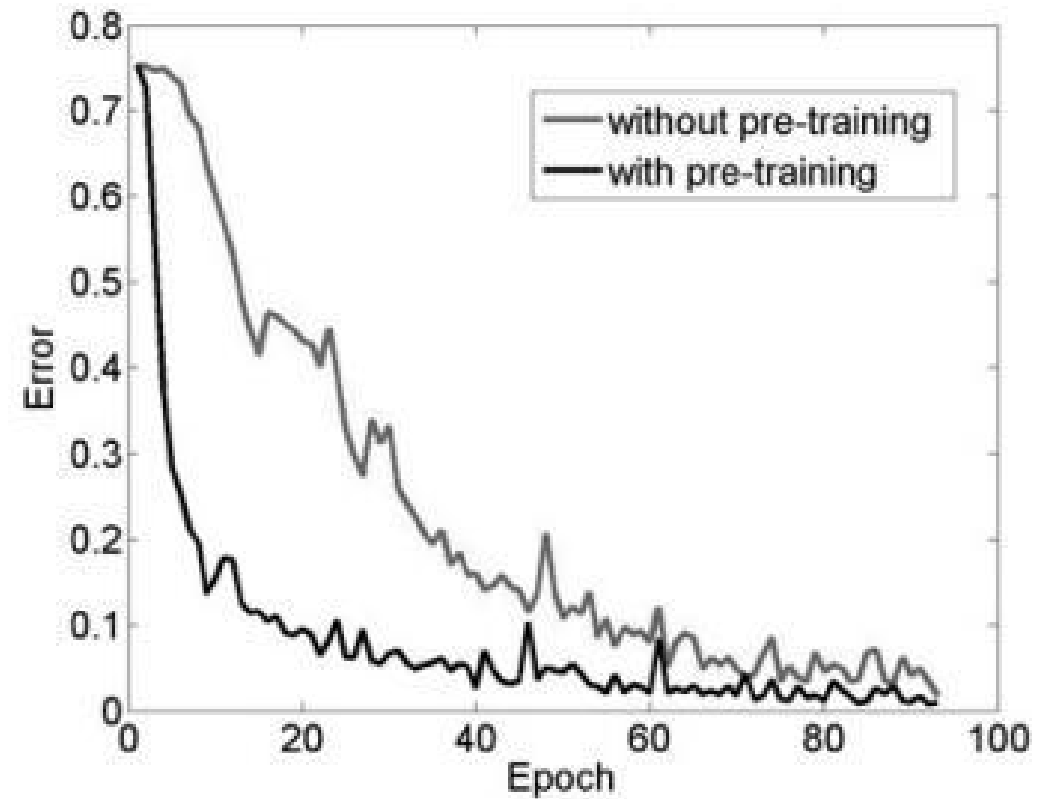


Pre-train

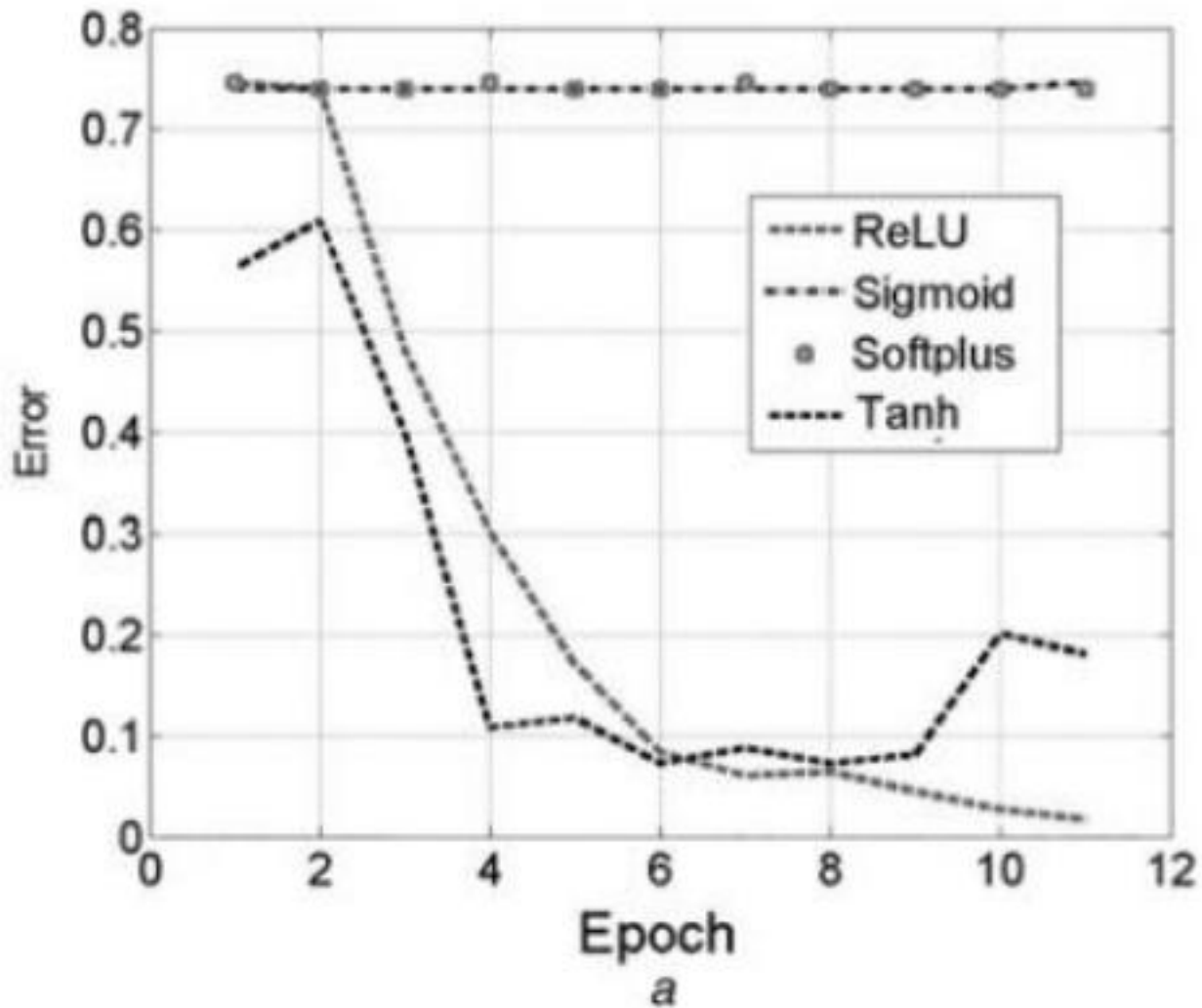
pre-trained sparse filters



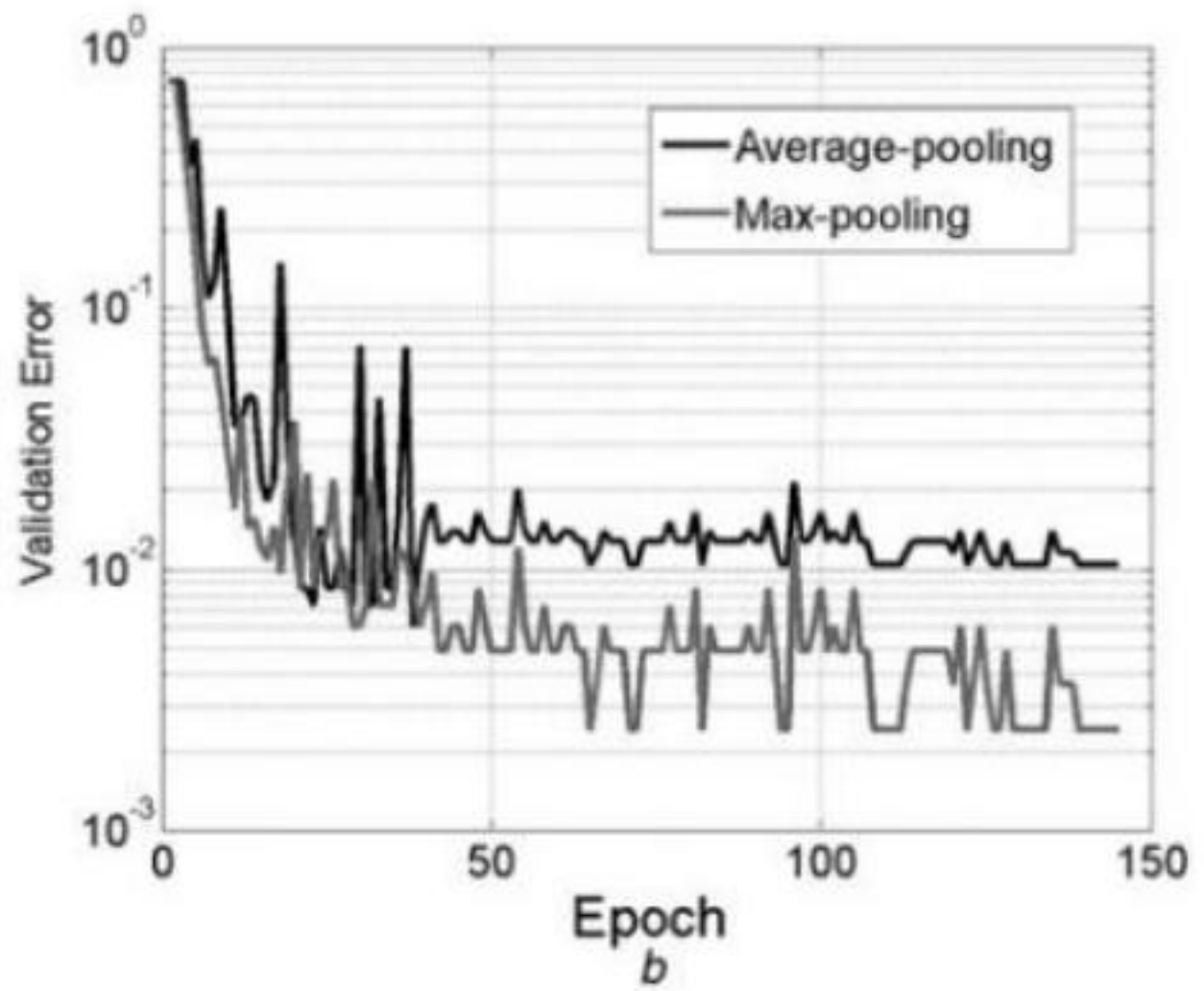
improvement



activation function



pooling method



Experiments on SEU dataset

Table 1 Confusion matrix for the cross-validation result

Class	Pose 1	Pose 2	Pose 3	Pose 4
pose 1	99.47	0	0.53	0
pose 2	0	100	0	0
pose 3	0	0	100	0
pose 4	0	0	0.45	99.55

Table 4 Classification accuracy compared with other six approaches

	Pose 1	Pose 2	Pose 3	Pose 4	Avg.
baseline [13]	97.70	87.55	85.95	89.30	90.63
WT [56]	97.52	92.77	88.99	83.02	89.23
RSE [57]	99.95	91.20	99.20	87.42	94.20
Bayes [58]	94.82	95.20	98.26	92.77	95.11
PHOG + SVM	99.83	88.71	89.12	73.20	91.56
SIFT + SVM	99.40	93.52	94.55	91.21	96.12
proposed	99.47	100	100	99.55	99.78

Misclassification analysis



a



b

At night & in real

Table 2 Confusion matrix for experiment using Driving-Posture-atNight

Class	Pose 1	Pose 2	Pose 3	Pose 4
pose 1	99.75	0	0.25	0
pose 2	0	100	0	0
pose 3	0	0	99.30	0.70
pose 4	0	0	0.50	99.50

Table 3 Confusion matrix for experiment using Driving-Posture-inReal

Class	Pose 1	Pose 2	Pose 3	Pose 4
pose 1	95.77	0	2.70	1.53
pose 2	0.22	99.15	0.63	0
pose 3	1.35	0.82	96.23	1.60
pose 4	0.55	0	1.90	97.55

Discussion

- Time-consuming;
- A large amount of data needed

自己的思考

- (1) 学习如何将深度学习应用于驾驶员行为分析
- (2) 局限性: **pre-defined** driver postures

Thank you