Vehicle Yielding Behavior Identification via Fast Multi-Object Tracking-by-Detection

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Some updates

- Both the **tracking** and **yield identification algorithms** and **codes** have been fully re-wrote by Java.
  - Very fast, tracking and yield identification takes less than 1 minutes (9600 fps) for a 160 minute 60 fps video. (the object detection takes around 400 minutes, 24 fps).
  - Much more stable, readable, tunable and accurate (of course).
  - Adding exhaustive grid search to search for the optimal parameters based on the manually checked ground truth. (the ground truth credits to Runan)
  - Evaluation metrics: precision, recall and F1-score
  - Located at https://github.com/nogrady/pedyield (private repository)
    - Send me your github account if you would like to try.
  - Labelled videos: https://www.youtube.com/watch?v=dxOufqxr8Xk&list=PL-ASdWq_qY8CUzvSGfKFhmFiMiGKsVSgz
    - Can only access by this link

Experimental Evaluation

- 10 videos, 16 minutes each
- Experiment steps:
  - Object detection
  - Multiple object tracking
  - Yield behavior identification
- Evaluation metrics

$$\text{Precision} = \frac{tp}{tp + fp}$$

$$\text{Recall} = \frac{tp}{tp + fn}$$

Experimental results (after parameter search)

Ground truth

Identification results

no signal change	unnecessary	yielded	did not yield	Total	**Precision**
unnecessary	408	2	1	411	**99.27%**
yielded	2	66	0	68	**97.06%**
did not yield	0	1	25	26	**96.15%**
Total	410	69	26	505	
Recall	**99.51%**	**95.65%**	**96.15%**		

signal change	unnecessary	yielded	did not yield	Total	Precision
unnecessary	409	2	1	412	99.27%
yielded	2	66	0	68	97.06%
did not yield	8	1	25	34	73.53%
Total	419	69	26	514	
Recall	97.61%	95.65%	96.15%		

previous results	unnecessary	yielded	did not yield	Total	Precision
unnecessary	416	2	1	419	99.28%
yielded	16	133	1	150	88.67%
did not yield	1	2	20	23	86.96%
Total	433	137	22	592	
Recall	96.07%	97.08%	90.91%		

To-do List

- Documentation
  - Configuration -> to do
  - Calibration -> to do
  - Deployment and run -> done
- Test on more videos (different scene, but similar settings)
- Pedestrian vs. vehicle conflicts identification
  - Post-encroachment Time (PET) rule -> working on, have some preliminary results
  - Relative Time to Collision (RTTC)

Post-encroachment Time (PET) rule (preliminary results)

- Rule: if the time difference between a vehicle and a pedestrian pass the same location, larger than t seconds, I consider it as a vehicle-pedestrian conflict event.
- Preliminary results (need some ground truth to verify)