Pedestrian vehicle speed estimation at road crossing

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Introduction

- Road crossing: pedestrians and drivers
  - Significant part of injuries in urban areas
  - Errors can be fatal (Penden et al., 2004)
    - 45% @ 45km/h
    - 10% @ 30km/h

- Objective: obtain deeper understanding about visual perception of vehicle approximation and road crossing decision taking

Road crossing decision taking

- Visual timing (Rosembloom, et al. 2008)

- Motion perception (Simpson, et al. 2003)
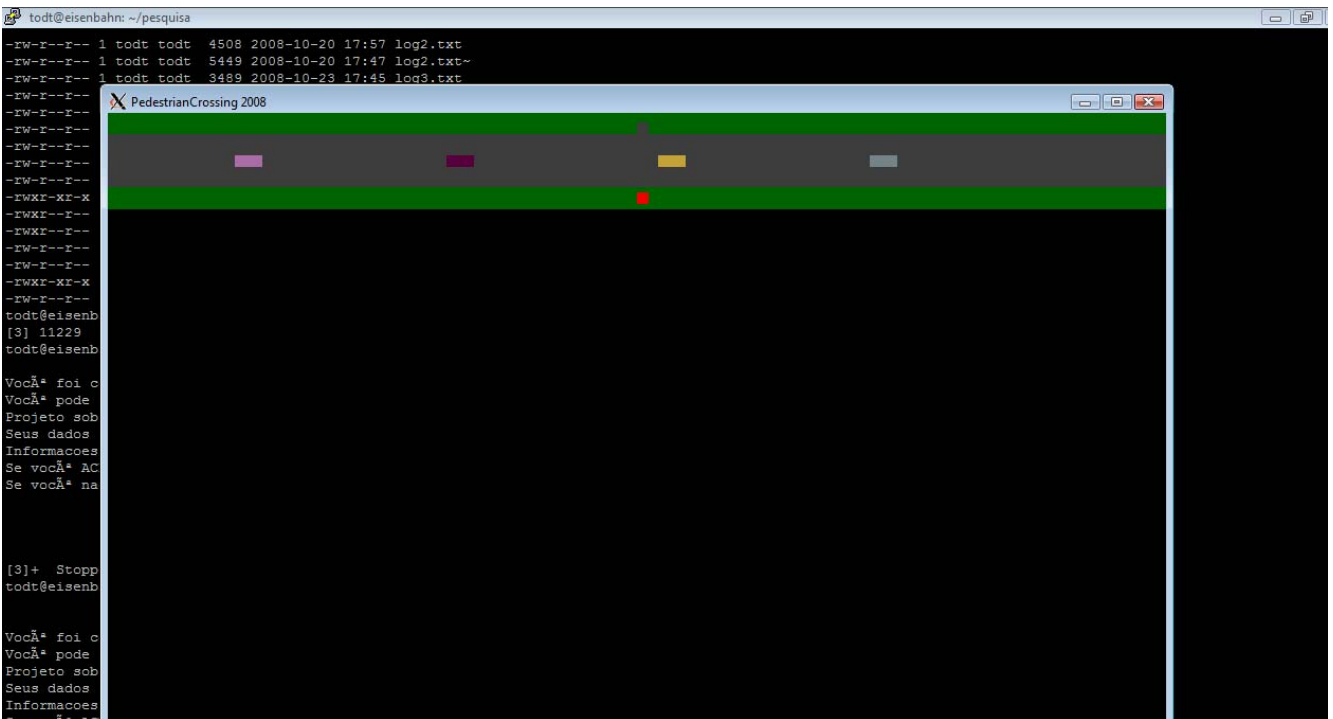
- Time gap (Lobjois and Carvalho, 2007)

Development of research tool

- Simulator
  - Software developed at UFPR
  - Open source image processing library (OpenCV)
  - Multiplatform: Linux (Ubuntu) and Windows (XP)
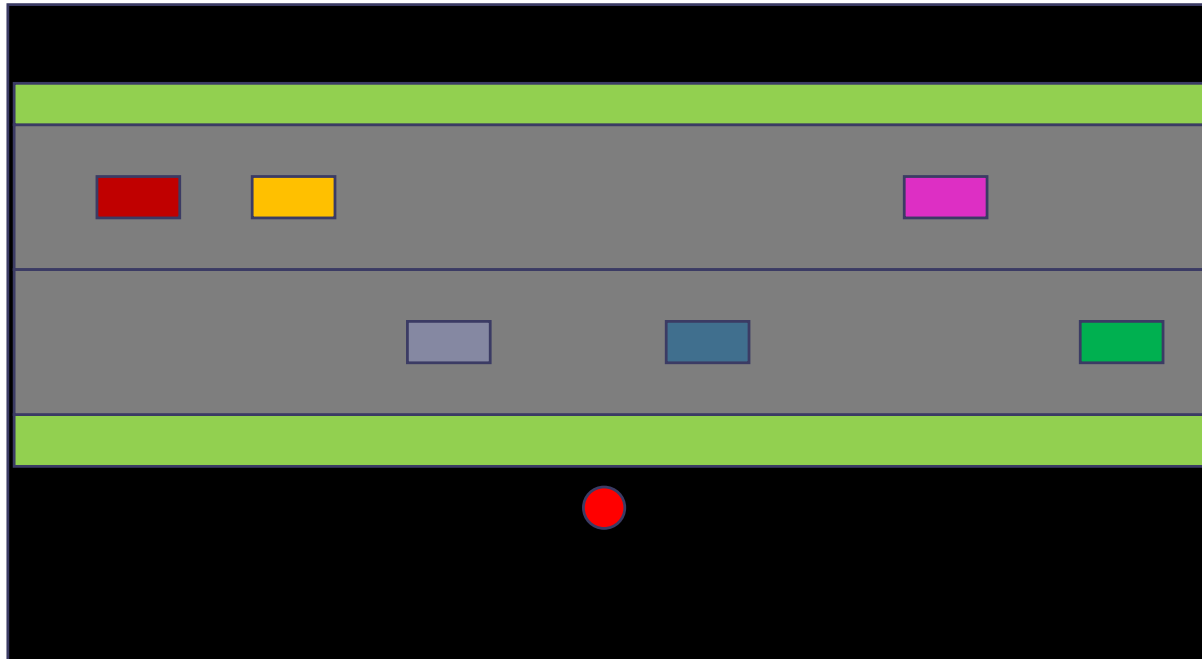 - Measure of distance-t-collicion of cars and pedestrian

One-way crossing
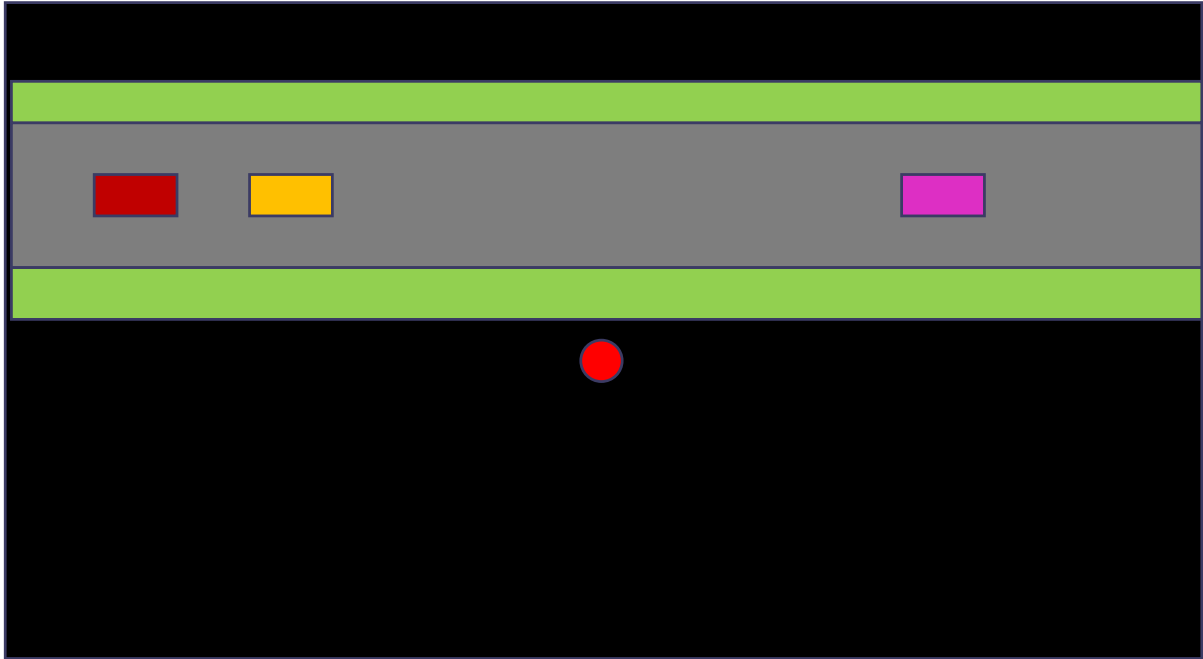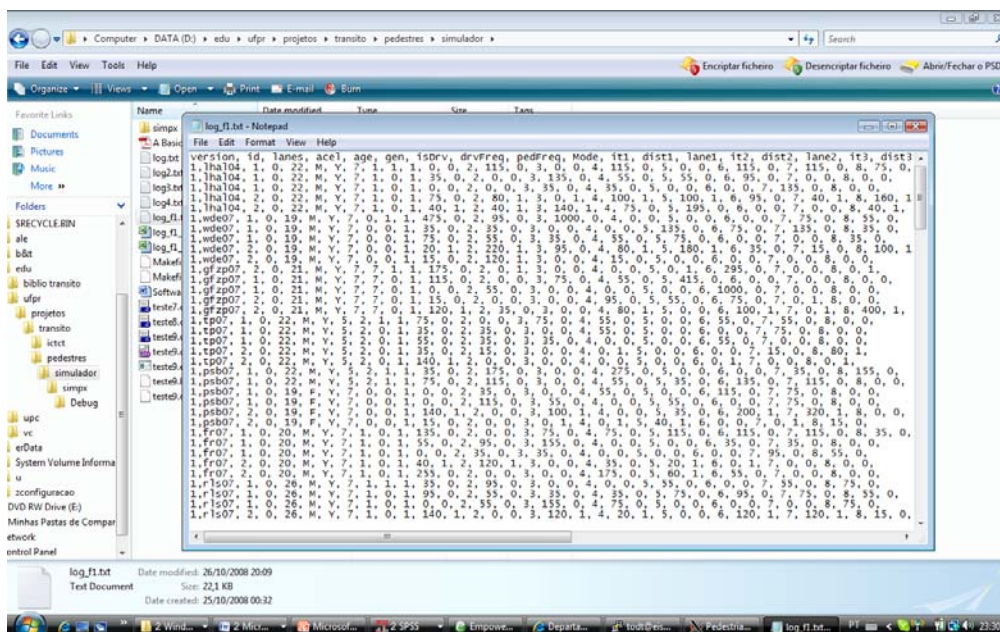

One-way crossing

Two-way crossing

Two-way crossing

Outputs

- Integrated record of demographical data
  - Age, gender, driver frequency, pedestrian frequency, ...

- For each try
  - Distances to collision
  - Lane of minimum distances to collision

Outputs

Experiments

- For each subject, 8 tries of:

  - 1 way, trainning
  - 1 way, last moment that pedestrian can cross
  - 2 way, last moment that pedestrian can cross
  - 1 way, cross whenever subject thinks that it is safe, without visual feedback

Method

- Subjects:
  - 35 undergraduate students
    - 17 ... 27 years old (mean 20.4, sd 2.6)
    - 29 male / 6 female
    - 25 drivers / 10 non-drivers
    - 4 experiments run per subject
      - 140 experiments
      - 1120 crossing tries

Method

- Subjects performed in sequence:

  - 1. demographic questionnary
  - 2. experiment 1-way last moment, 8 tries
  - 3. experiment 2-way last moment, 8 tries
  - 4. experiment 1-way last moment, without feedback, 8 tries
  - 5. experiment 1-way cross when you want, without feedback, 8 tries

Results

- Spliting sample in two groups, 50% in each group, according to age:
  - Group 1: 17-19 years   Group 2: 20-27 years
  - M10 mean , sd: (2.88, 1.495) x (1.72, 1.74)

- Group with lower age has significant difference with more accidents

Results

		N	Mean	Std. Deviation	Std. Error	95% Confidence Interval for Mean		Minimum	Maximum
						Lower Bound	Upper Bound		
M10a	1,00	17	2,88	1,495	,363	2,11	3,65	0	6
	2,00	18	1,72	1,742	,411	,86	2,59	0	4
	Total	35	2,29	1,708	,289	1,70	2,87	0	6
M20a	1,00	17	2,65	1,539	,373	1,86	3,44	0	5
	2,00	18	2,61	1,883	,444	1,67	3,55	0	6
	Total	35	2,63	1,699	,287	2,04	3,21	0	6

Results

		Sum of Squares	df	Mean Square	F	Sig.
M10a	Between Groups	11,767	1	11,767	4,444	,043
	Within Groups	87,376	33	2,648		
	Total	99,143	34			
M20a	Between Groups	,011	1	,011	,004	,951
	Within Groups	98,160	33	2,975		
	Total	98,171	34			

Results

- No significative difference between drivers and non-drivers found, also for driving frequency

- No significative difference between age groups for other experiments

Results

Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
M11	35	0	6	2,57	1,720
M10a	35	0	6	2,29	1,708
M20a	35	0	6	2,63	1,699
Valid N (listwise)	35				

Conclusions

- Younger subjects (17-19 y.o.) were either unable to evaluate well the approximation of cars or they were more risk taking

- Vehicle approximation perception support to traffic engineers when stipulating speed limits

Future Work

- Improve simulation with vehicle acceleration configuration for each car
- Ramdom pedestrian initial position
- Stop in the middle when crossing in two lanes
- Panoramic view (2 or more monitors)
- Sound feedback

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Thank you!

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