Hypotheses and Experimental Design

Testing Hypotheses Using Performance Indicators

Marco Dozza
Chalmers University of Technology

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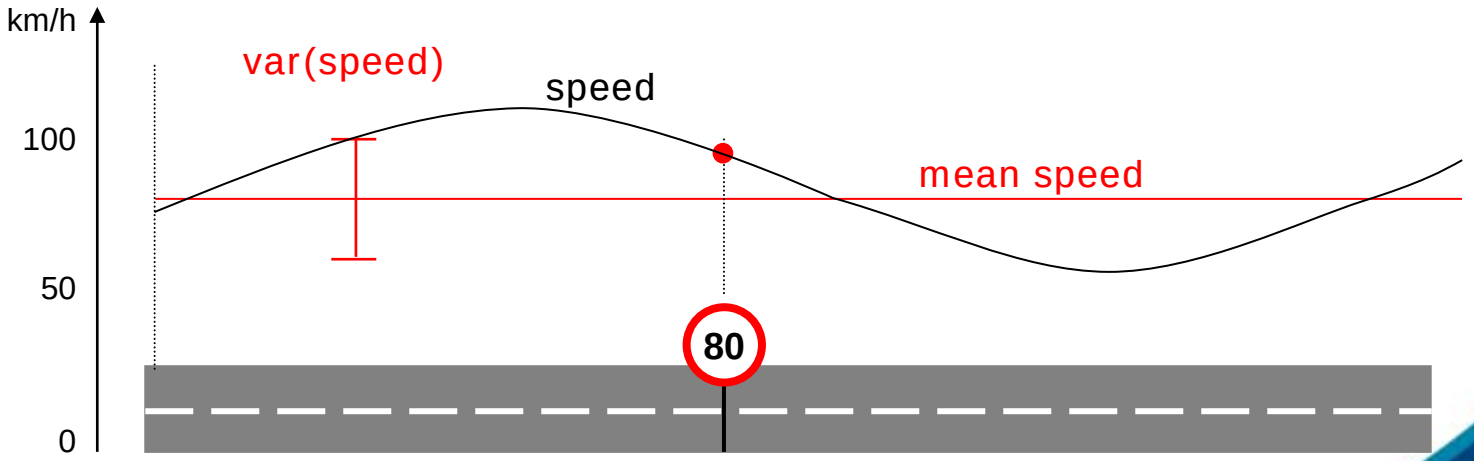
www.eurofot-ip.eu

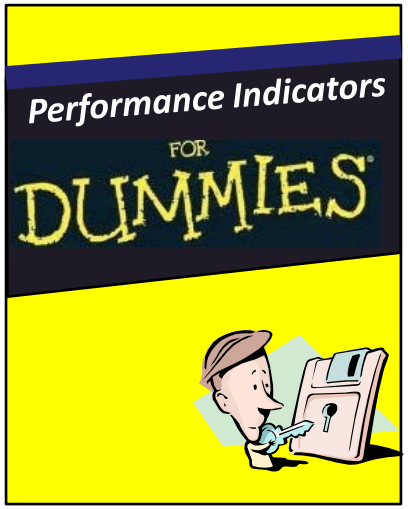
Performance Indicators (PI)

Performance Indicators are quantitative or qualitative measurements, agreed on beforehand, expressed as a percentage, index, rate or other value, which is monitored at regular or irregular intervals and can be compared to one or more criteria. [FESTA]



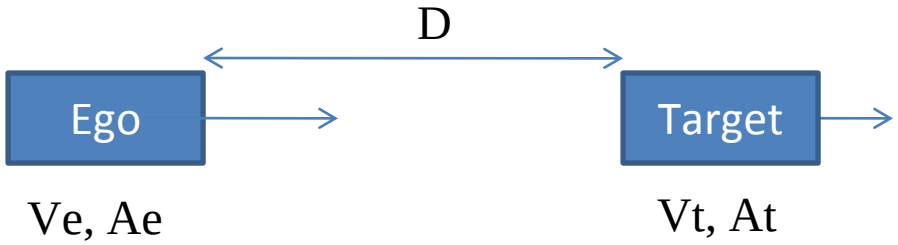
How to compute PIs to test hypotheses?

- Definition (e.g. equation)
- A set of data:
  - Comparison situations
  - Use case
  - Events
  - Situational variables (scenario)



Example from euroFOT analysis

- ACC reduces time to collision (TTC)
- mean(TTC)?
- or min(TTC)?
- maybe our interest is only events with short TTC.
- What is TTC? D/(Ve-Vt)?
- Or should we also consider accelerations?



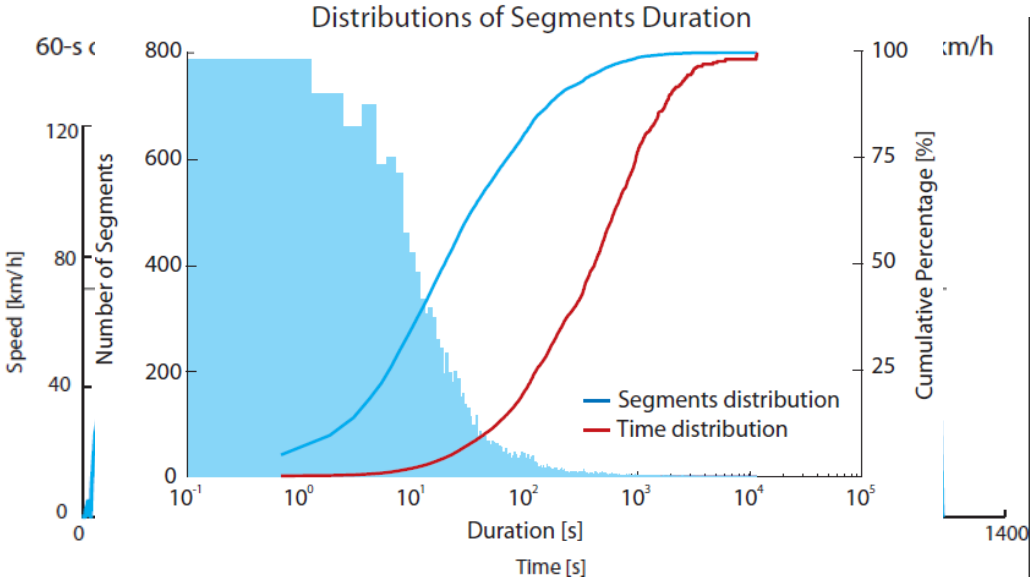
Definition of PIs

- The definition of PIs is crucial but not straightforward.
- Objective PIs eventually become an algorithm.
- Subjective PIs are harder to define.
- Sometimes PIs used in the analysis end up being a surrogate of the PIs used in the hypothesis, and as such they become a trade off between robustness and generality of the results.

Escher, 1958

Example from euroFOT analysis

- ~~LDW increases lateral control.~~
- LDW decreases standard deviation of lane position.
- Issues:
  - Standard deviation of lane position depends on duration of the data (e.g. not reliable when data is less than 60s).
  - Data from SQL queries returns segments of data with different duration



Dozza, Bärgman, Lee 2012.

Calculation of PIs

- PIs create requirements on the data (e.g. duration).
- *Chunking*:
  - Avoids short duration segments
  - Merges PIs from different data segment in a *fair* way.
  - Increases statistical power.
- However,
  - Independent observation assumption must be verified before statistics.

Escher, 1958

Conclusions

- PIs need a definition and a set of data to be calculated.
- PIs are a reality check for hypotheses.
- PIs are tradeoffs between robustness and generality of the results.
- The nature of the data creates requirements for the PIs and **viceversa.**
- Statistics depend on the nature of the PIs and their distribution.

8 Functionalities, 28 Partners, 1000 Vehicles

1 Field Operational Test, **8 Functionalities**

28 Partners, 1000 Vehicles, 1 Field Operational Test

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