Australian National University

Vision Based Steering Behaviour Imitation for Self-driving Car

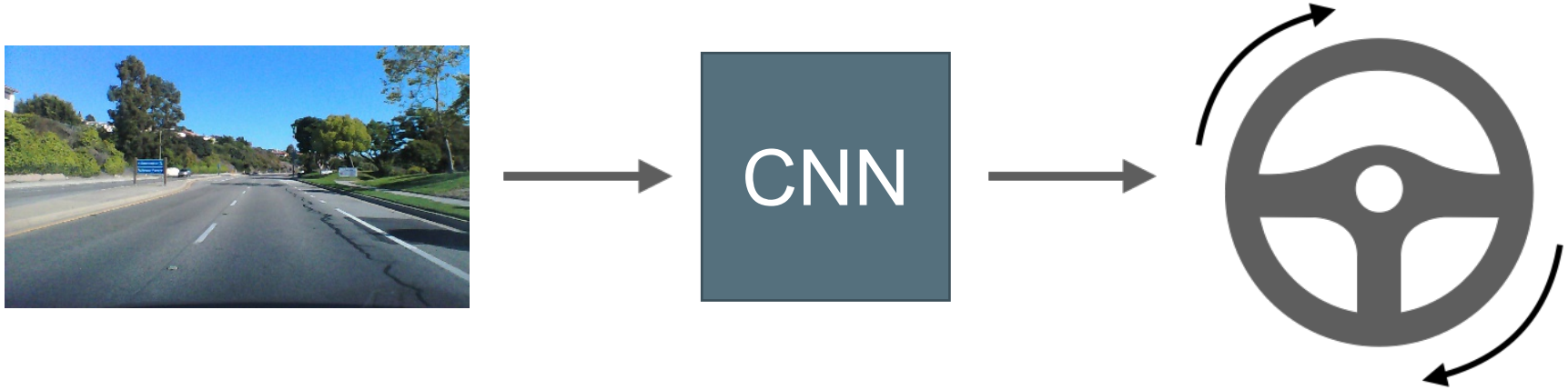
Group 27

Chaoxing Huang	u6441859
Ruitao Leng	u6777647
Zhaowen Xu	u6749372
Xinyu Gao	u6656678
Chensheng Zhang	u6615212

http://www.chinatsp.com/plartform

Introduction

- Vision based self driving model
- End to end steering angle prediction

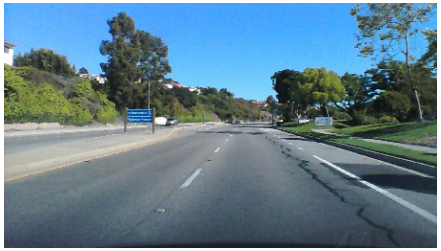


Methodology

Single stream

$$L = \frac{1}{N}\sum_{i=1}^{N}(\theta_i - \bar{\theta}_i)^2$$

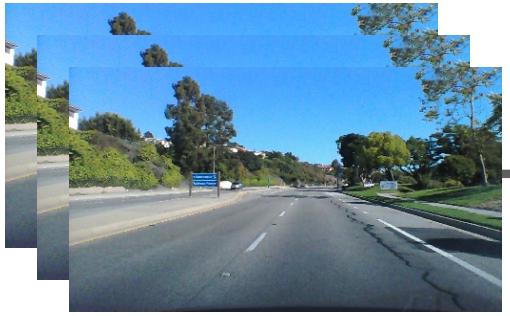
Learning goal:
minimize ***MSE***



RGB

CNN

Steering angle



RGB x 3

CNN

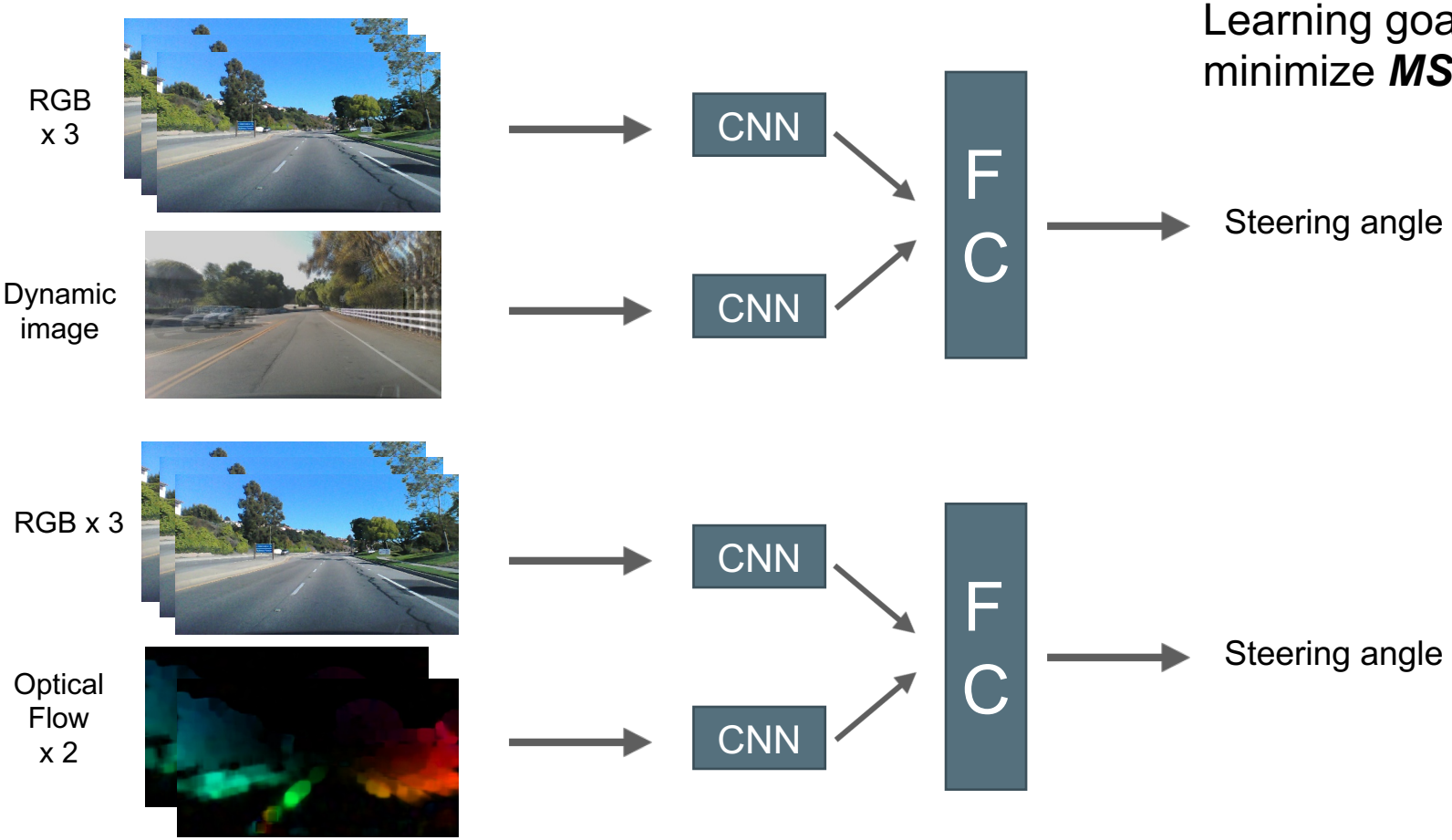
Steering angle

Methodology

$$L = \frac{1}{N}\sum_{i=1}^{N}(\theta_i - \bar{\theta}_i)^2$$

Two streams

Learning goal: minimize ***MSE***



Work Load Distribution

Group Member	Work load distribution	Contribution ratio
Chaoxing Huang	- Network Architecture - Method design	24%
Ruitao Leng	- Data preprocessing - Model testing	18%
Zhaowen Xu	- Model Tuning - Paper research	22%
Xinyu Gao	- Data preprocessing - Paper research	18%
Chensheng Zhang	- Data analysis - Model testing	18%

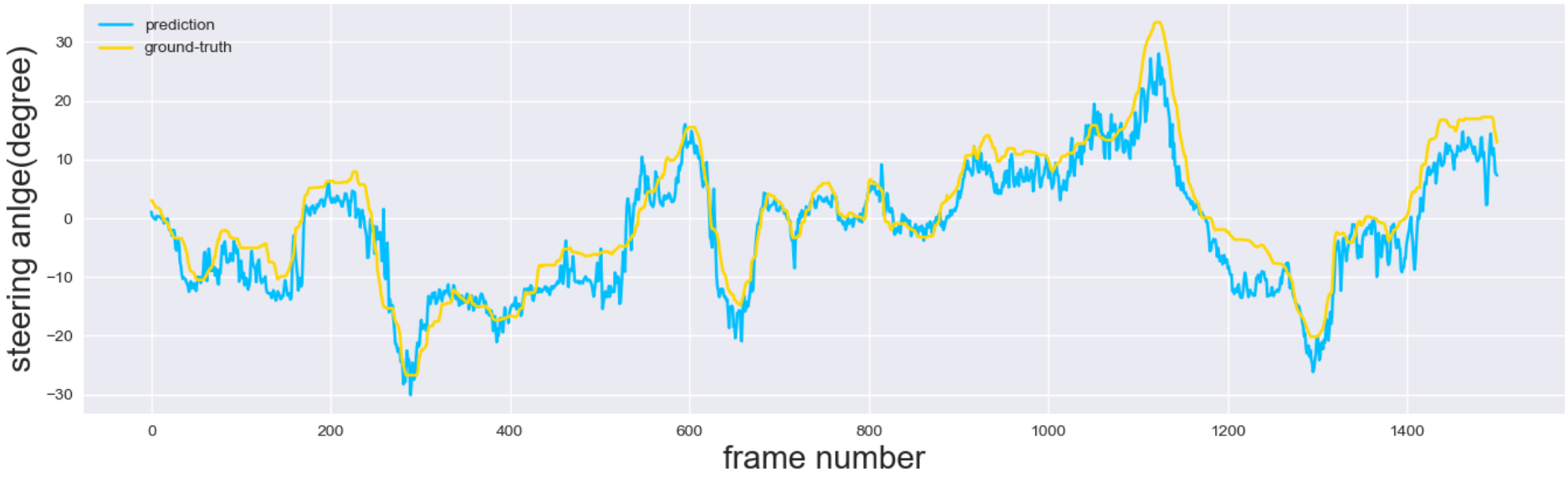
Experiment

Table 1: RMSE of different models(in degree)

Model	City testset	Hill testset
single stream single RGB	19.04	23.89
single stream 3× RGB	7.23	13.91
3×RGB +1× optical flow	7.10	10.92
3×RGB +2× optical flow	6.09	9.73
3×RGB +dynamic image of 3 frames	6.93	10.15
3×RGB +dynamic image of 5 frames	5.99	11.51

The model is trained on Sully Chen's 2016 Dataset(40k images) and tested on 2018 Dataset (20k City+13k Hill).

Experiment


prediction
ground-truth
steering anlge(degree)
30
20
10
0
−10
−20
−30
0
200
400
600
800
1000
1200
1400
frame number

Experiment – ANU Campus Test

Activation heat map

Conclusion

- Video sequence and temporal information can significantly improve the steering performance
- Redundant temporal information of the past can degrade the performance

Future Work

- LSTM, RNN, 3D-CNN
- Deep reinforcement learning
- GAN

Reference

- Simonyan, K., & Zisserman, A. (2014). Two-stream convolutional networks for action recognition in videos. In *Advances in neural information processing systems* (pp. 568-576).
- Rodriguez, C., Fernando, B., & Li, H. (2018). Action anticipation by predicting future dynamic images. In *Proceedings of the European Conference on Computer Vision (ECCV)* (pp. 0-0).
- Bojarski, M., Del Testa, D., Dworakowski, D., Firner, B., Flepp, B., Goyal, P., ... & Zhang, X. (2016). End to end learning for self-driving cars. *arXiv preprint arXiv:1604.07316*.
- Bojarski, M., Choromanska, A., Choromanski, K., Firner, B., Jackel, L., Muller, U., & Zieba, K. (2016). Visualbackprop: visualizing cnns for autonomous driving. *arXiv preprint arXiv:1611.05418*, *2*.

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Chensheng Zhang Xinyu Gao

College of Engineering & Computer Science, ANU

ENGN 6528 Project Demo

https://www.youtube.com/watch?v=7juEYI-gGKw&feature=youtu.be