Gap acceptance for vehicles at an unsignalized T-intersection

Nikola Groverová SPMS 2020

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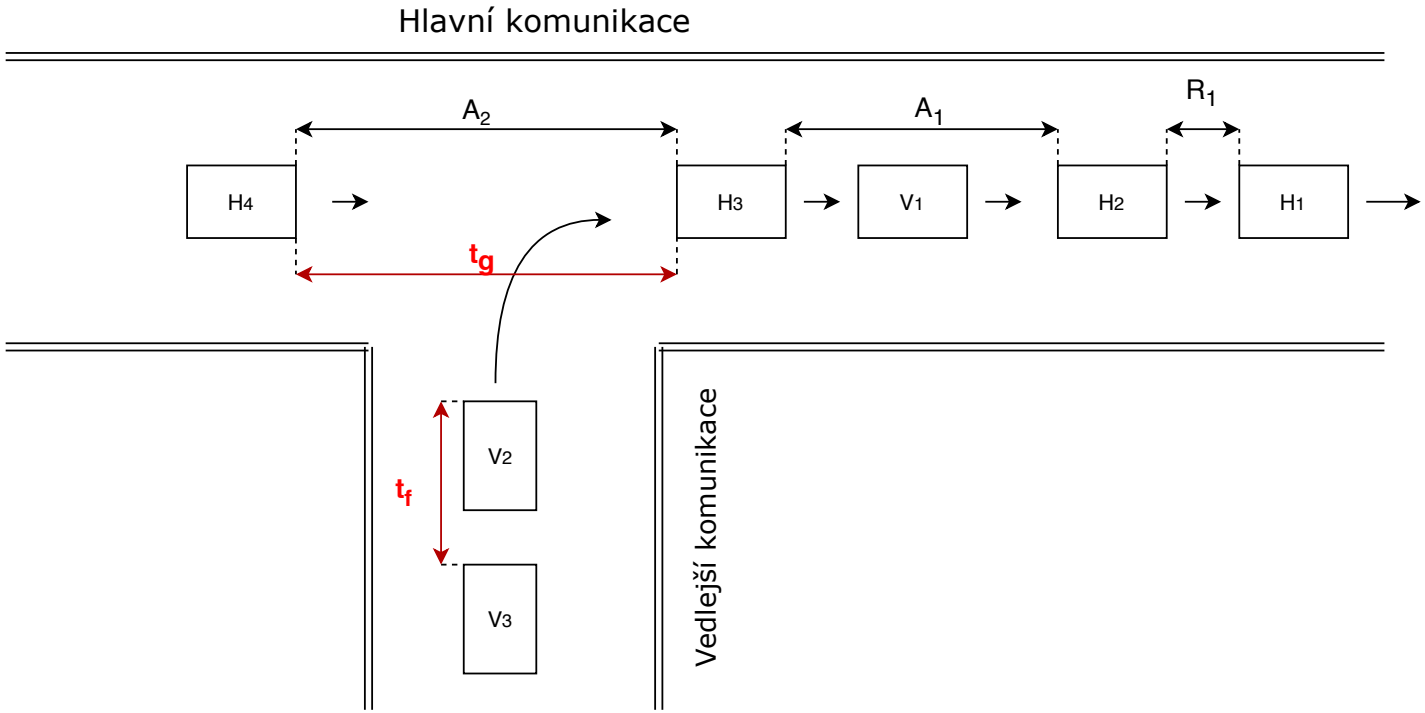
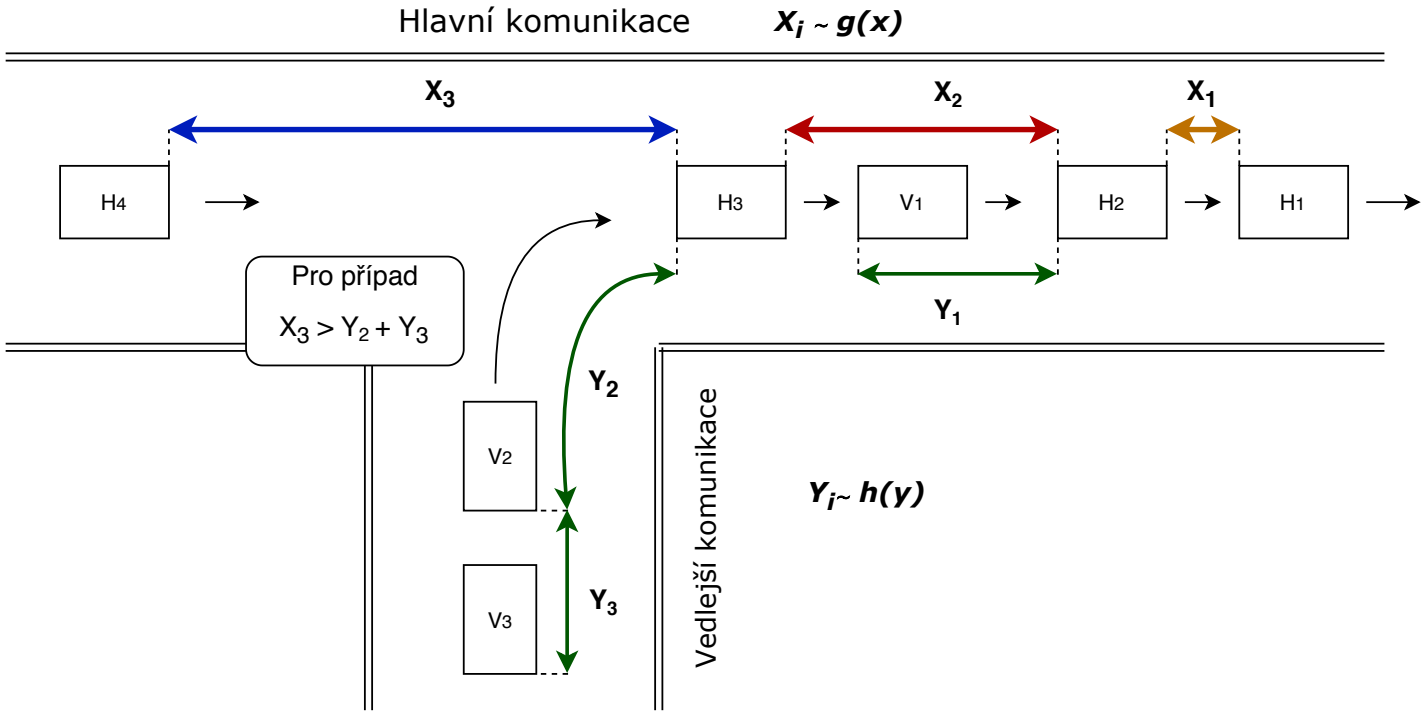
Observed situation

- A_i accepted gap
- R_i rejected gap
- t_g critical gap



Using probability



Assumptions, use of critical gaps

Assumptions

- Saturated state of traffic,
- no traffic congestion,
- consistent and homogeneous drivers,
- neigbouring gaps are independent

Use of critical gaps

$$c = q_p \cdot \int_{t=0}^{\infty} h(t) \cdot g(t) dt$$

Used distributions

Gamma distribution

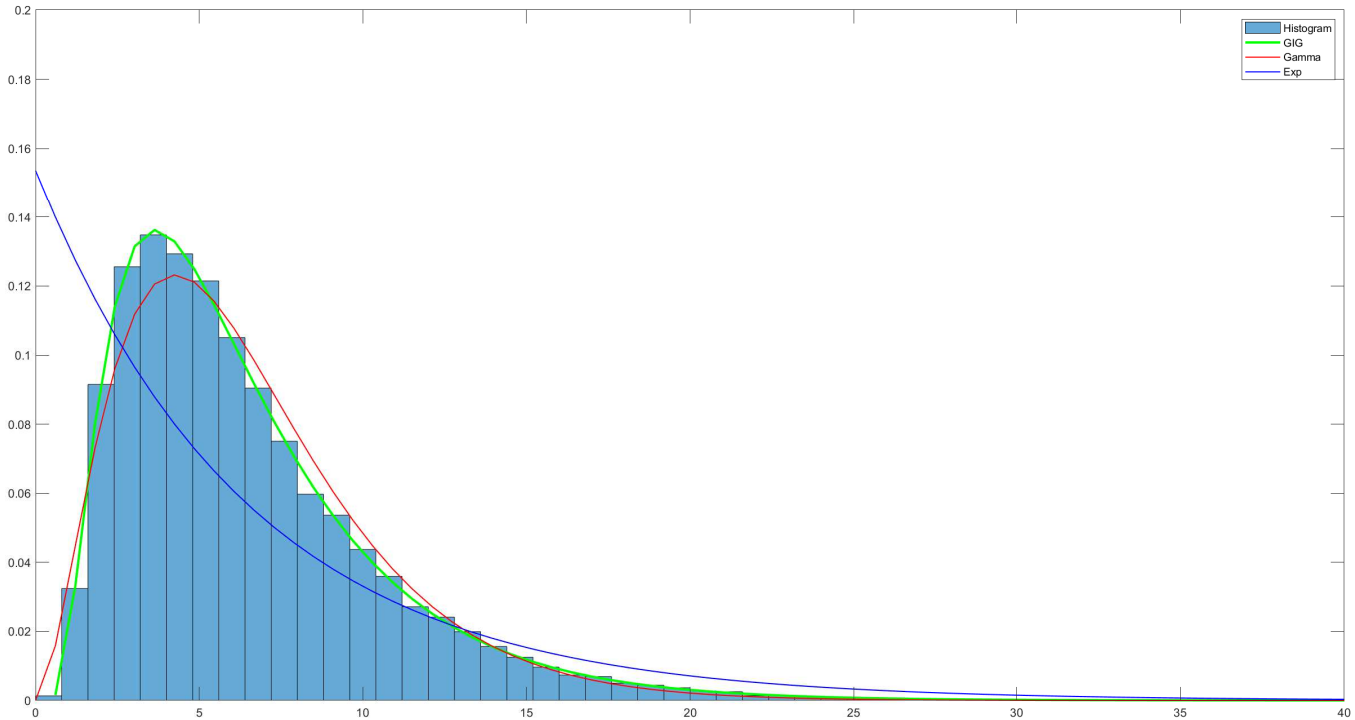
$$g(x) = A\theta(x)x^{\beta}\mathrm{e}^{-\lambda x},$$

Generalized Inverse Gaussian distribution

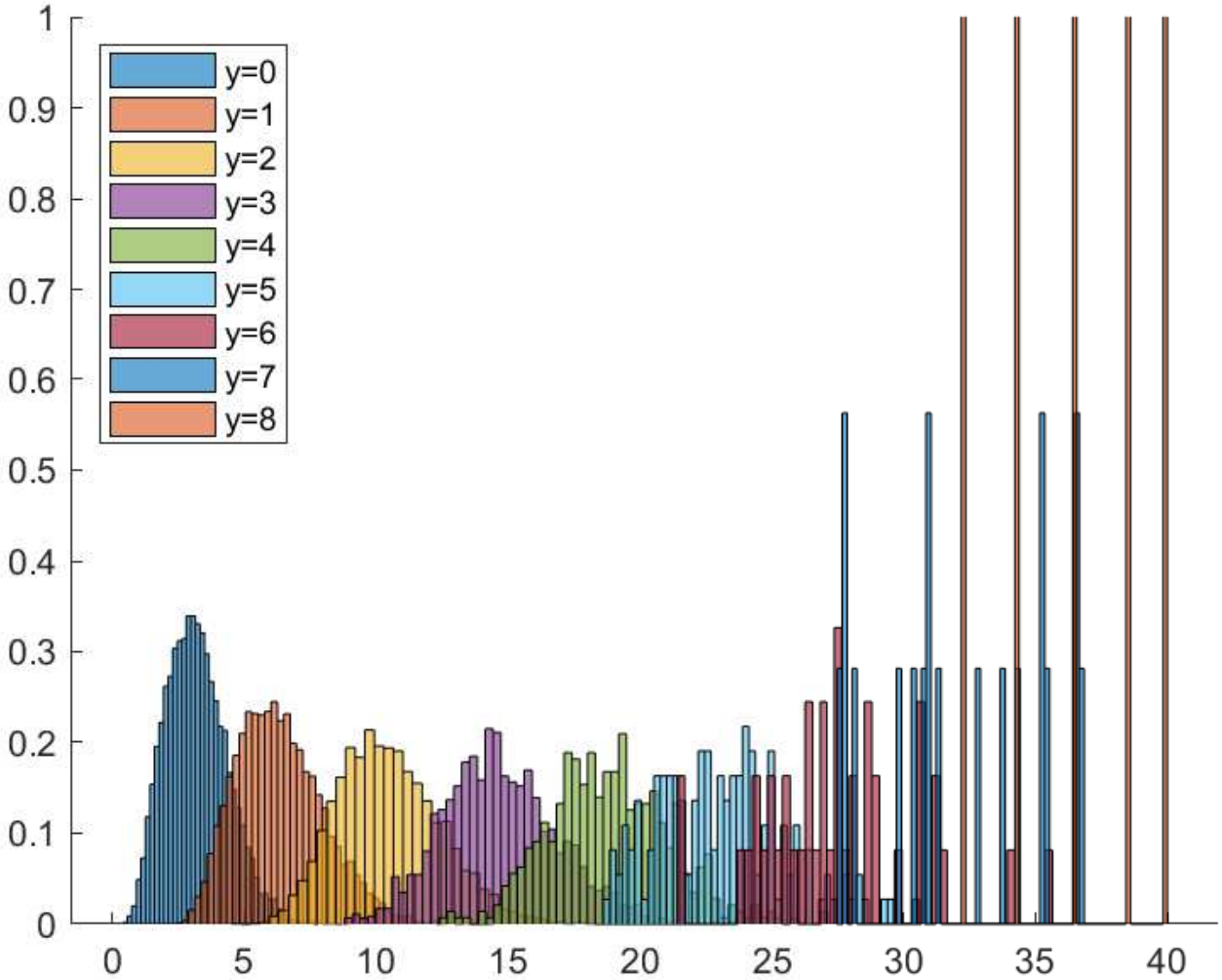
$$g(x) = A\theta(x)x^{\alpha}\mathrm{e}^{-\frac{\beta}{x}}\mathrm{e}^{-\lambda x}.$$

Analysis of collected data

- Data collected in Dresden, Germany,
- 32950 samples available.

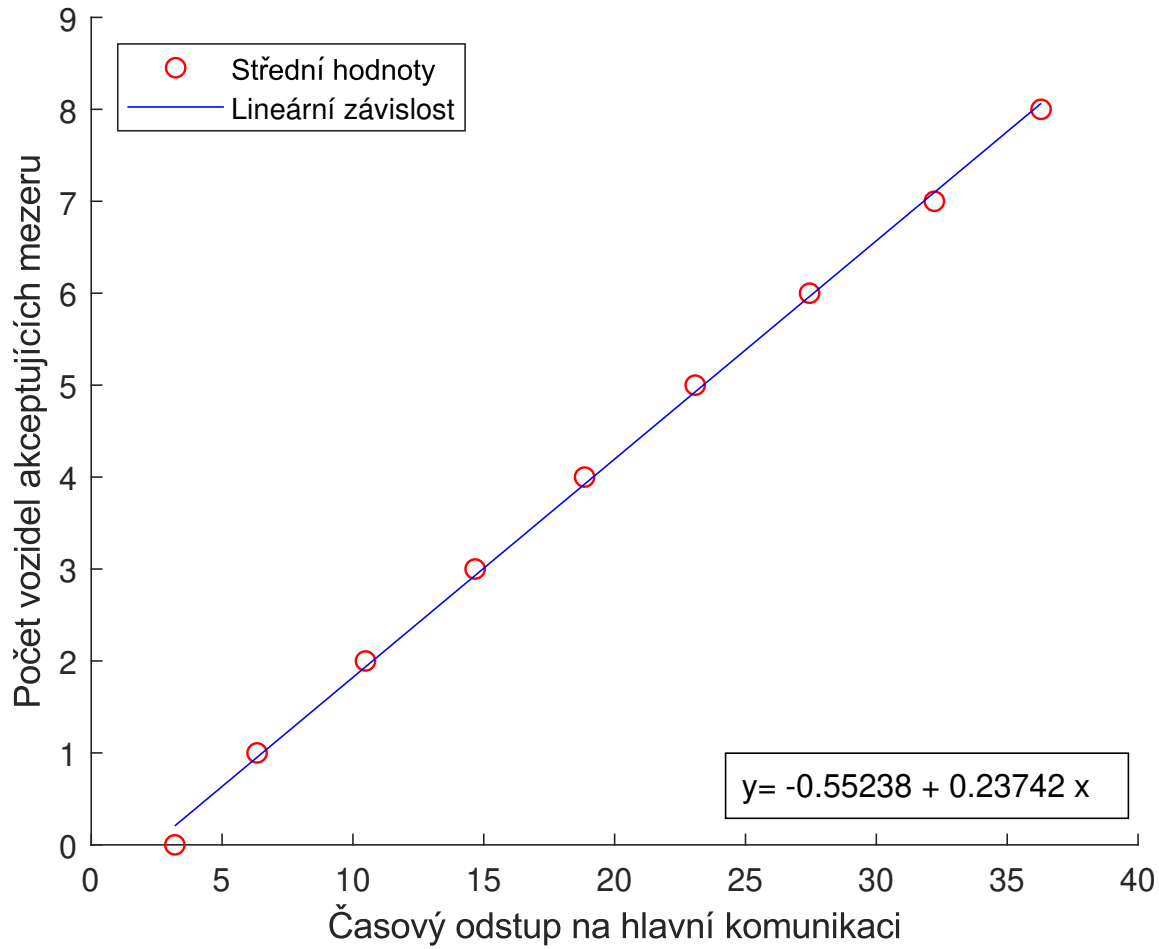


Gaps accepted by y vehicles

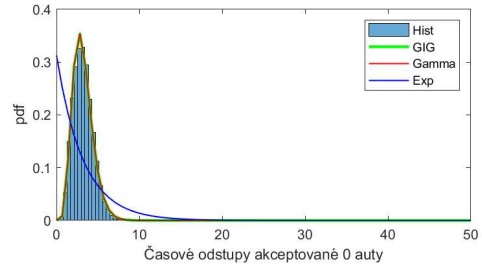


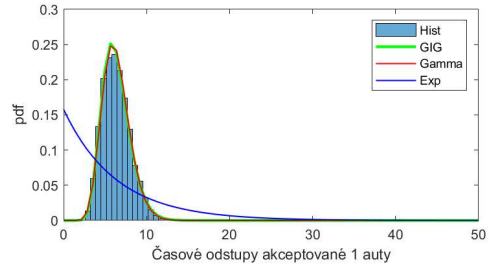
Siegloch method

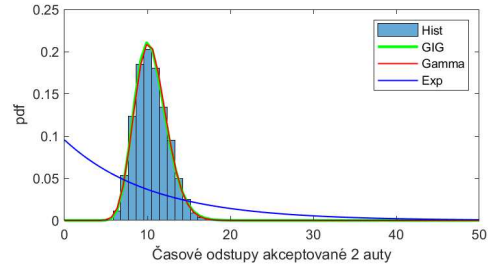
Used for determining the critigal gap t_g

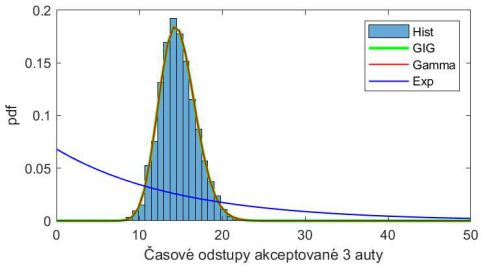


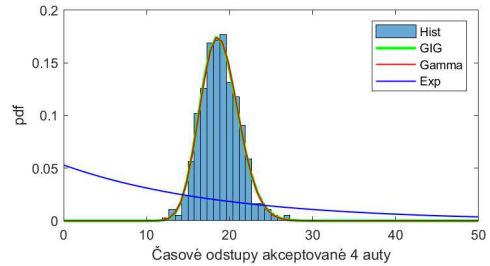
Fitting probability distributions

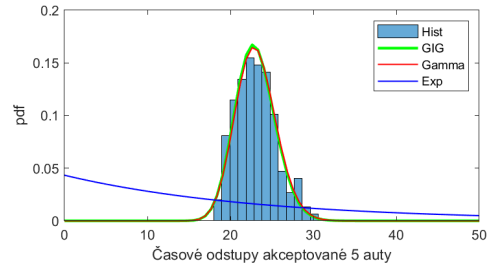


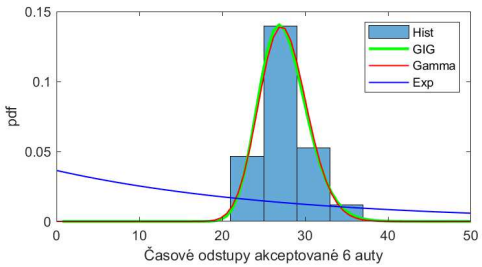


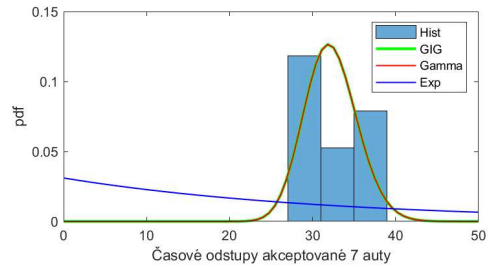








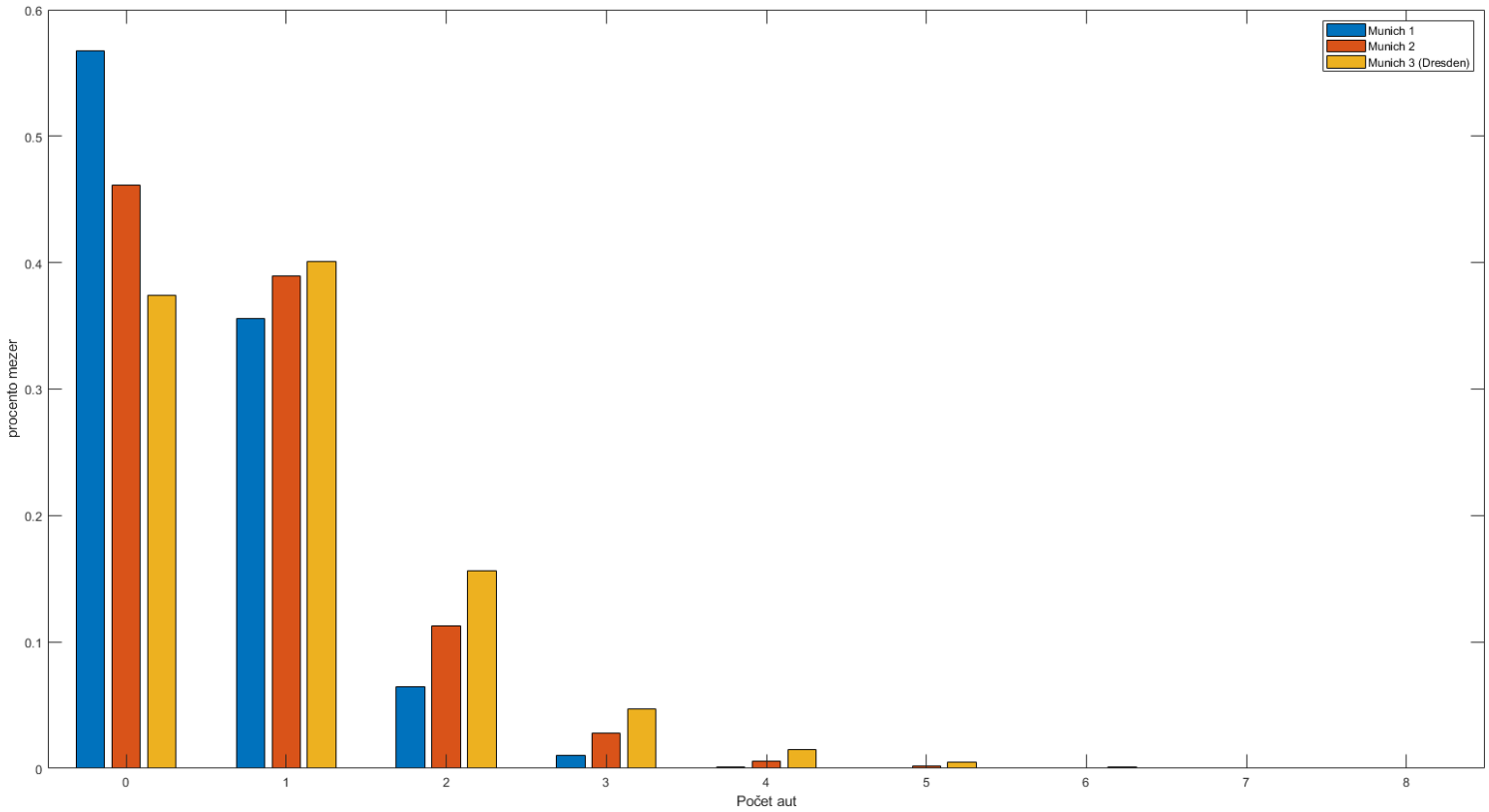




Distributions for the gaps accepted by y vehicles

- Using MLE with seeds using the method of moments,
- Kolmogorov-Smirnov goodness of fit test,
- for $y = 0, 1$ GIG distribution fits the data,
- for $y > 1$ Gamma and GIG distribution return similar results.

Procentual decomposition



Procentual decomposition

$Hk(x)$ is the cdf for the distribution of critical gaps accepted by k vehicles

$$\delta_k = \mathbf{E}_g\left[H_k(x)\right] - \mathbf{E}_g\left[H_{k+1}(x)\right]$$

When is $\delta_0 < \delta_1$?

$$\mathbf{E}_g\left[1 - 2H_k(x) + H_2(x)\right] < 0$$

For exponential distribution:

$$\delta_k = \frac{\lambda\mu^k}{(\lambda+\mu)^{k+1}}, \qquad \delta_0 < \delta_1 \Longleftrightarrow \lambda < 0$$

Conclusion

- GIG distribution is better only for the gaps for 0,1 vehicles,
- for gaps accepted by more vehicles Gamma and GIG distribution become interchangeable.