Datengetriebene Ansätze für die Mobilität

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Die Entstehung unserer Städte und Regionen

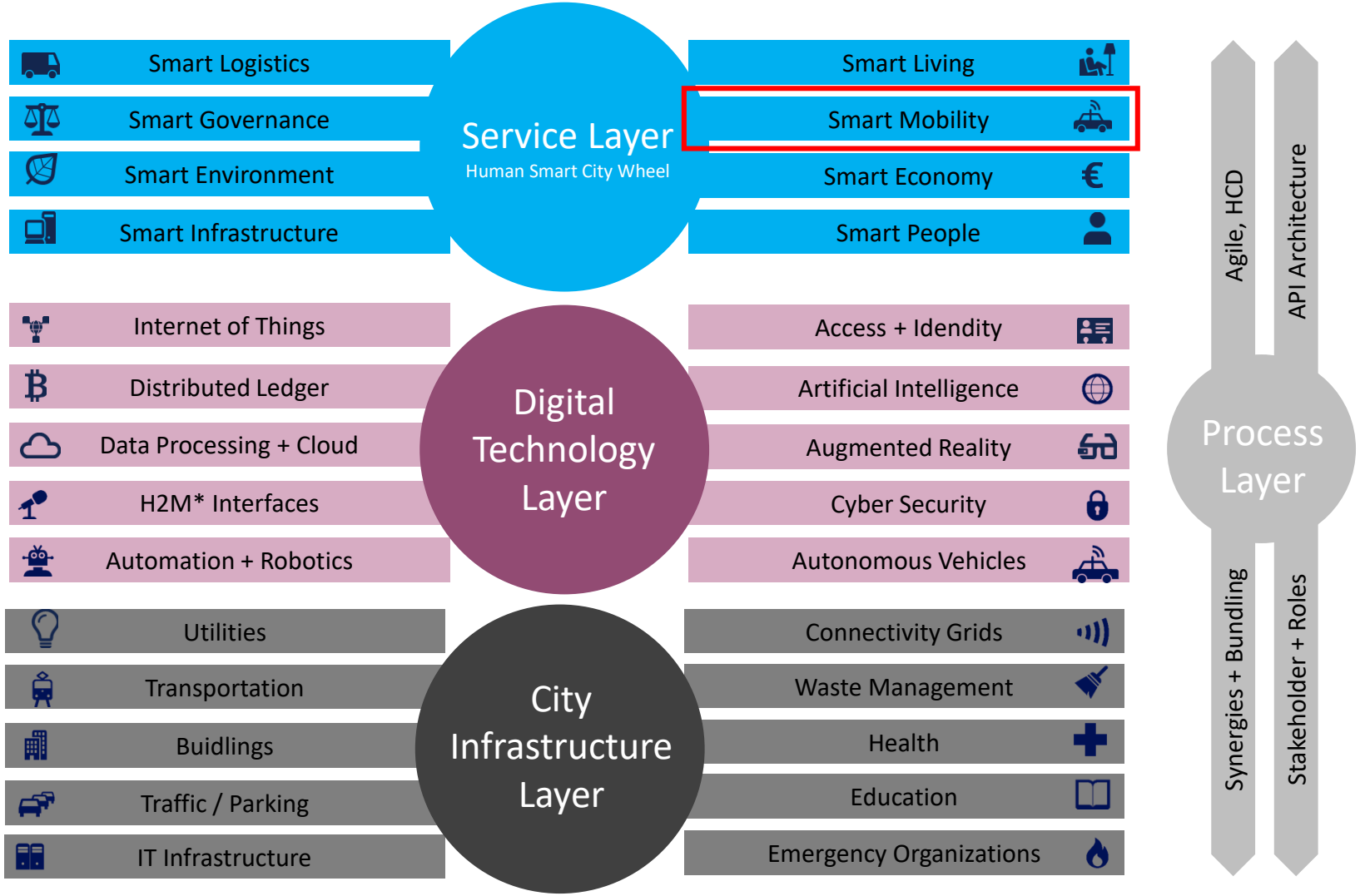
Die Smartifizierung unserer Städte/Regionen

- **Smart Cities** sind: Orte, an welchen ICT mit Infrastruktur, Architektur, Alltagsgegenständen und/oder mit unserem Körper verbunden wird, um dadurch *soziale, ökonomische und ökologische Probleme* anzugehen.
- **Smart City 1.0** (technologiegetrieben): Technologieanbieter wie Cisco und/oder IBM *verkaufen* Städte wie PlanIT und Songdo ihre IT-Lösungen.
- **Smart City 2.0** (aktiviert durch Technologie, geleitet durch die Stadt): Stadtpräsidenten *nähern sich* den Technologieanbieter *mit speziellen Fragen* an, wie Rio de Janeiro IBM wegen Erdrutschen um IoT-Sensortechnologie anfragte.
- **Smart City 3.0** (mitgestaltet durch Bürger): Den Bürgern wird durch die Stadt *partizipatorische Technologie* zur Verfügung gestellt, um *demokratische Prozesse* zu ermöglichen, wie etwa Wien mit den Bürgerkraftwerken experimentiert.

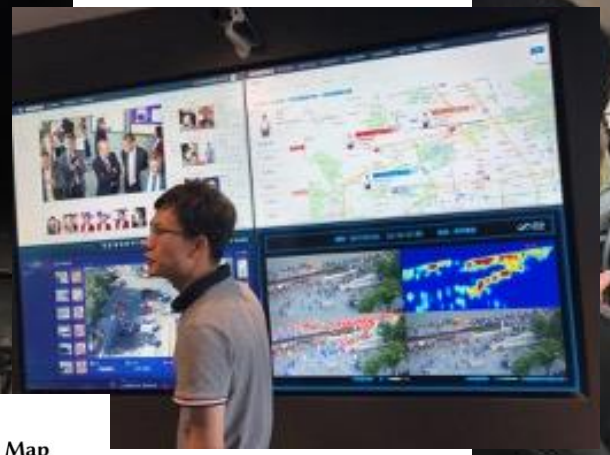
Wie entwickelt man die Smart Capital Region?

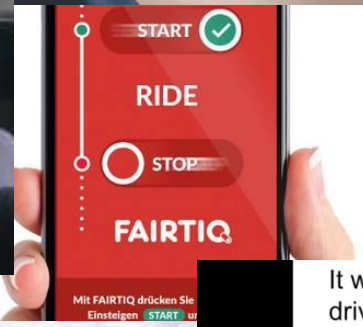
- Die Vision der **Smart City**: kann auf die Städte Bern, Fribourg, etc., die *Smart Capital Region* sowie die Smart Nation Schweiz angewandt werden.
- In der **Smart Capital Region**: soll eine intelligente Verknüpfung der Infrastrukturen in den Bereichen Transport, Energie und Kommunikation die *Lebensqualität der Bevölkerung erhöhen* und gleichzeitig den Ressourcenverbrauch minimieren.
- Die **Hauptstadtregion Schweiz**: setzt sich dafür ein, dass die öffentliche Hand und Infrastrukturunternehmen zusammenarbeiten und *innovative Lösungen entwickeln*.
- **Gemeinsam mit den Infrastrukturunternehmen** (wie der Post, SBB und Swisscom): entwickeln wir eine *humanistische, menschzentrierte Vision* einer Smart Capital Region.

Unsere Human Smart City Architektur



2018, l'année de la mobilité?





A Force-Directed Approach for Offline GPS Trajectory Map Matching

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ABSTRACT

We present a novel algorithm to match GPS trajectories onto maps offline (in batch mode) using techniques borrowed from the field of force-directed graph drawing. We consider a simulated physical system where each GPS trajectory is attracted or repelled by the underlying road network via electrical-like forces. We let the system evolve under the action of these physical forces such that individual trajectories are attracted towards candidate roads to obtain a map matching path. Our approach has several advantages compared to traditional, routing-based, algorithms for map matching, including the ability to account for noise and to avoid large detours due to outliers in the data whilst taking into account the underlying topological restrictions (such as one-way roads). Our empirical evaluation using real GPS traces shows that our method produces better map matching results compared to alternative offline map matching algorithms on average, especially for routes in dense, urban areas.

CCS CONCEPTS

• **Information systems** → **Geographic information systems**; • **Theory of computation** → Computational geometry;

KEYWORDS

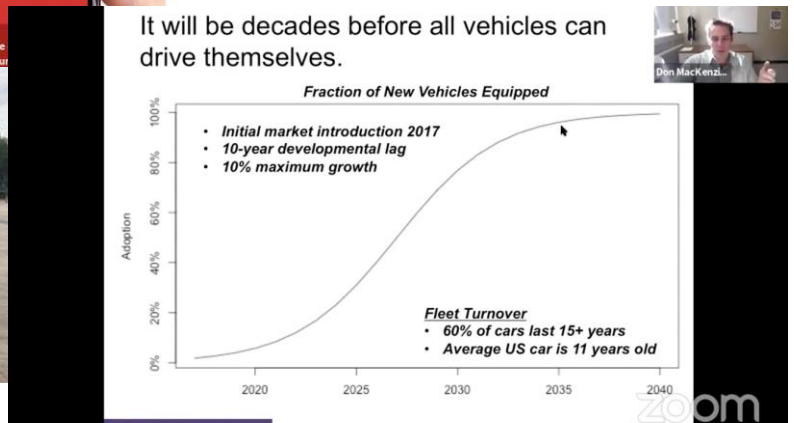
Map matching, force-directed algorithms, GPS trajectory, road map, offline routing

1 INTRODUCTION

Map matching is the process of mapping a geospatial trajectory obtained from a GPS receiver onto a given road network. As the coordinates obtained from these devices are not always precise, in dense road networks the task of matching these onto a real map is not trivial. Several candidate roads may exist in close proximity and a map matching algorithm must ensure that the resulting path on the road network is plausible and that physical constraints (e.g., one-way streets, obstacles) are respected.

Map matching has been studied for over a decade [25] and a large collection of algorithms exist with varying degrees of complexity and accuracy. Existing algorithms can be divided into two broad categories: i) online or real-time algorithms, where the algorithm has to determine the likely position on a map given the history of previous points, for example on a vehicle equipped with a GPS navigation device, and ii) offline algorithms, where the entire trajectory is known in advance and the algorithm has to adjust the trajectory points a posteriori such that they represent on a map the likely route taken by the vehicle.

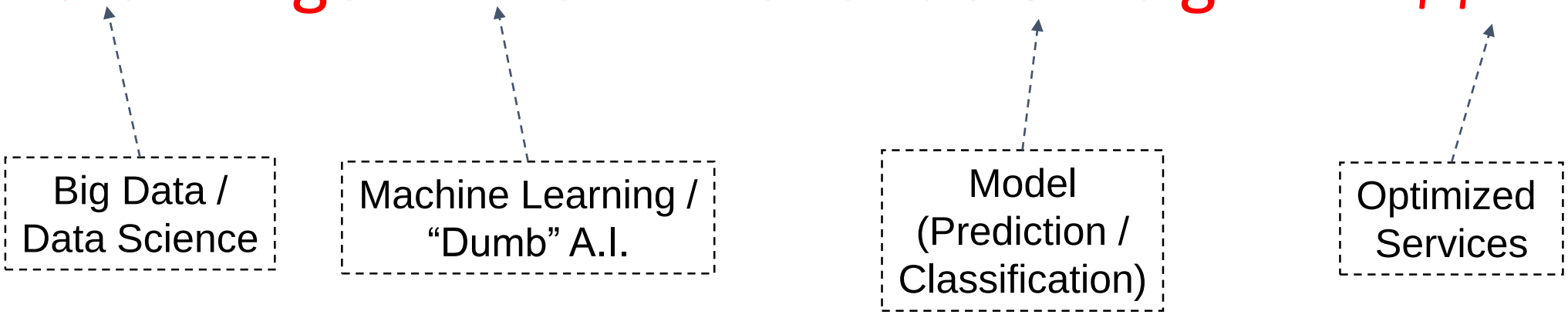
The present article considers offline map matching. This problem has received less focus than its real-time counterpart as it is not useful for real-time navigation. However, in many applications, such as logistics and supply chain management, the analysis of vehicle trajectories is done a posteriori once the vehicles have returned to the depot, where a map matching algorithm is used to correct measurement errors by the GPS receivers and produce a trajectory that lies completely on a real map network. One of the



Data

Data is the new oil

- Data + Algorithms ➔ Actionable Insight ➔ $$

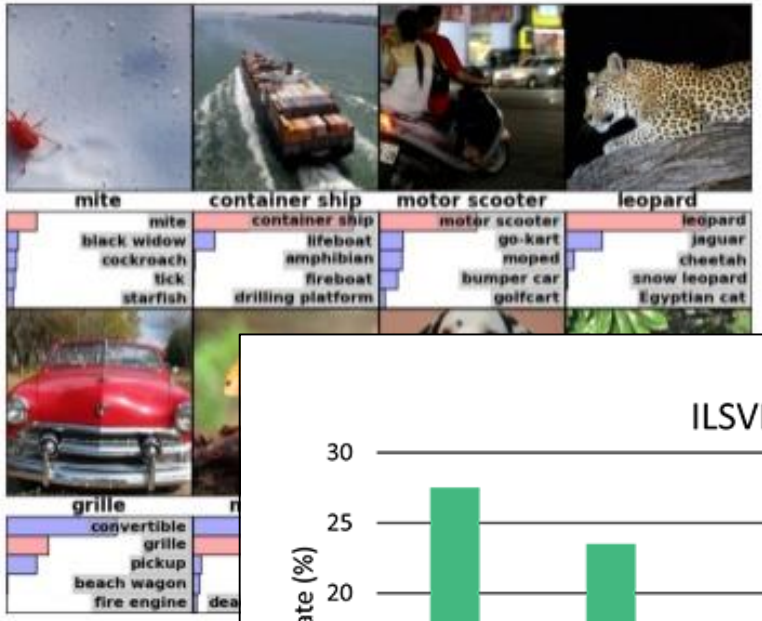


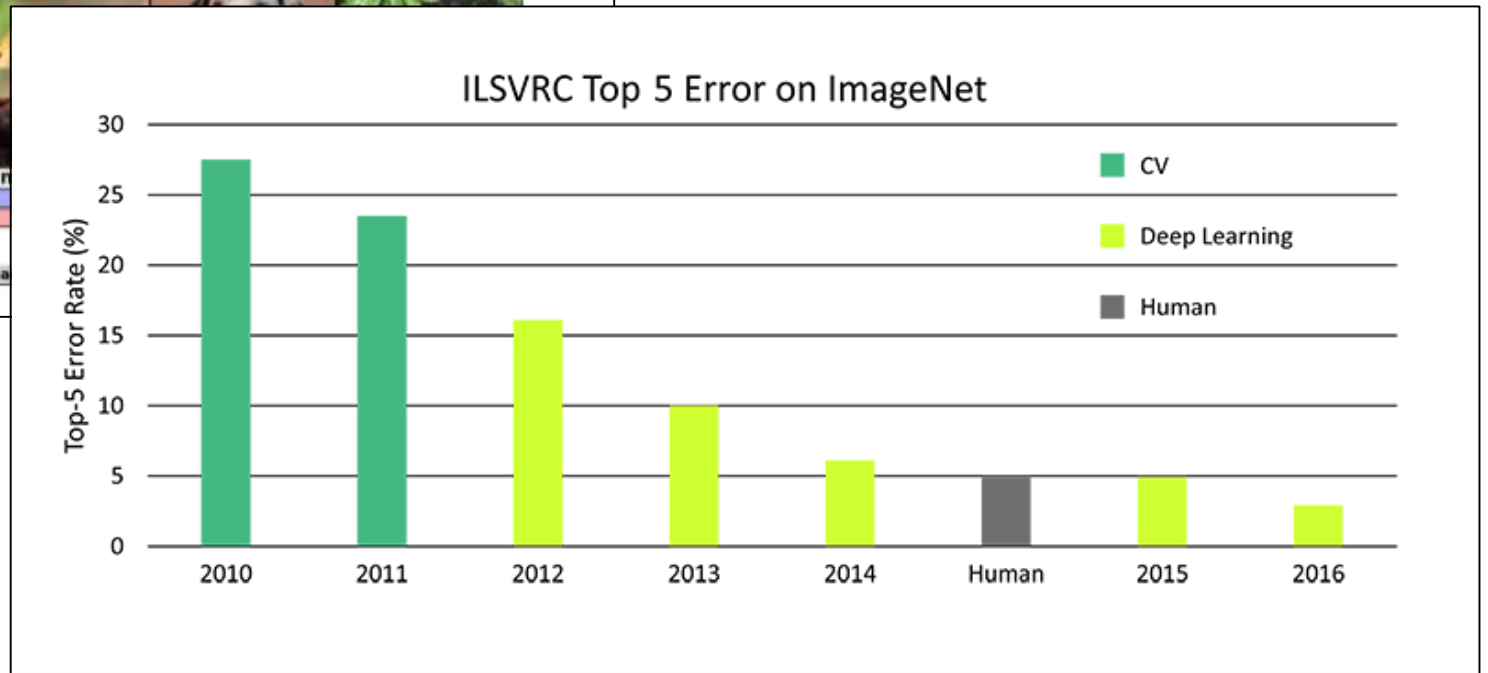
Des progrès fous…

ImageNet Challenge

IMAGENET

- 1,000 object classes (categories).
- Images:
  - 1.2 M train
  - 100k test.



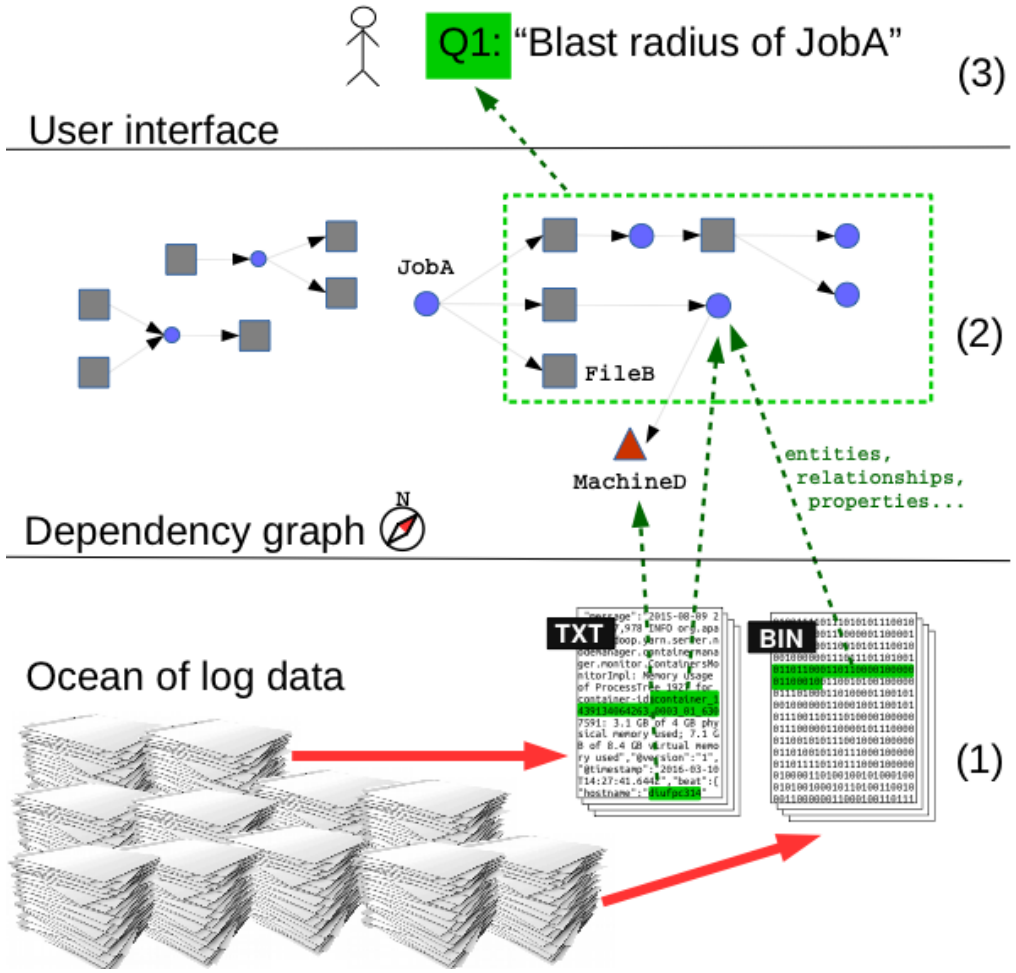


… et des problèmes qui le sont encore plus

Turning a STOP sign into a 45 mph speed limit

[K. Eykholt et al. CVPR 2018]

Data Transparency



Dependency-Driven Analytics: a Compass for Uncharted Data Oceans.
Ruslan Mavlyutov, Carlo Curino, Boris Asipovm, and Phil Cudre-Mauroux.
CIDR 2017

Data Ownership