Vehicle Interaction Learning

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07/31/2019

Train on NGSIM

- Exchange x and y: (x1, y1, x2, y2) -> (y1, x1, y2, x2)

IoU0.9 Acc: 84.5%, Change_Lane_Acc: **92.7%**, Traj_Cls_Acc: 97.6%

- Validate on HighD:

Exchange:

IoU0.9 Acc: 56.3%, Change_Lane_Acc: 55.7%, Traj_Cls_Acc: 62.6%

No-exchange:

IoU0.9 Acc: 52.7%, Change_Lane_Acc: 51.5%, Traj_Cls_Acc: 70.3%

Train on NGSIM

- With max_norm and only global normalize scale factor:

(x1, y1, x2, y2, x_scale, y_scale)

IoU0.9 Acc: 82.1%, Change_Lane_Acc: 90.1%, Traj_Cls_Acc: 97.4%

- Validate on HighD:

Exchange:

IoU0.9 Acc: 64.1%, Change_Lane_Acc: 72.7%, Traj_Cls_Acc: 63.4%

No-exchange:

IoU0.9 Acc: 49.5%, Change_Lane_Acc: 56.0%, Traj_Cls_Acc: 69.6%

Train on NGSIM

- Random rotation:

$$\begin{bmatrix} x' \\ y' \end{bmatrix} = \begin{bmatrix} cos\theta & -sin\theta \\ sin\theta & cos\theta \end{bmatrix} * \begin{bmatrix} x \\ y \end{bmatrix}$$

(x1, y1, x2, y2) -> random θ

IoU0.9 Acc: 83.3%, Change_Lane_Acc: 90.1%, Traj_Cls_Acc: 97.1%

- Validate on HighD:

Exchange:

IoU0.9 Acc: 82.4%, Change_Lane_Acc: 80.1%, Traj_Cls_Acc: 75.9%

No-exchange:

IoU0.9 Acc: 46.8%, Change_Lane_Acc: 35.2%, Traj_Cls_Acc: 68.5%

Train on NGSIM

- Random rotation with larger regression weight (99:1):

IoU0.9 Acc: 85.3%, Change_Lane_Acc: 89.4%, Traj_Cls_Acc: 97.3%

- Validate on HighD:

Exchange:

IoU0.9 Acc: 88.5%, Change_Lane_Acc: 81.9%, Traj_Cls_Acc: 85.4%

No-exchange:

IoU0.9 Acc: 64.7%, Change_Lane_Acc: 56.9%, Traj_Cls_Acc: 73.6%

Other observations

- Max-norm is harmful when using random rotation
- Even with random rotation, we still need to exchange during validation
- **Rethink the coordinate transformation**

(-350->500, 350->1200) scale 1200

(3500->4350, -3500->-2650) scale 4350

(-350->1000, 350 - 1700) scale 1700

Feature distribution rely on initial distance and trajectory length.

Different Scale Factor for x and y

- **Idea: 1. No local norm, only norm globally with a common scale factor for x and y 2. Shorter Length (HighD Avg:58, NGSIM:205)**

Future Work

- Train together
- More dataset
- More augmentation
- Split NGSIM dataset

NGSIM vs HighD (max_norm)

	NGSIM	HighD
X1_mean	-4.37e-02	-1.62e-02
Y1_mean	4.74e-01	4.12e-02
X1_scale_mean	1.83e+01	3.37e+02
Y1_scale_mean	1.41e+03	4.24e+00
X2_mean	-2.25e-01	-2.10e-02
Y2_mean	4.22e-01	-1.30e-02
X2_scale_mean	1.83e+01	3.37e+02
Y2_scale_mean	1..41e+03	4.24e+00