UNIVERSITY OF TRENTO

Vienna Metro Simulation

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Why evaluating a Metro System?

- In an ***historical city***, massive street projects cannot take place;
- Can increase the maximum number of people moving ***up to 20 times***;
- Can be fully powered by ***clean energy***.

Basic idea

Create a ***Discrete Events Simulation (DES)*** to simulate the Vienna metro to get insights about its behaviour.

Our Goals

Goal # 1

Evaluate the performances of the current system

Goal # 2

Estimate possible system evolutions

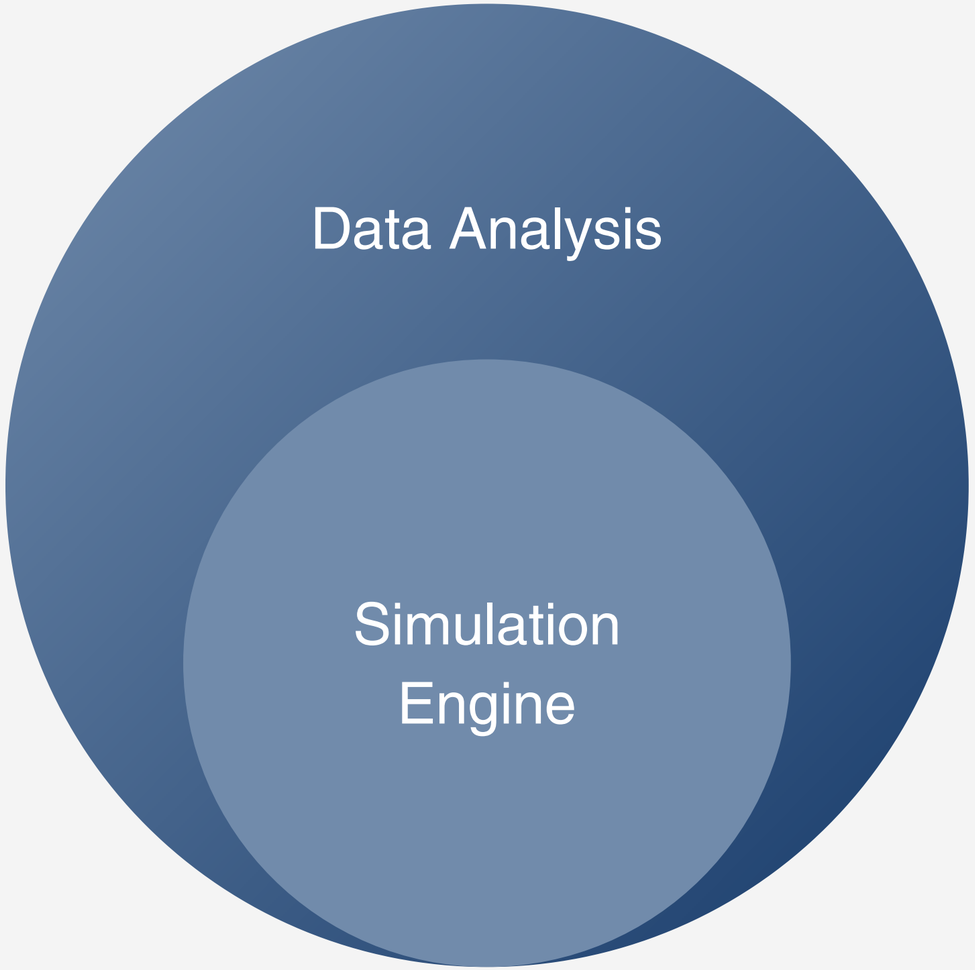
Our Codebase

PYTHON

Extremely flexible for the high level data analysis

RUST

Type safe and fast, for a performant somulator



Our Assumptions

1. **Train Speed**
   Acceleration is ignored
2. **People arrival**
   It follows a Poisson process
3. **People do not have a destination**
   They roam randomly
4. **Railroad capacity**
   Cannot go inline
5. **Line forking**
   Require to be done manually

The current system

Train per line

10

Train capacity

800 PERSON

Average train speed

32.5 KM/H

Average distance before a crash

10000 KM

Average person arrival at each station

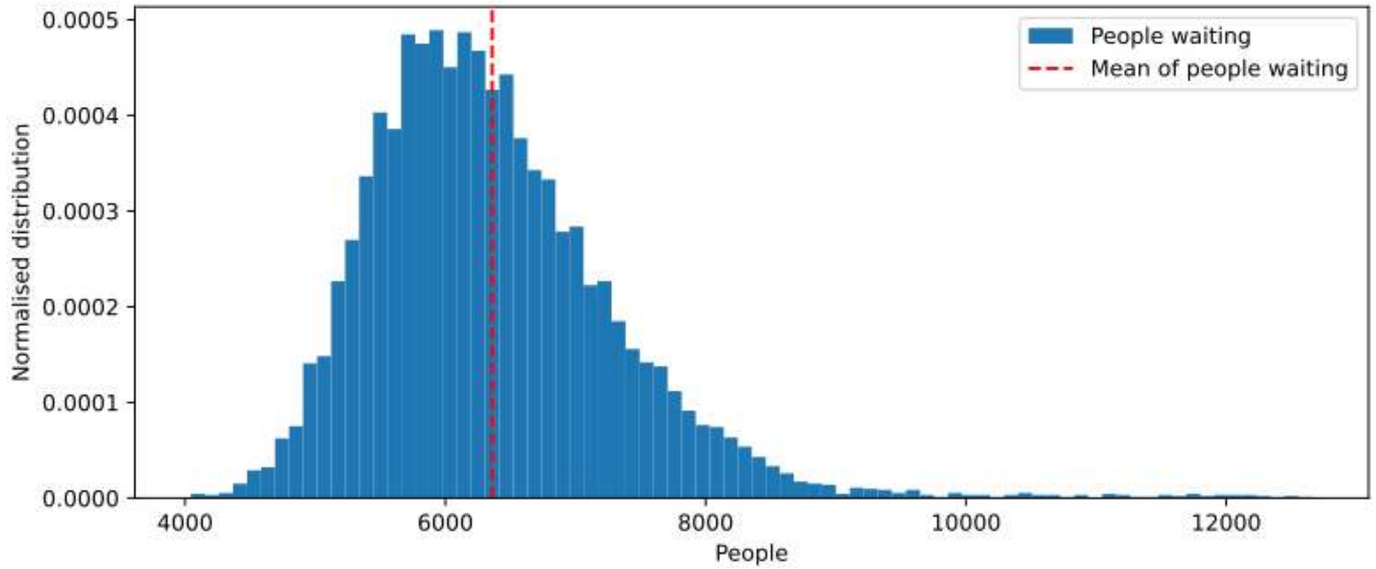
10 SECONDS

Simulation & Warm-up length

30 DAYS + 30 DAYS

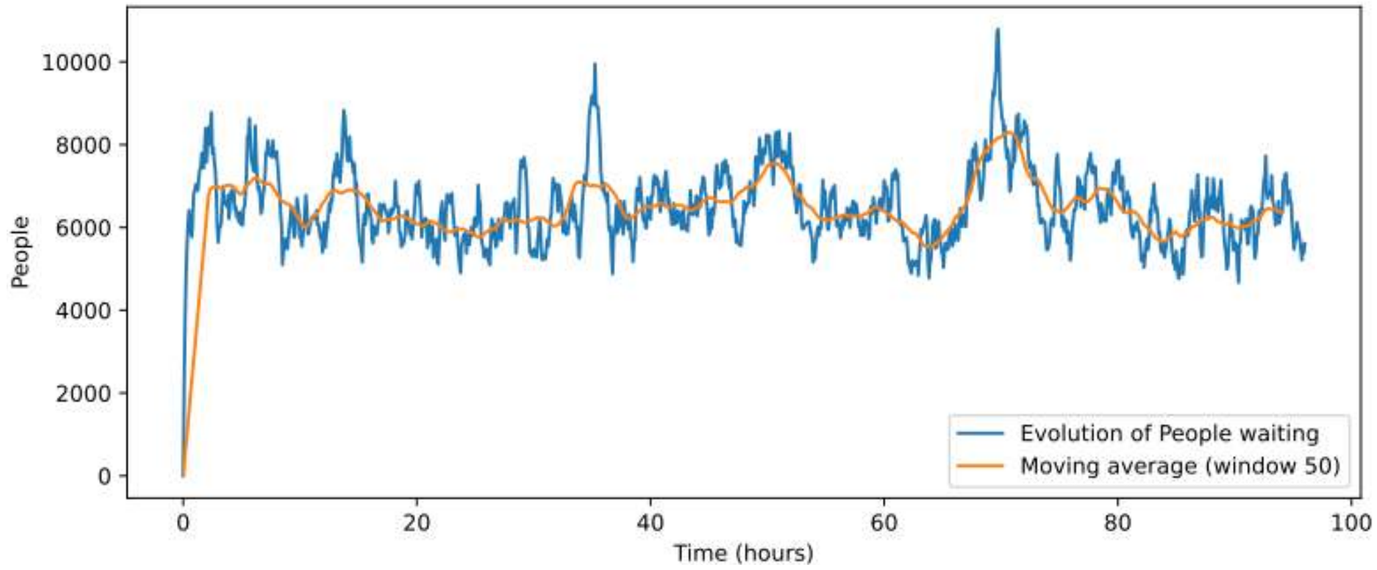
The people Waiting

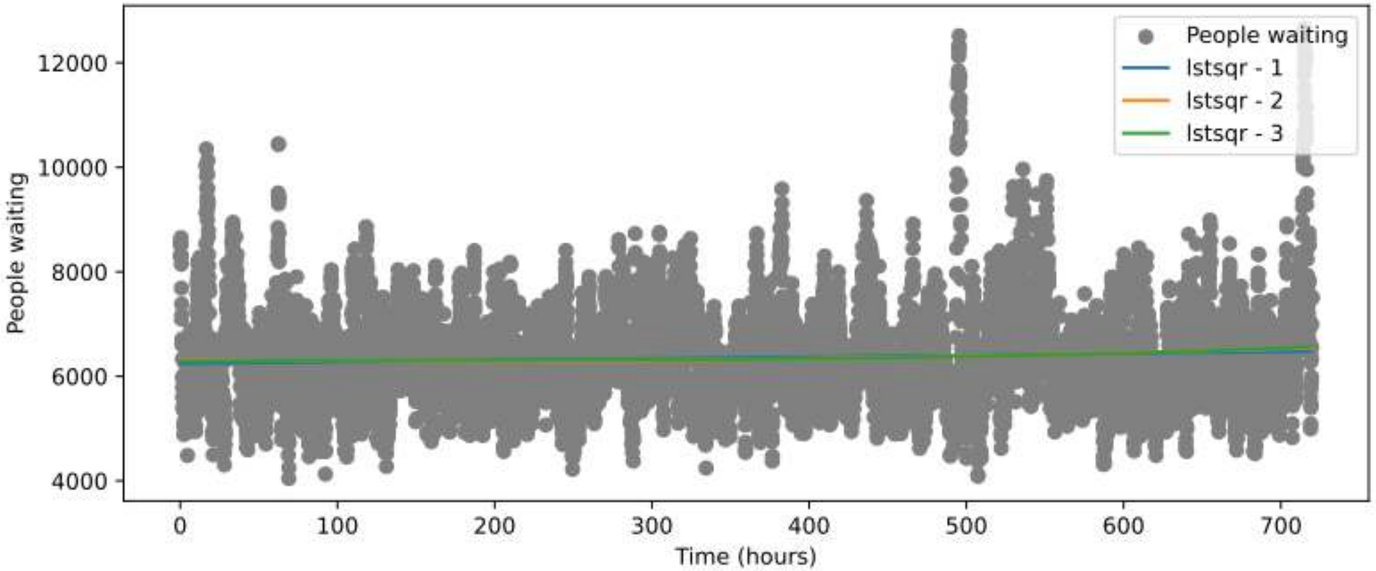
Analysis of people served in interval of 10 minutes.



More in depth

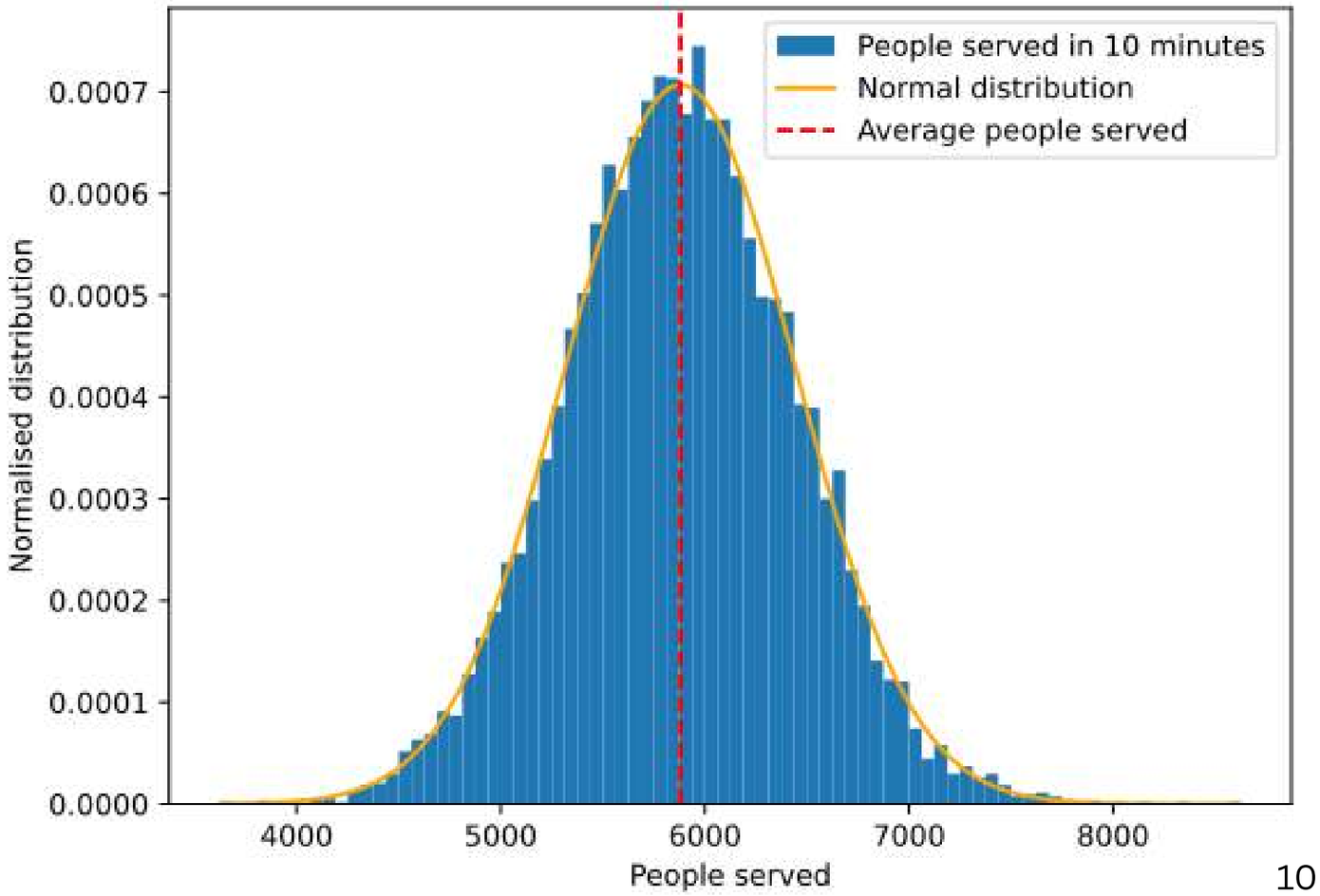
Evolution and trends



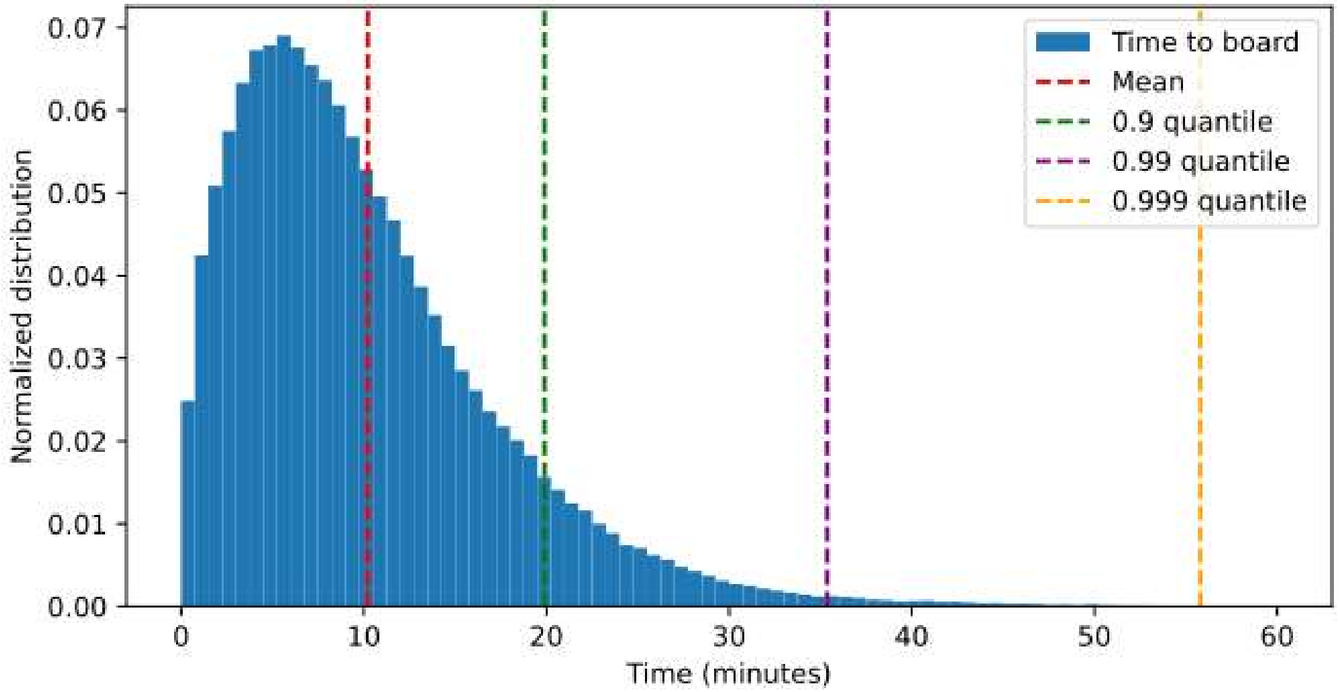


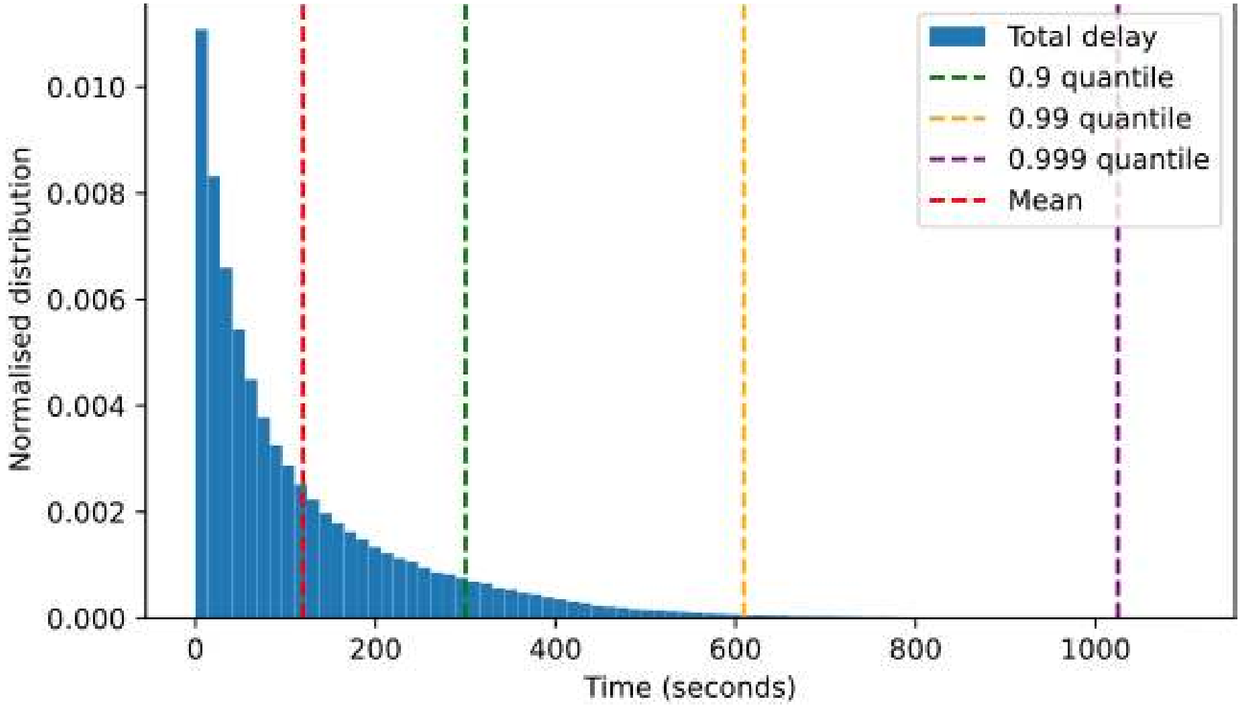
The people Served

Analysis of people served in interval of 10 minutes.

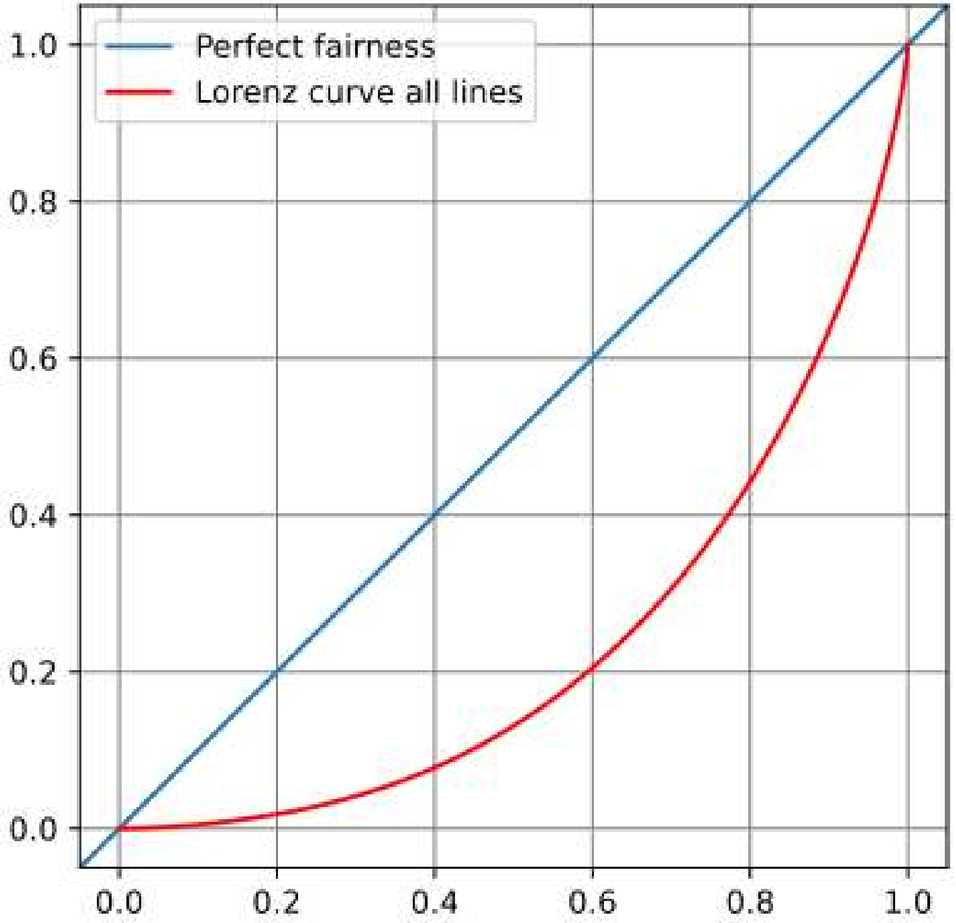


Time to board
& Delays





Fairness indices



$$\text{Gini} \approx \text{gap} \cdot (1.5 - (0.5 \cdot \text{gap}))$$

Line	Lorenz	Gini
Whole system	0.398	0.518

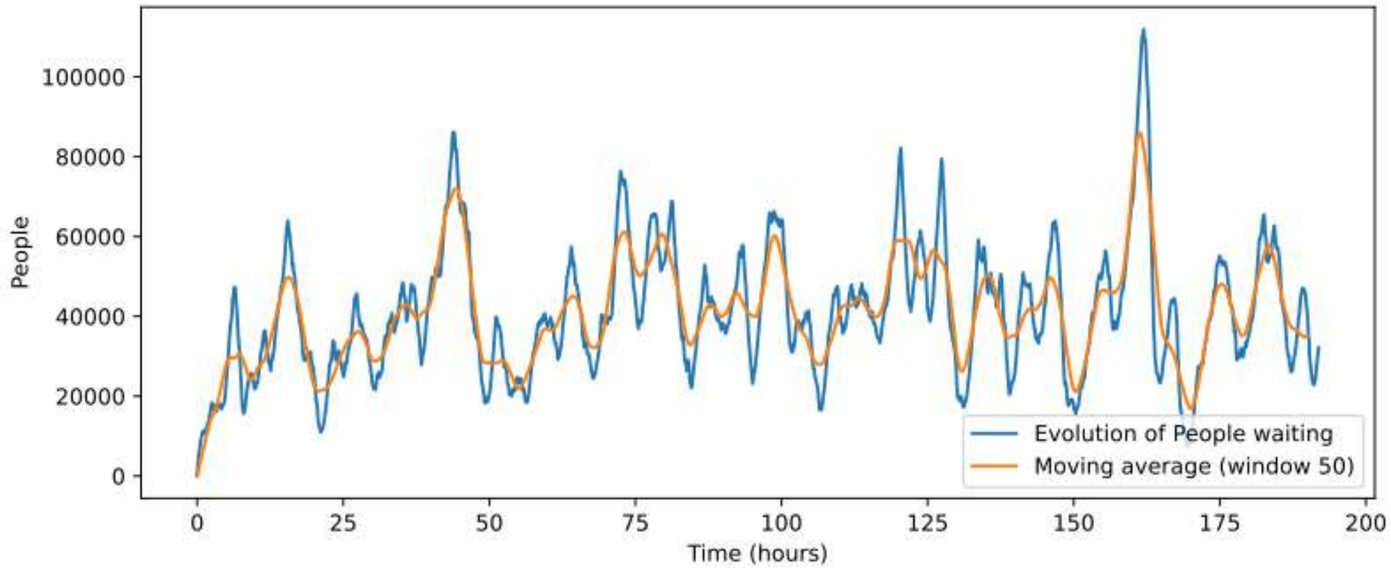
The extreme scenario

Average distance before a crash

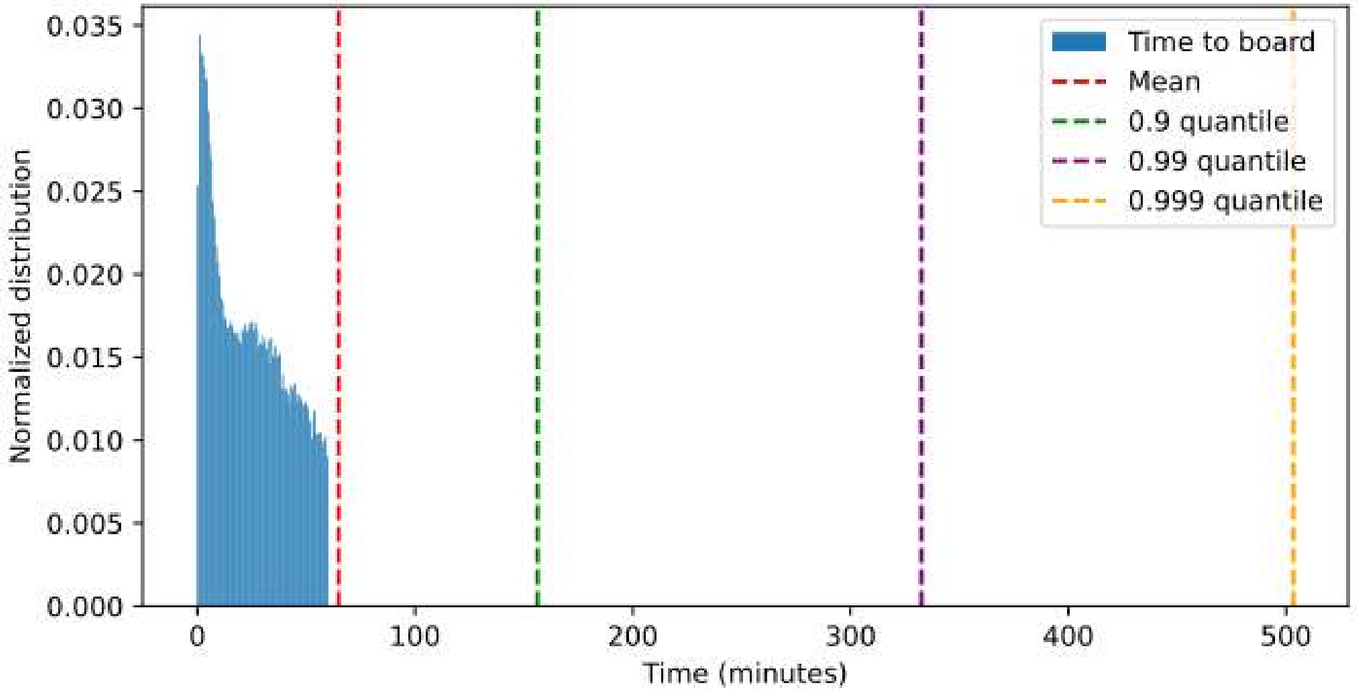
100 KM

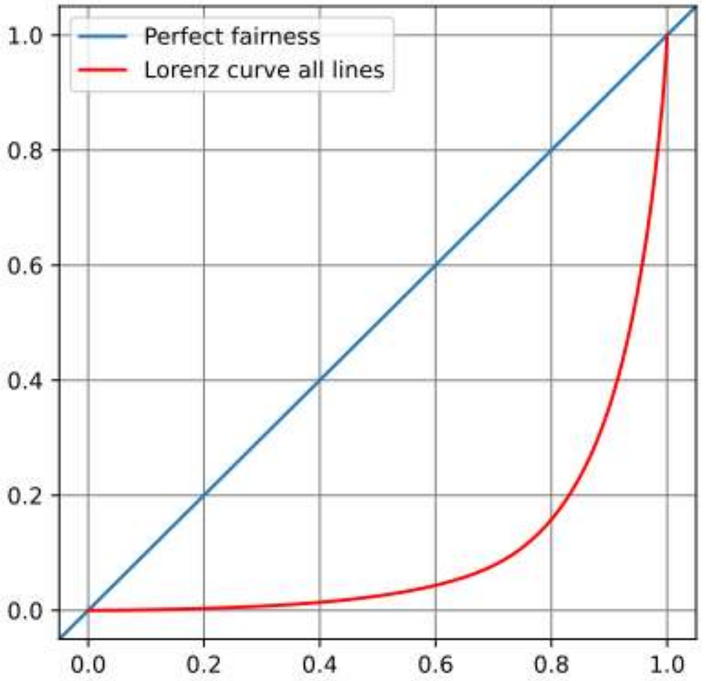
Average Recover Time

1H



But it lacks
service quality





Our Future works

Realistic train acceleration

Trains movement according to Vienna metro time-table

Distribution of people arrival based on station positioning

People movement according to a pathfinding algorithm

Thank you
for the attention

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