UNIVERSITÄT OSNABRÜCK

Lecture: Map-based - PACMAN

SYS - programming internship

Playability of different movement models in Pacman

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Abstract

Within the shared SYStems programming internship we created a multiplayer Pacman-Game playable on real world maps. The maps are generated with OpenStreetMap-Data. The ghost movement is based on the models **MSLAW** and **Randomstreet**. This paper shows the impact of different movement parameters of these models on playability.

For evaluation purposes some changes were made to the original game:

- Pacman moves automatically to the nearest package with the OSMRM.
- Pacman doesn't get teleported to the other side of the map if he leaves screen.
- The main matric is the score. Additional ones are: count of lost packages and avg. get-time

Game Stats

Stats:

- Games played = 400
- Hours played ≈ 33 h
- Collected packages = 5733
- Delivered packages = 3476
- Different parameters tested = 10
- Models analyzed = 2
- Maps tested = 1

Common parameters of Randomstreet and MSLAW

The results for the impact of the in common parameters (`ghost-num`) and `min/max-speed` are shown in fig. 1 and fig. 2. It turned out that the `pause-time` has no inpact on the playability. This is due to the implementation of the ghost movement in Pacman.

Contrary to expectations, as the number of ghosts increases, the game becomes more linear rather than exponential. This is caused due to the number of available packages is tied to the number of ghosts. It is futher noticeable is that the **Randomstreet** is consistently harder than **MSLAW**.

For a specific `min/max-speed` the player is unable to catch up to a ghost and capture his package. At a speed of 4 m/s - 14 m/s for **Randomstreet** and 6 m/s - 16 m/s for **MSLAW** the game gets almost impossible to play.

Because the ghosts move faster they cover more distance on the map and therefore are more likely to carry a package. Also, if pacman is unlikely to get a package he can't lose it as often. As shown in fig. 4 only `min/max-speed` had impact on the average package get time. All other parameters like `cluster range`, `cluster-ratio` and `number of waypoints` had no significant impact on the metrics as shown in fig. 3.

Plots for `ghost-num` and `min/max-speed`

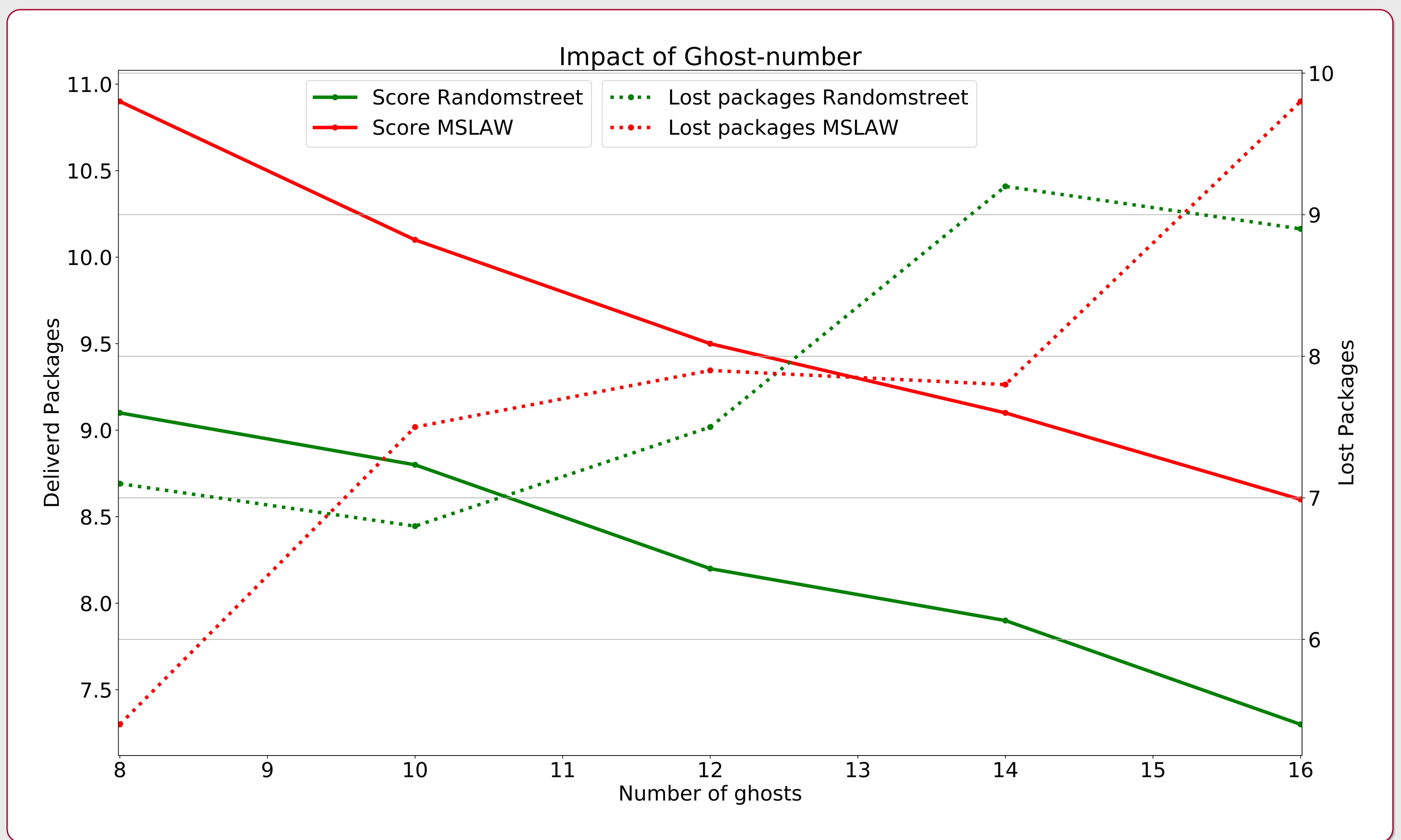

Figure 1: Impact of ghosts

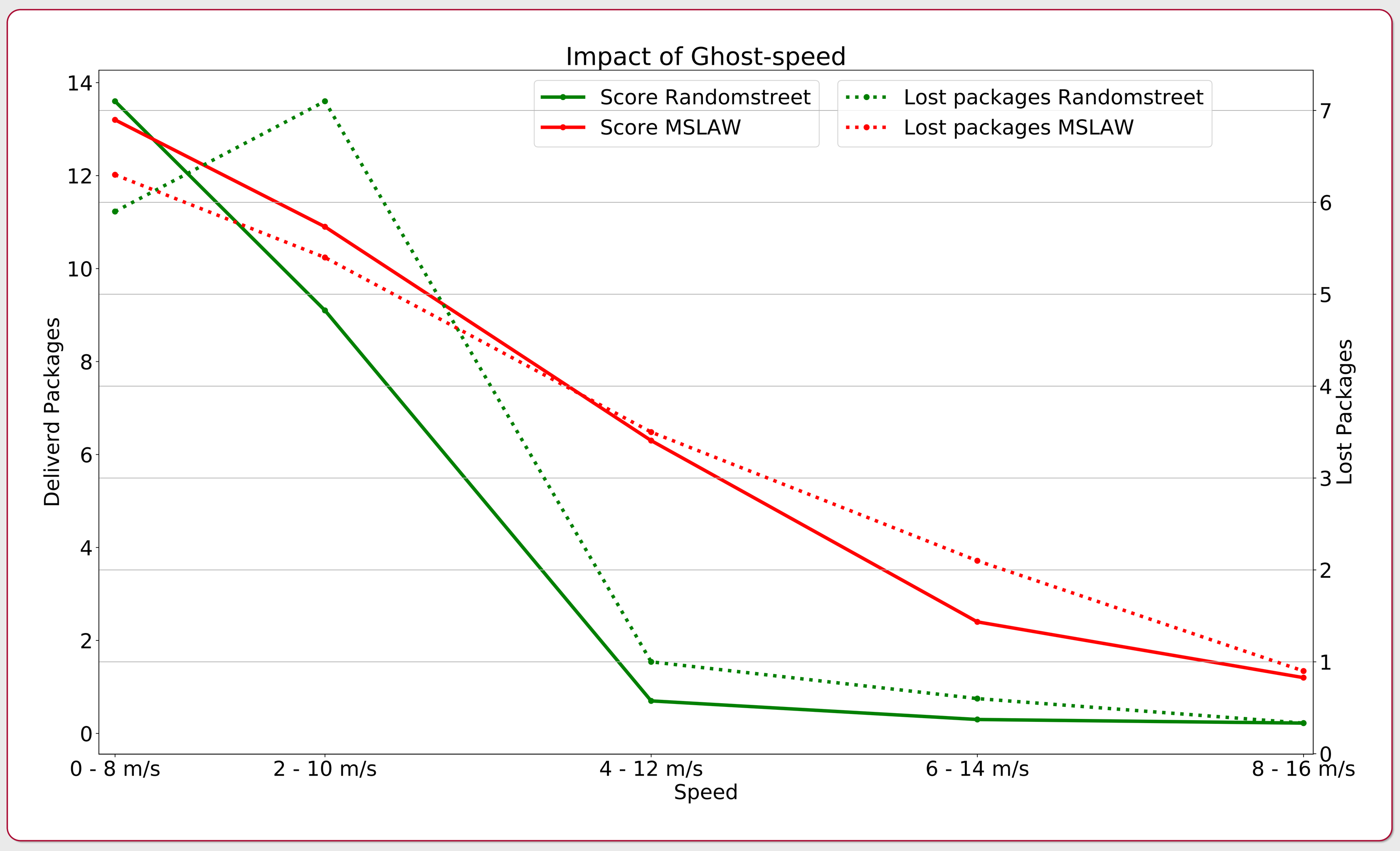

Figure 2: Impact of speed

Inpact of cluster parameters

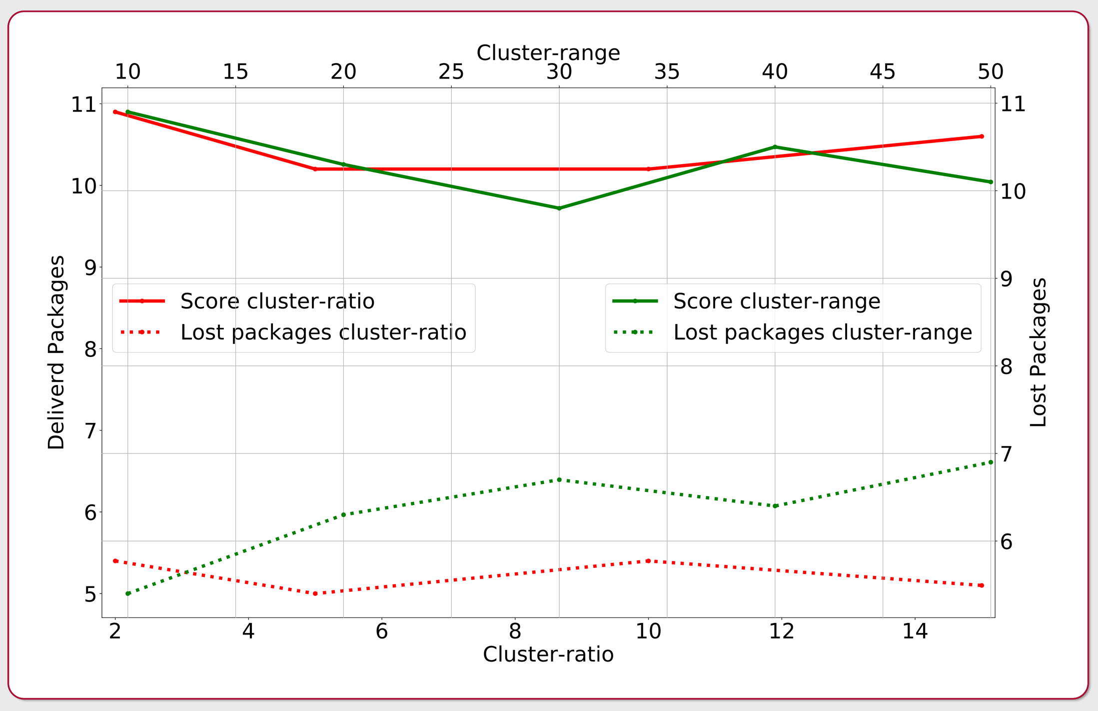

Figure 3: Impact of cluster parameters

Conclusion

Therefore the only meaningful parameters to change difficulty are `ghost-num` and `min/max-speed`. These parameters have to be in relational to the map size. All collected data is based on 3.66 km^2 map of Osnabrueck (zoomlevel 15). On bigger maps you need to increase the `min/max-speed` to get equivalent level of difficulty.

Inpackt on avagrage get time

Inpact on average get time

	MSLAW/Randomstreet Speed parameter				
Speed	0-8 m/s	2-10 m/s	4-12 m/s	6-14 m/s	8-16 m/s
AVG-Time	7.28 / 7.26	10.74 / 9.75	107 / 21.5	180 / 52.0	262 / 97.0
	MSLAW/Randomstreet Ghost number				
GhostNum	8	10	12	14	16
AVG-Time	10.74 / 9.57	10.82 / 9.28	11.5 / 9.80	10.3 / 9.91	10.9 / 8.91

Figure 4: Impact on avg. get speed

Further information:

K. Lee, S. Hong, S. J. Kim, I. Rhee, and S. Chong, "Slaw: A mobility model for human walks,"

M. Schwamborn, N. Aschenbruck, "Introducing Geographic Restrictions to the SLAW Human Mobility Model,"

M. Schwamborn,N. Aschenbruck, "Synthetic map-based mobility traces for the performance evaluation in opportunistic networks

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