Vehicle Interaction Learning

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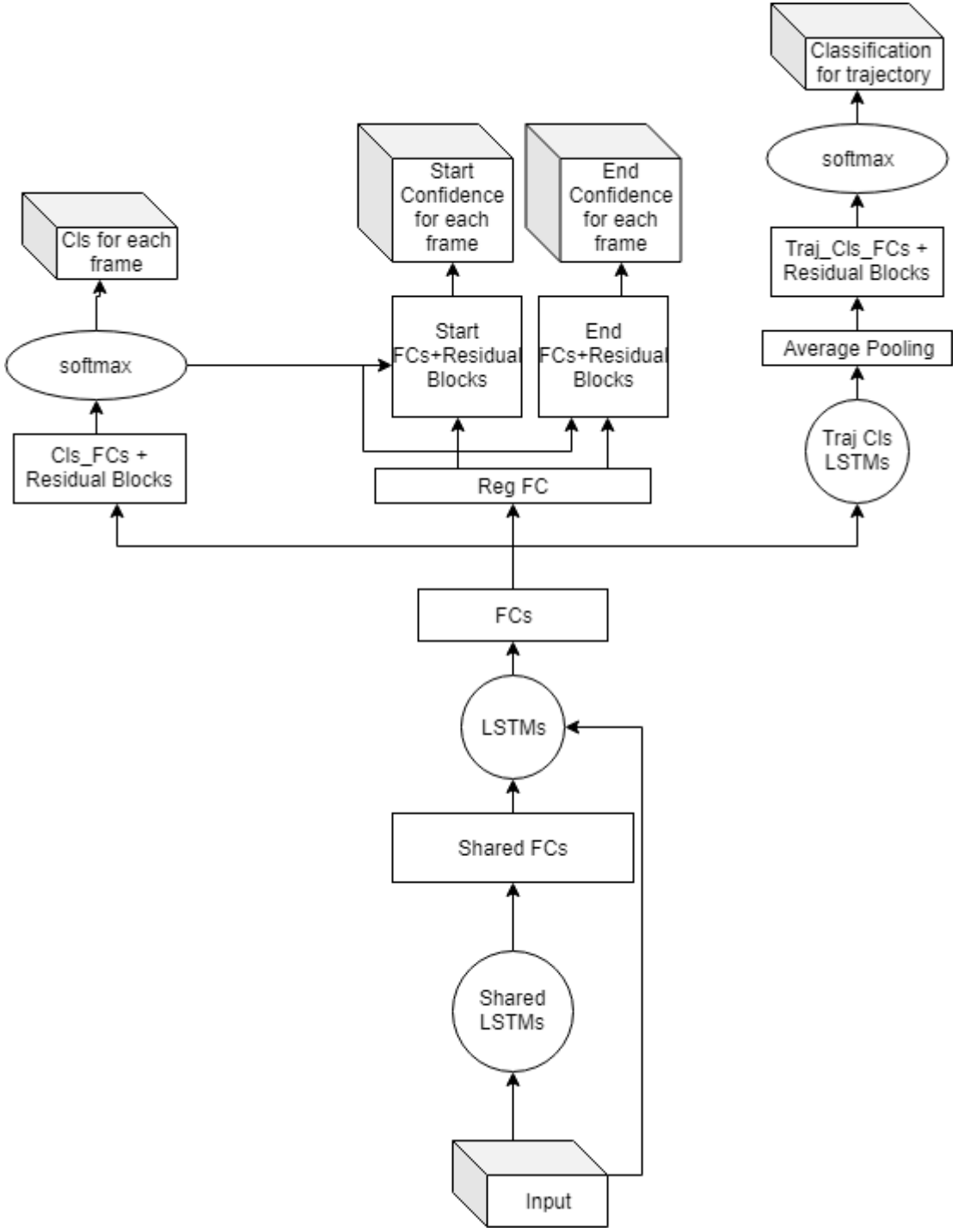
Preprocess Data

- Samples without interactions: too much (Tracks 1: 16157:47) -> try 1:1
- Symmetry: Overall Recognition vs Relative Motion
- Overall Recognition -> 1. Feed samples and their mirrors together into the neural network 2. Use (frame[0].x1 + frame[0].x2)/2 as ref

Model

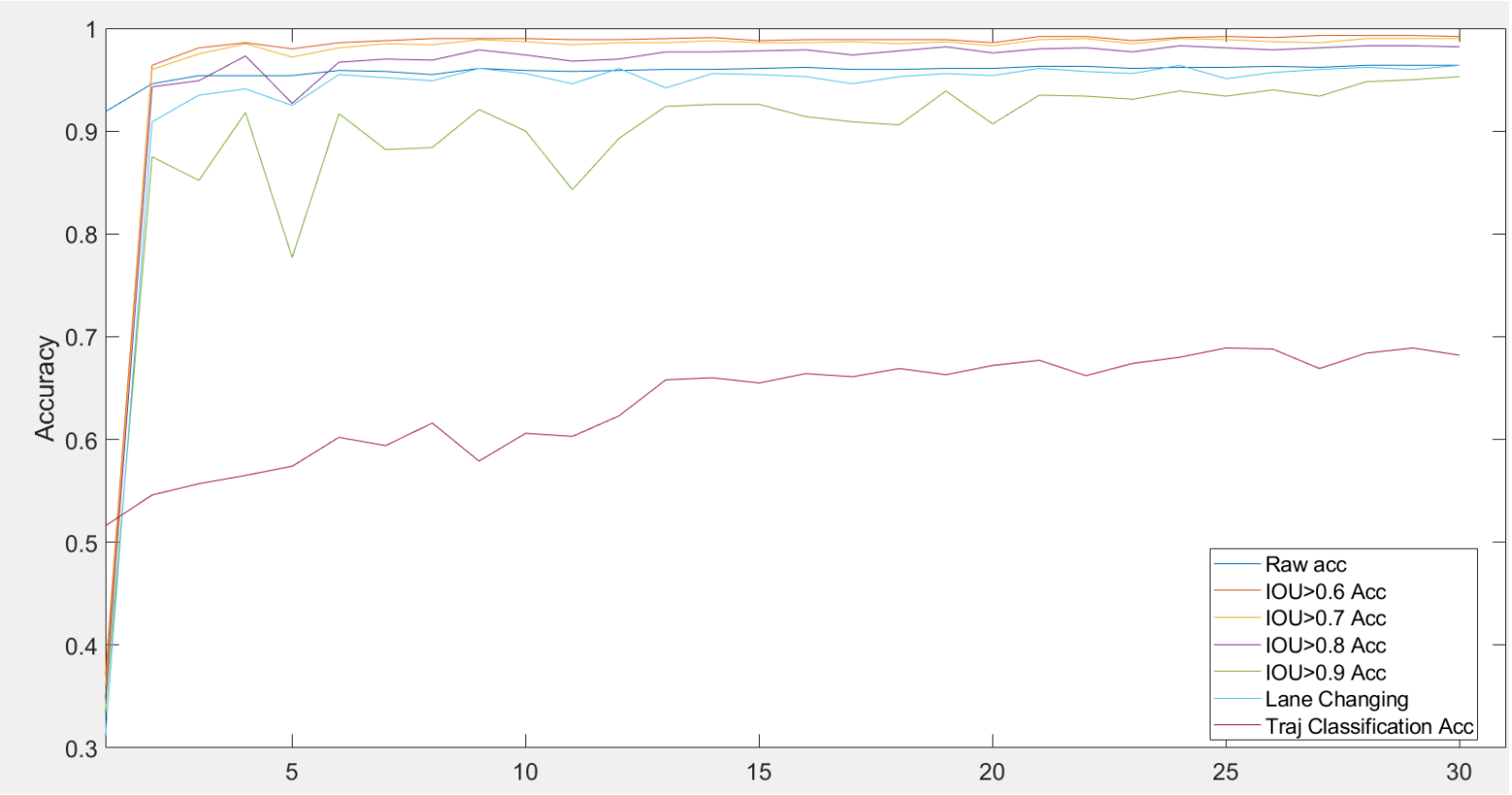
- Shared encoder
- Residual blocks make converge faster
- Interaction between tasks
- Conditional loss function
- Has interaction: Loss = w1 * cls_loss + w2 * reg_loss +w3 * traj_cls_loss
- Not: Loss = traj_cls_loss
- Huge Model -> Slow
- Sol: Pad+Pack for variable-length sequences to do mini-batch SGD
- -> ~120s for 10304 samples each epoch (batch size=64)



Result

w1 = 1, w2=0->10 from epoch 1 to epoch 20, w3 = 1; Total 30 epochs

10304 samples (Has interaction : Not = 1:1)
8242 training samples, 2062 test samples



Metrict	Best
Raw Acc	96.4%
IOU>0.6 Acc	99.2%
IOU>0.7 Acc	99.0%
IOU>0.8 Acc	98.2%
IOU>0.9 Acc	95.3%
Lane Changing	96.4%
Traj Classification Acc	68.2%

Other trying

- Much deeper model -> Not converge even with many residual blocks

- w1 = w2 = 0 (only train traj_cls) -> traj_cls_acc: 53.9%

Generalization ability?

Epoch 1:

```
**** Raw Acc 0.238, IOU6 Acc 0.159, IOU7 Acc 0.145, IOU8 Acc 0.128, IOU9 Acc 0.115,
Change Lane Acc 0.148, Traj Cls Acc 0.524
```

Epoch 20:

```
**** Raw Acc 0.778, IOU6 Acc 0.048, IOU7 Acc 0.043, IOU8 Acc 0.043, IOU9 Acc 0.040,
Change_Lane_Acc 0.037, Traj_Cls_Acc 0.539
```

Future Work

- 1. More interaction between tasks? Strategy for controlling task loss? New NN technique? (attention, transfomer…)

- 2. Process position, velocity, and acceleration further? Only with x and y? Averaging window?

```
["x", "y", "width", "height","xVelocity", "yVelocity", "xAcceleration", "yAcceleration"]
```

- 3. New task?