**Friedrich-Alexander-Universität**
**Technische Fakultät**

FAU

# Presentation: Comparing Domestic Flights With Train Alternatives

## Stefan Dendorfer, 05.07.2023

## Business flight data of municipality of Cologne in 2019

| origin | destination | quantity | emissions |
|--------|-------------|----------|-----------|
| CGN | SAW | 2 | 1006 |
| CGN | GIG | 2 | 6256 |
| CGN | VIE | 2 | 484 |
| CGN | ARN | 2 | 1420 |
| CGN | TLV | 2 | 1302 |
| CGN | MGA | 2 | 5966 |
| CGN | CLJ | 2 | 760 |
| CGN | PEK | 2 | 4870 |
| CGN | PRG | 2 | 118 |
| CGN | TXL | 4 | 496 |
| CGN | TXL | 14 | 1736 |
| CGN | TXL | 2 | 496 |
| DUS | ARL | 2 | 2390 |
| DUS | ARN | 2 | 754 |

**Facts:**

- 200 valid flight entries

- 99 domestic flights

- Most frequent:

  - 49 CGN-TXL (Cologne – Berlin)

  - 15 CGN-MUC (Cologne – Munich)

  - 8 CGN-DRS (Cologne – Dresden)
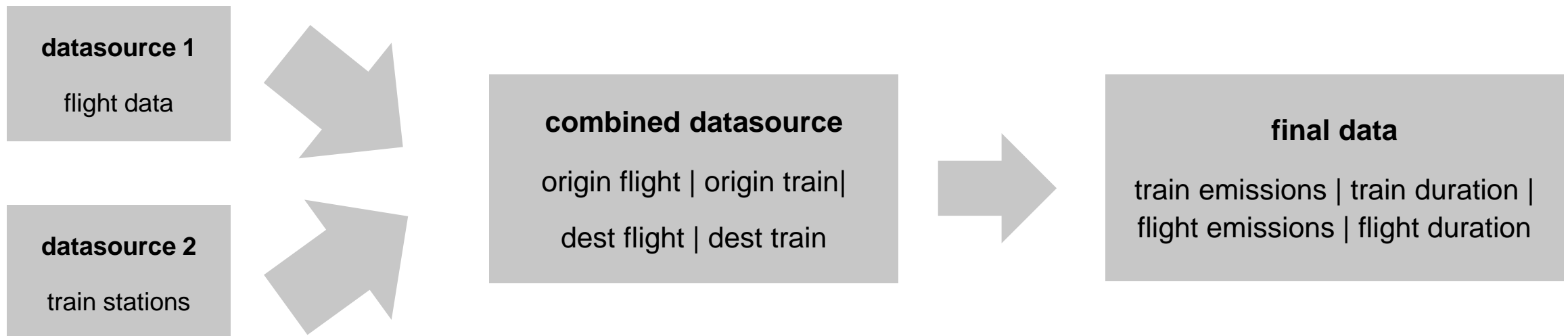
# Datasource 2
## Train stations in Germany

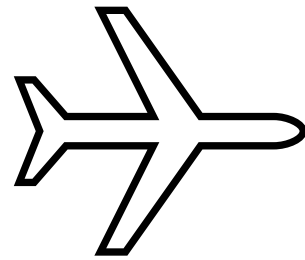| evanr | name | long | lat |
|---|---|---|---|
| | Search column... | Search column... | Search column... |
| 8002551 | Hamburg Elbbrücken | 10,0245 | 53,5345 |
| 8001944 | Eutingen Nord | 8,7531 | 48,4847 |
| 8003074 | Ingolstadt Audi | 11,4074564 | 48,7904959 |
| 8001723 | Einbeck Otto-Hahn-S... | 9,89290953 | 51,8144784 |
| 8004371 | Nörvenich-Rommels... | 6,547586 | 50,782539 |
| 8010340 | Straßgräbchen-Berns... | 14,052047 | 51,361469 |
| 8001510 | Dornstetten-Aach | 8,48291 | 48,4733 |
| 8001966 | Feldolling | 11,852244 | 47,895336 |
| 8002060 | Frankfurt(Main)-Gate... | 8,59449506 | 50,0565739 |
| 8002535 | Halver-Oberbrügge | 7,574042 | 51,191867 |
| 8003105 | Jaderberg | 8,182909 | 53,339108 |
| 8003297 | Kierspe | 7,61622906 | 51,1300136 |
| 8003305 | Reken-Klein Reken | 7,03519821 | 51,7870373 |
| 8005169 | Rosenheim Aicherpark | 12,089467 | 47,851651 |

**Mapping airports to train stations:**

- 39 german airports

```
SELECT evanr FROM t WHERE
      (
        name LIKE '%{search_name}%'
        OR name LIKE '%{iata}%'
      )
      AND
      (
        name like '%Flughafen%'
        OR name like '%Airport'
      )
```
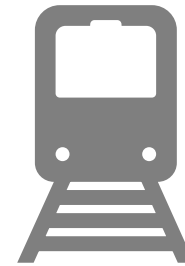
**Nuremberg airport closest DB train station is central station!**

**datasource 1**

flight data

**datasource 2**

train stations

**combined datasource**

origin flight | origin train|

dest flight | dest train

**final data**

train emissions | train duration |
flight emissions | flight duration

# Data of interest

- flight distance

- flight duration

- flight emissions



- train emissions

- train duration
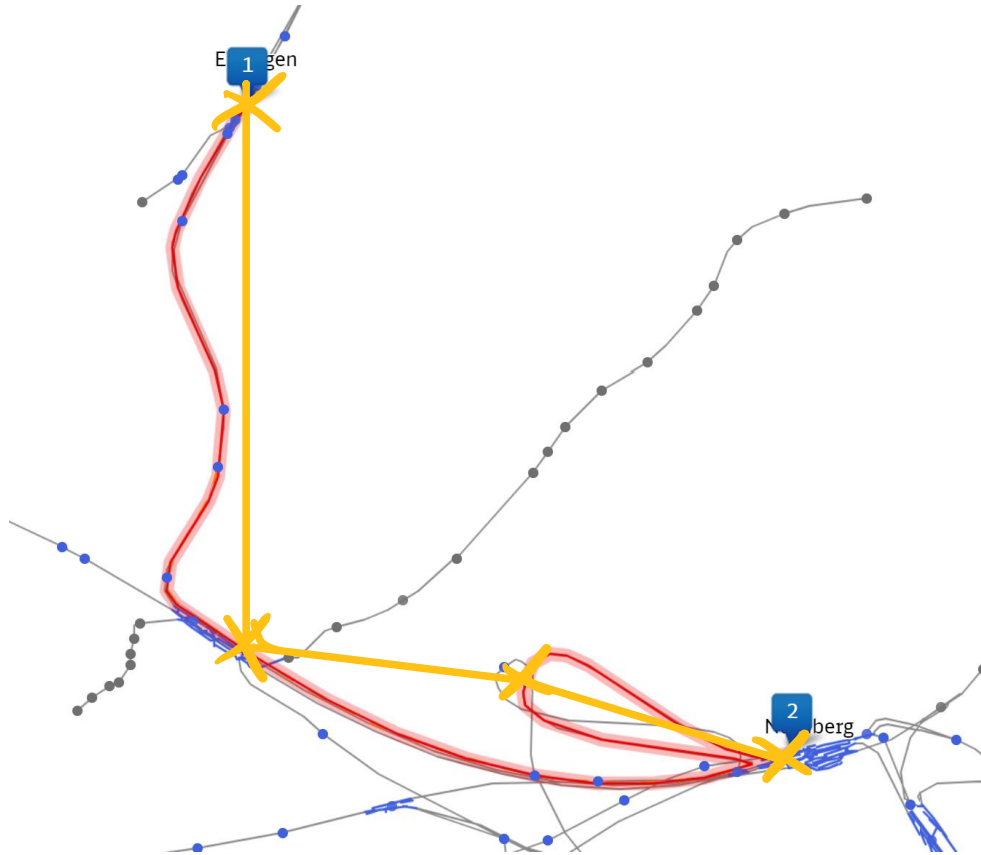
- train distance

# Flight data

spherical distance *s*

velocity *v*                    $t = s / v$

duration *t*

| trip | estimated_duration | actual_duration | nonstop |
|------|-------------------:|----------------:|---------|
| CGN-TXL | 64 | 70 | yes |
| CGN-FRA | 40 | 180 | no |
| CGN-MUC | 62 | 70 | yes |

# Train data

**Distances:**

- Get distances in between legs (yellow)

**Durations:**

- Consult HAFAS client
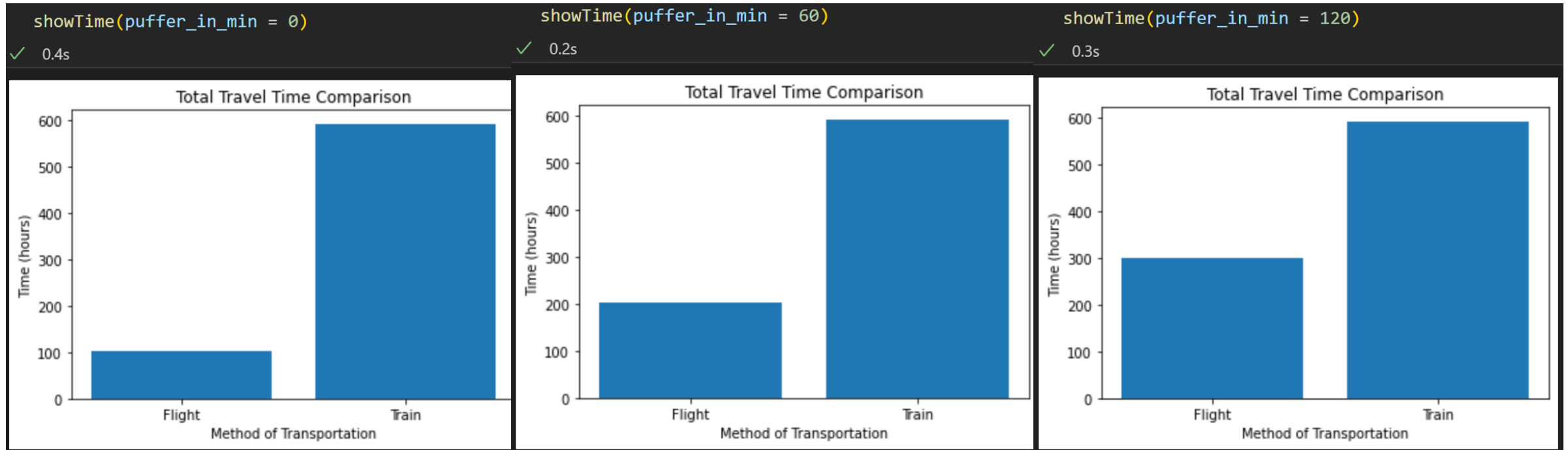
**Emissions:**

- 93 g/km regional, 46 g /km interregional

| Verkehrsmittel | | Treibhausgase [1] |
|---|---|---|
| Pkw | | 162 |
| Flugzeug, Inland | | 271 [2] |
| Eisenbahn, Fernverkehr | | 46 [3] |
| Linienbus, Fernverkehr [6] | g / Pkm | 37 |
| sonstiger Busverkehr [5][6] | | 42 |
| Eisenbahn, Nahverkehr | | 93 |

https://umweltbundesamt.de

**DB NETZE** Trassenfinder    https://trassenfinder.de

# Final data
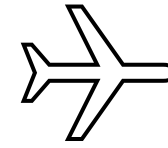
| origin | destination | flight_duration | train_duration | train_emissions_A | train_emissions_B | flight_emissions | quantity |
|--------|-------------|-----------------|----------------|-------------------|-------------------|------------------|----------|
| CGN | TXL | 64 | 354 | 1860 | 26286 | 496000 | 4 |
| CGN | TXL | 64 | 354 | 1860 | 26286 | 1736000 | 14 |
| CGN | TXL | 64 | 354 | 1860 | 26286 | 496000 | 2 |
| CGN | TXL | 64 | 354 | 1860 | 26286 | 496000 | 4 |
| CGN | TXL | 64 | 354 | 1860 | 26286 | 248000 | 2 |
| CGN | TXL | 64 | 354 | 1860 | 26286 | 496000 | 2 |
| CGN | MUC | 62 | 342 | 2697 | 25927 | 714000 | 2 |
| CGN | MUC | 62 | 342 | 2697 | 25927 | 476000 | 4 |
| CGN | HAM | 57 | 316 | 1860 | 19386 | 808000 | 4 |
| CGN | HAM | 57 | 316 | 1860 | 19386 | 202000 | 2 |

# Comparison duration

# Comparison emissions

# Any questions?