Gatik

We own the middle mile.™

Intelligent Mapping Solutions

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Company Overview

Background

The Leader In Autonomous Short-Haul Logistics

- Founded in 2017 by veterans of the autonomous technology industry
- Customers: Walmart, Kroger, Tyson Foods, Georgia-Pacific and more
- Current locations include Texas, Arkansas & Ontario (Canada)
- Expanding to new markets throughout 2025
- Use case leverages point-to-point movement of goods to optimize safety and efficiency and meet customer needs

Class 8 vehicles for highway-only driving between hubs

Distribution Center

Class 3-7 cold chain capable vehicles for urban, semi-urban, and highway driving environments

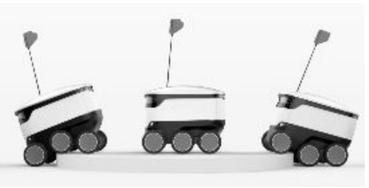
Distribution Center

Sorting Center

Store

Depot/Locker

Pickup Hub



Slower moving vehicles with limited capacity

Home

Definition	Highway only; hub-to-hub; Class 8; >400 miles	Highway & Semi Urban; DC-hub-store; short-haul; Up to 400 miles	Urban; store-to-home; smaller robots; 1-5 miles
Technological Differentiation	Highway-only capabilities	Purpose built technology for fixed & repeatable routes/networks. Tailored for urban, semi-urban & highway driving	Geofenced use-cases Leading to countless route combinations

Gatik

Making the Supply Chain More Responsive and Efficient

Service

- Increase Product Flow
- Driver Shortage Hedge
- Dedicated Capacity

99%+ Delivery On-Time

Savings

- Lower Costs
- Higher Utilization
- Real-time Tracking

Savings 20%+

Safety

- Reduce Accidents
- Improve Visibility
- Increase Control

Exemplary Safety Record

Sustainability

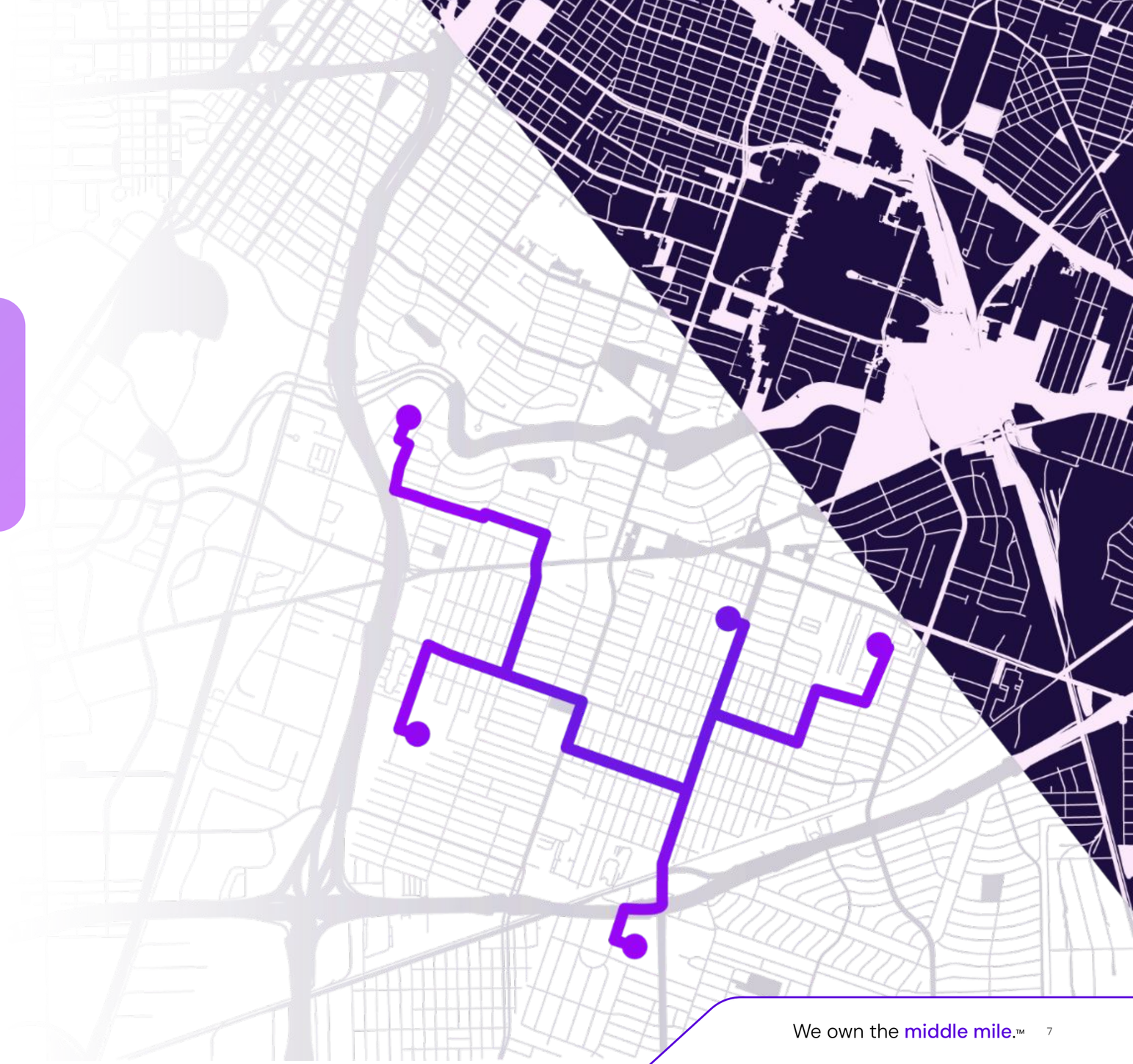
- Meet emission targets
- Full EV solutions
- Simplify Maintenance

EV/AV Solution

Structured Autonomy

Customized solution for restricted route and roadway interactions **shorten validation time** and **optimizes for safe operations**

- **Hyper-Constrained** | Custom-fitting AV technology for known routes
- **Route Optimized for Safety** | Pre-defined and risk-mitigated

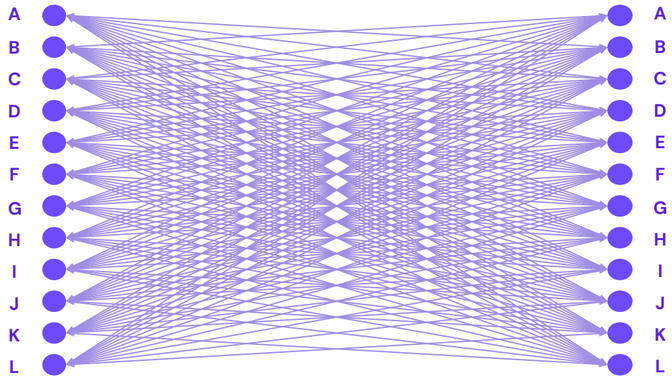


Allows for Incremental Expansion of Operational Design Domain

- Broader ODDs like Geofenced regions: Value proposition is to enable transport between many to many locations. Solving for a single route doesn't really provide any value. **A given route connection may not even see any customer demand during service**
- Before deployment, each of these route variations need to be validated

Each route variation, might or might not provide value - but to enable the service all nodes need to be considered, developed and validated

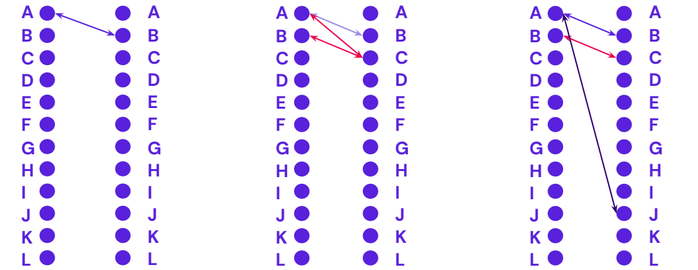
Approach needs to be generalized and resources are required to be spent to validate all routes



- Gatik's fixed route ODDs: Value proposition is to enable transport between one to one location. **Solving for a single route immediately provides value - Promise of trips - multiple times a day, 7 days a week**
- Before deployment, only specific route(s) needs to be validated.

Each route(s), provides guaranteed value for service.

Targeted use of resources for development & validation of each route – also very high confidence validations



Completely New Routes
Only routes that add commercial value (A<->B) are validated instead of all the variations

Extending Existing Routes
Adding route from B to C, also extends route from A to C. Allows incremental extension

Adding New Destinations
Adding a new route from A to J, doesn't necessarily mean we need to solve for all routes to J

AI-inspired

Mapping Approaches

* Prepared together with **Amir Yazdani**, Sr. Research Scientist

A Balancing Act

1. Safety
2. Efficiency
3. Cost

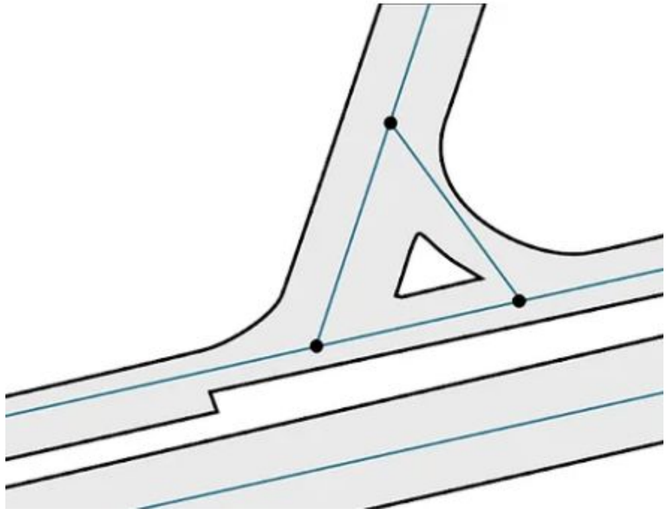
Maps

SD Maps

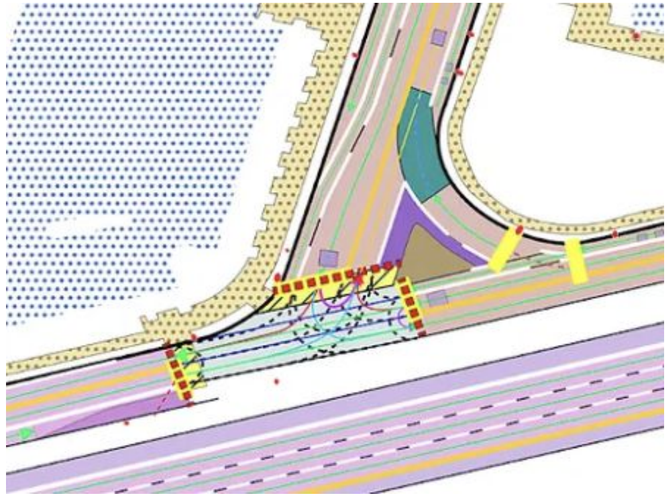
are available in abundance, but the information provided is very limited.

HD Maps

are costly and hard to adapt but are needed **now** for safe autonomous driving.



vs



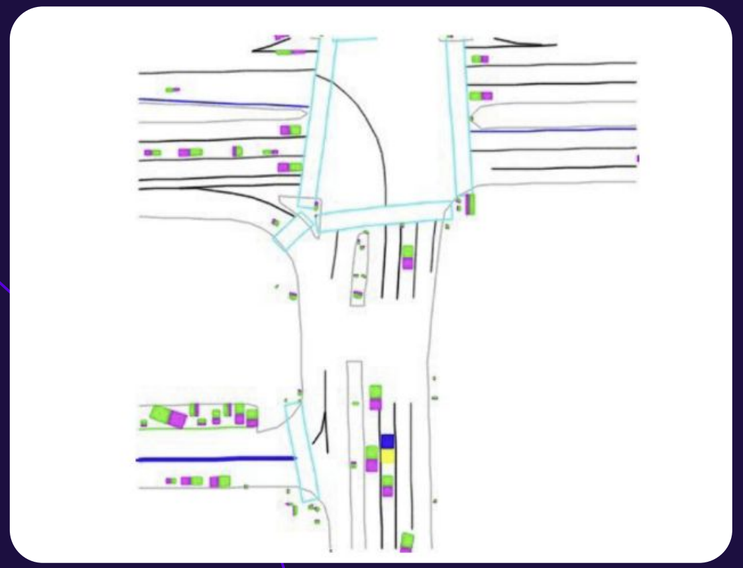
[Woven by Toyota blog]

HD Maps

Rasterized vs Vectorized

Rasterized Maps

require CNNs, offer limited receptive fields and are computationally heavy.

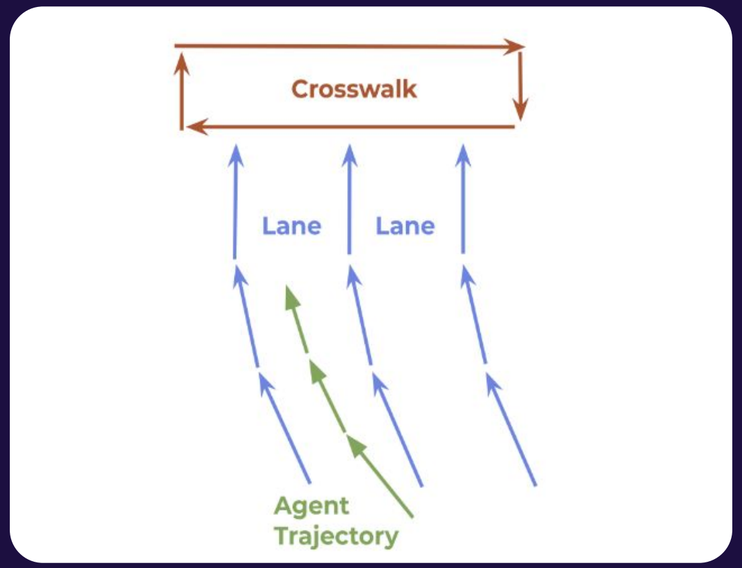


["VectorNet...", Gao et. al., 2020]

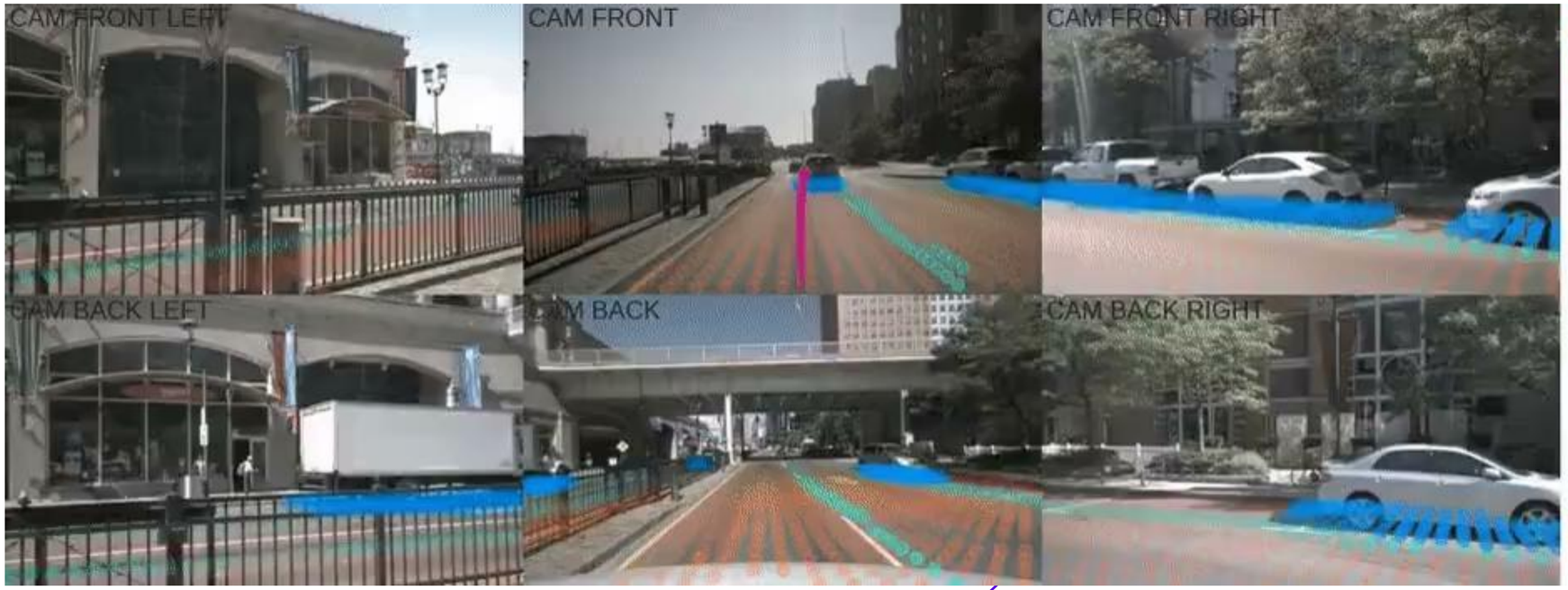
vs

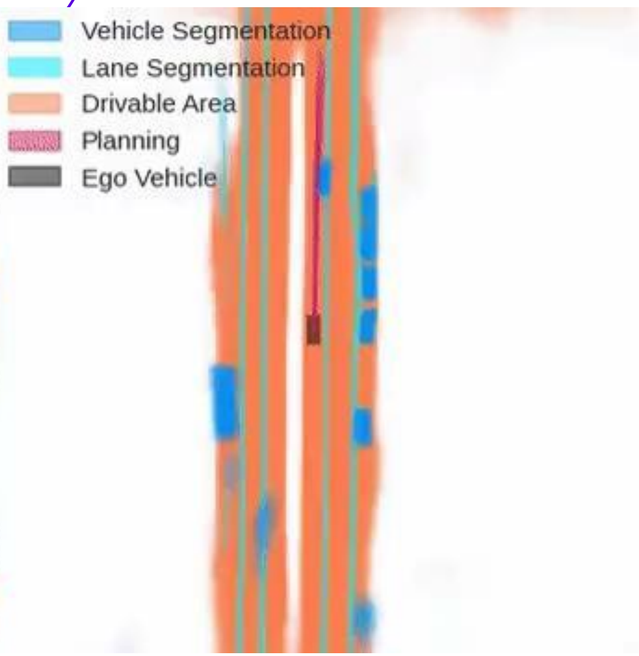
Vectorized Maps

require GNNs / Transformers and offer polylines with attributes including map elements and motion trajectories



Rasterized Pixel HD Maps





["Lift, Splat, Shoot...", Philion et. al., 2020]

Vectorized Polylines HD Maps

["MapTRv2…", Liao et. al., 2023]

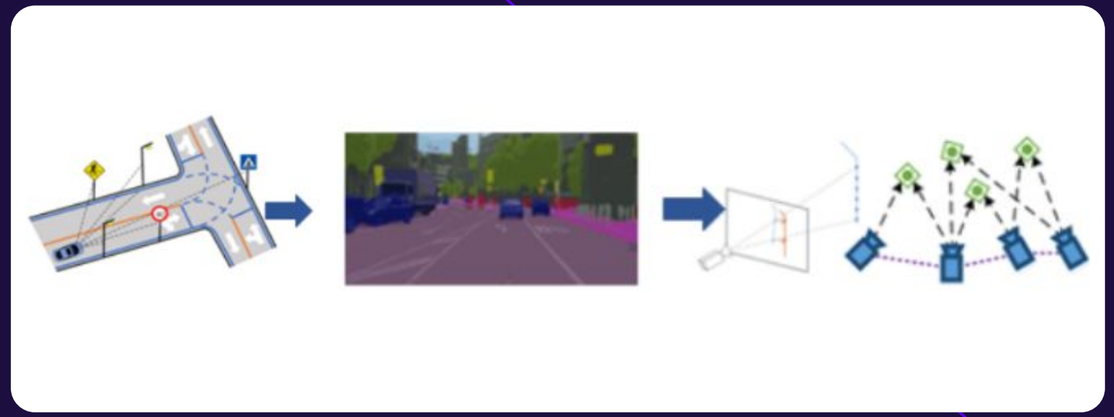
Problem with HD Maps

- Cannot fully rely on pre-collected HD maps
- Need online adaptation for:
  - Road works
  - Closed lanes / roads
  - Map erros

Mapping

Offline

Data collection process and assigned fleet using sensor data, rule-based algorithms and manual labor



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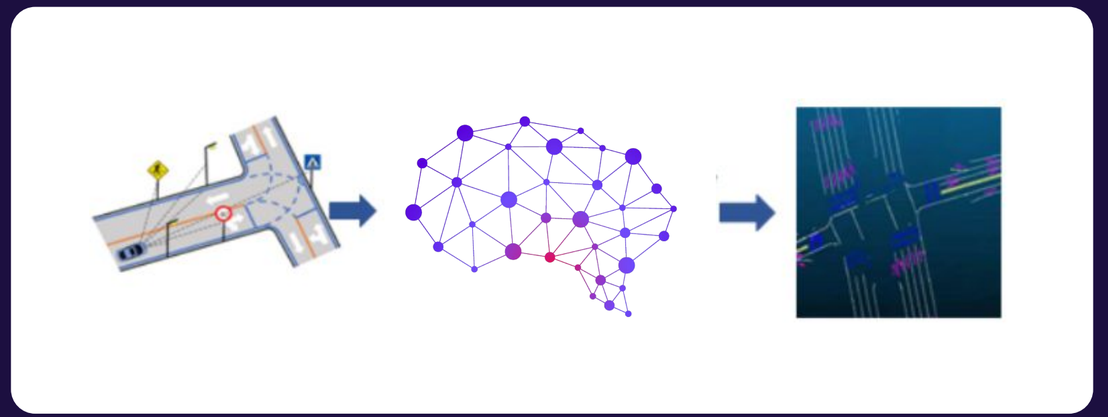
Online

Map is created / adapted during real-time driving using prior information and on onboard AI engine



["HD Maps Construction Based on Visual Sensor: A Comprehensive Survey", Tang et. al., 2023]

Online Mapping vs Offline Mapping

	Offline Mapping	Online Mapping
Sensors	Abundant (even multiple vehicles)	Limited (by one vehicle)
Cost	High (due to manual labor)	Lower (due to automatic updates)
Scalability	Low (due to high cost and manual work)	High
Quality	High	Medium
Computing/time requirements	Mitigated (no need in real time)	High (real time processing and onboard HW)

Challenges

- **Real-Time Processing**
  - Maps must be updated as the vehicle moves through the space w/o delay

    GPU accelerators to the rescue

- **Scene understanding**
  - Series of traffic cones –> a new lane boundary

    High-level reasoning (e.g., by LLM/VLM)

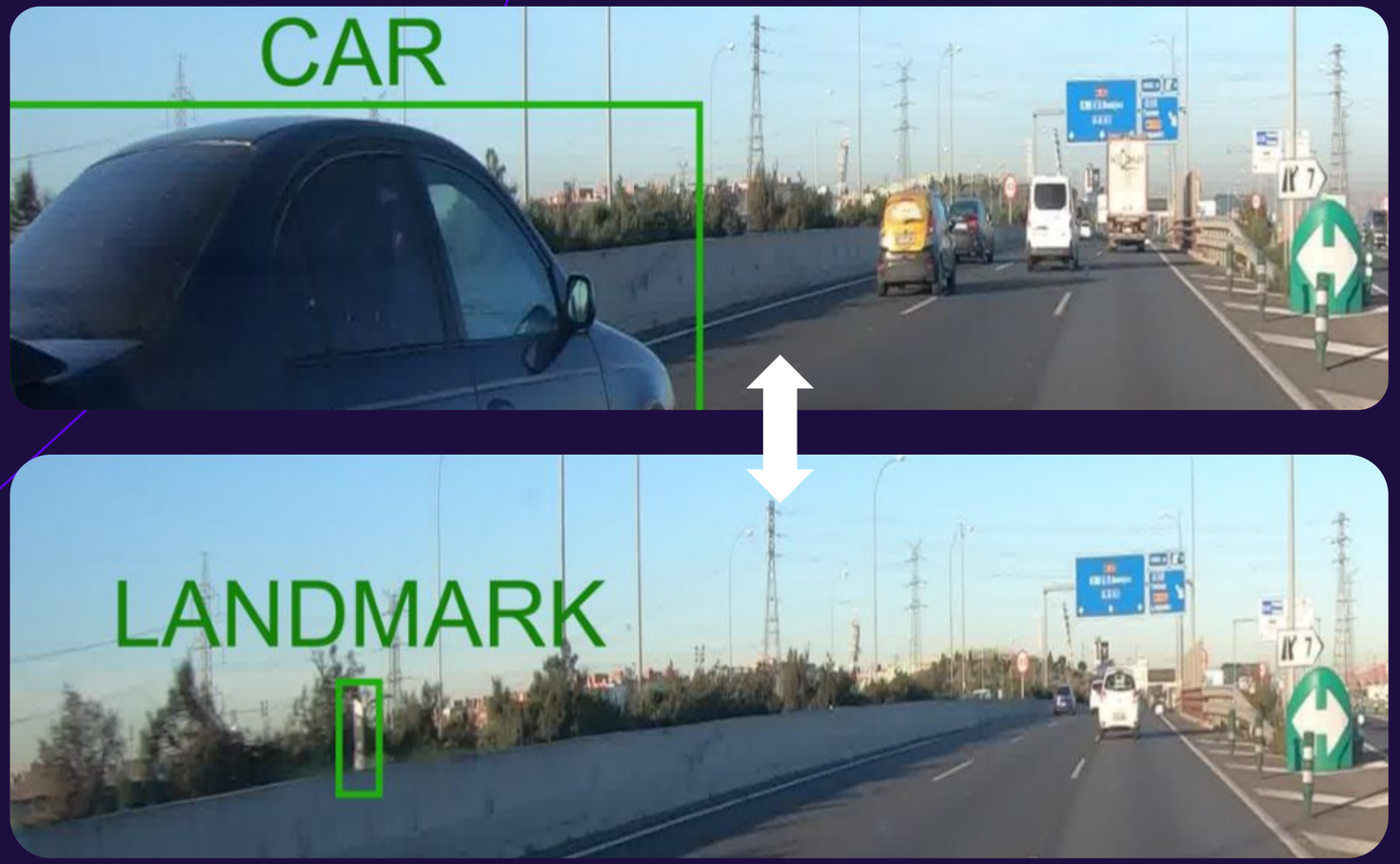
Challenges

- **Consistent representation**
  - Hard to maintain because of the *diverse geometric structures* of map elements in real time

    Need **flexible** mapping format

- **Lack** of information
  - Occlusion

    Repeatable routes help

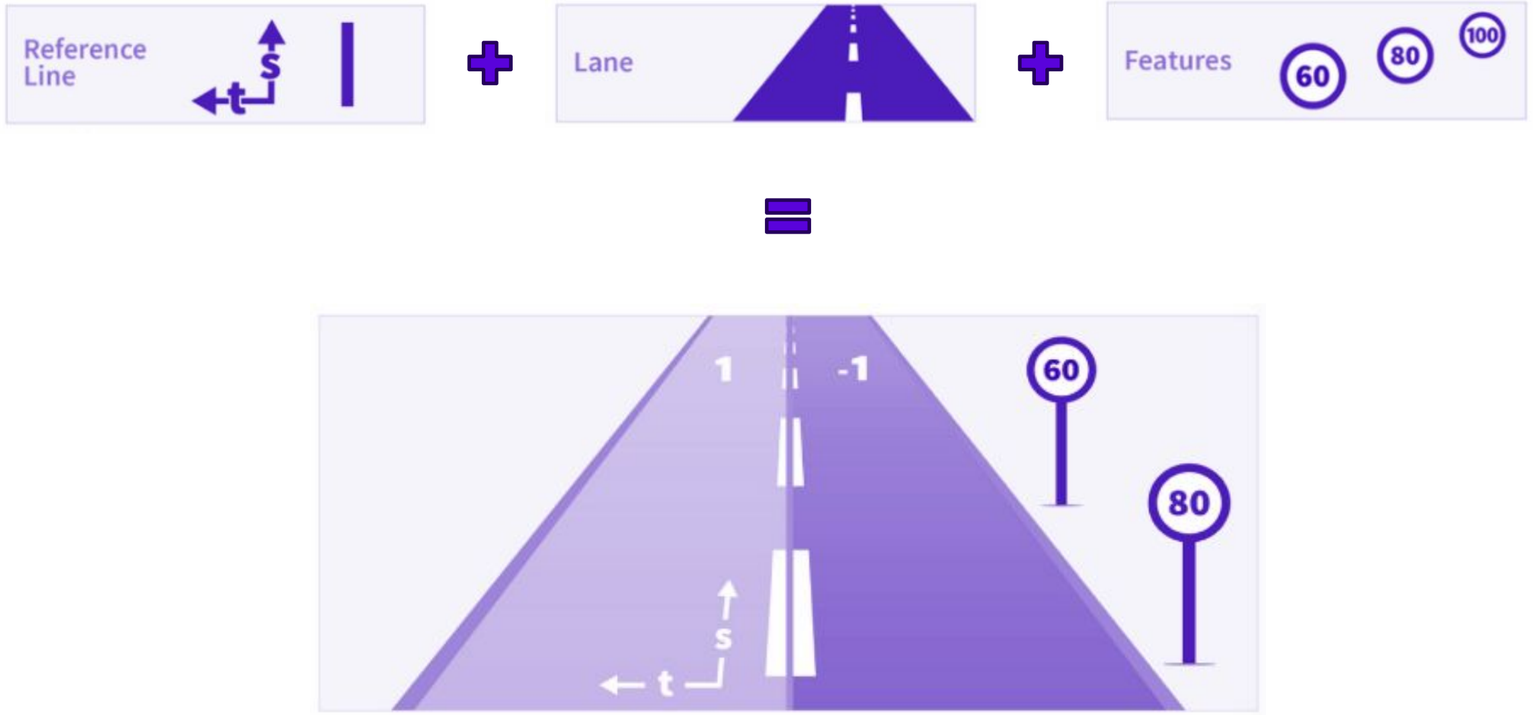


["Video-based Deep Matching for Object Occlusion Detection", Samblas et. al.]

Map Formats

- **There is no <u>unified</u> format of an HD map**
  - A variety of open and proprietary formats
- **Top-down representation**
  - Historically, one of the first format used by various companies since the beginning of 2000s
  - Representation of road as an imaginary center line

    Any info about road element (e.g., lane) is added as an attribute to it
  - Extremely **complex** and **implicit** representation

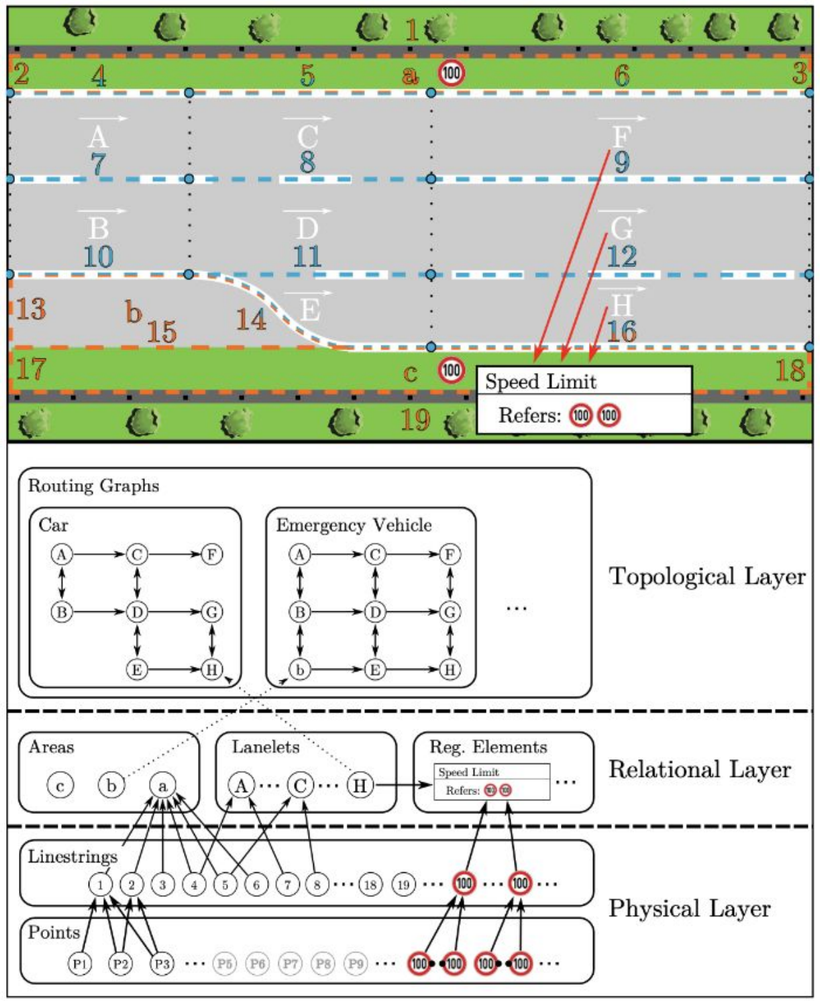


Map Formats: Flexibility

- **Bottom-up representation**
  - **Lanelet2** (2018)
  - Primitives:

    points > linestrings > polygons > lanelets
  - A different approach: neighbourhood **relations!**
  - Able to encode the **explicit** representation of lanes

    Even **basic** scheme of **interaction** between an agent and a map element
  - Incorporated in ROS 1/2



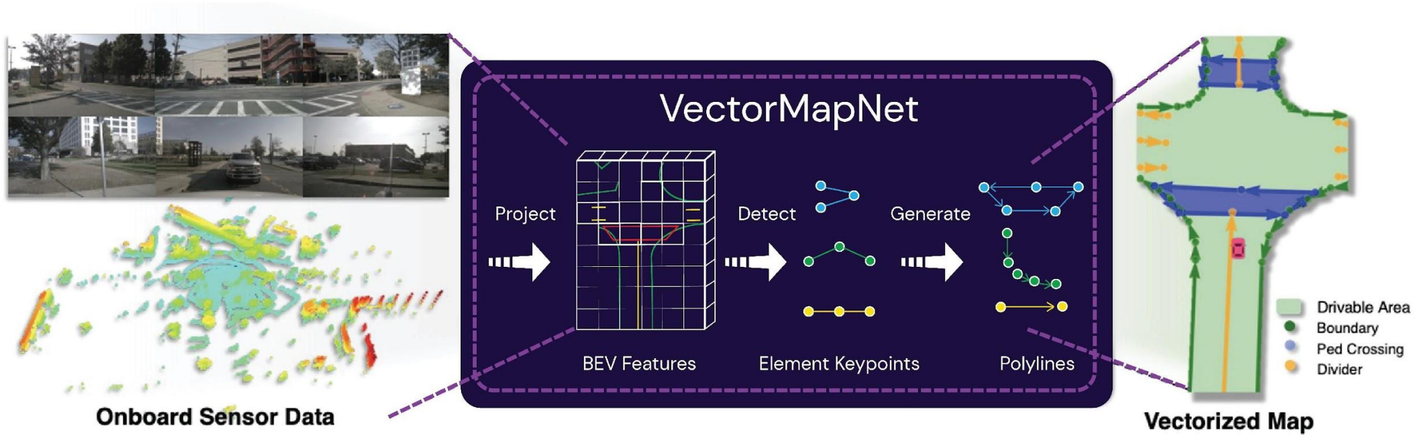
["Lanelet2...", Poggenhans et. al., 2018]

No Prior Info Usage

Dependent on what prior information to use:

- **No prior** knowledge
  - Only perception input
  - **Use case:** baseline, initial creation

    points > linestrings > polygons > lanelets

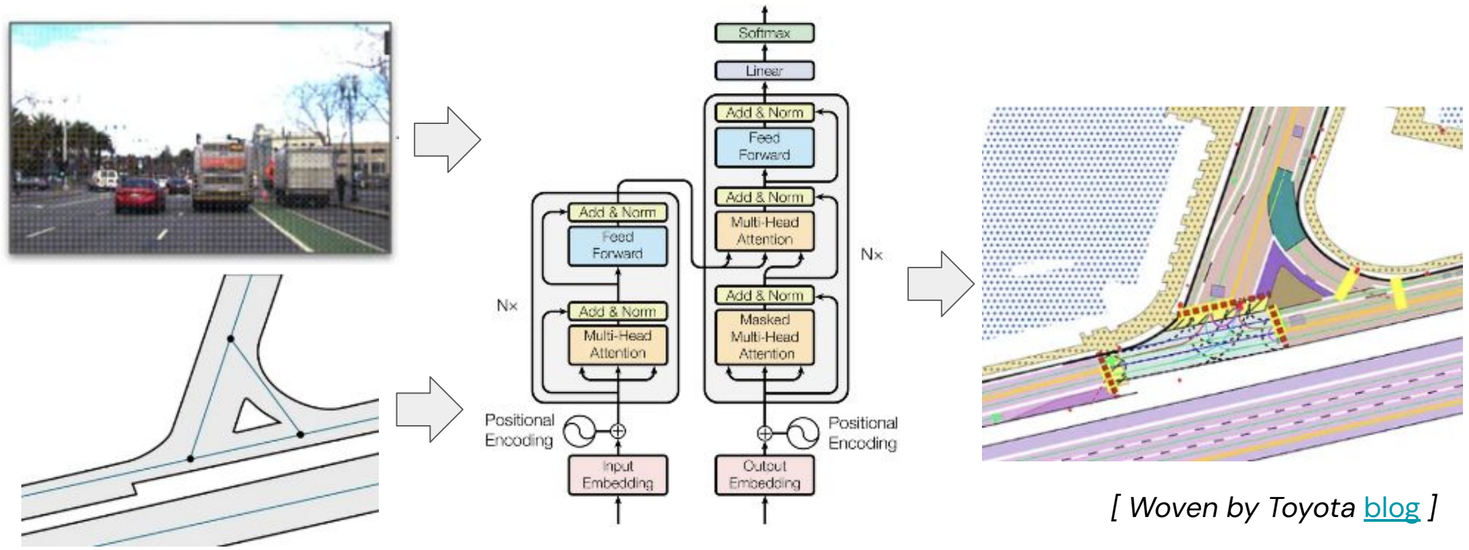


["VectorMapNet...", Liu et. al., 2022]

Prior: SD Map

Dependent on what prior information to use:

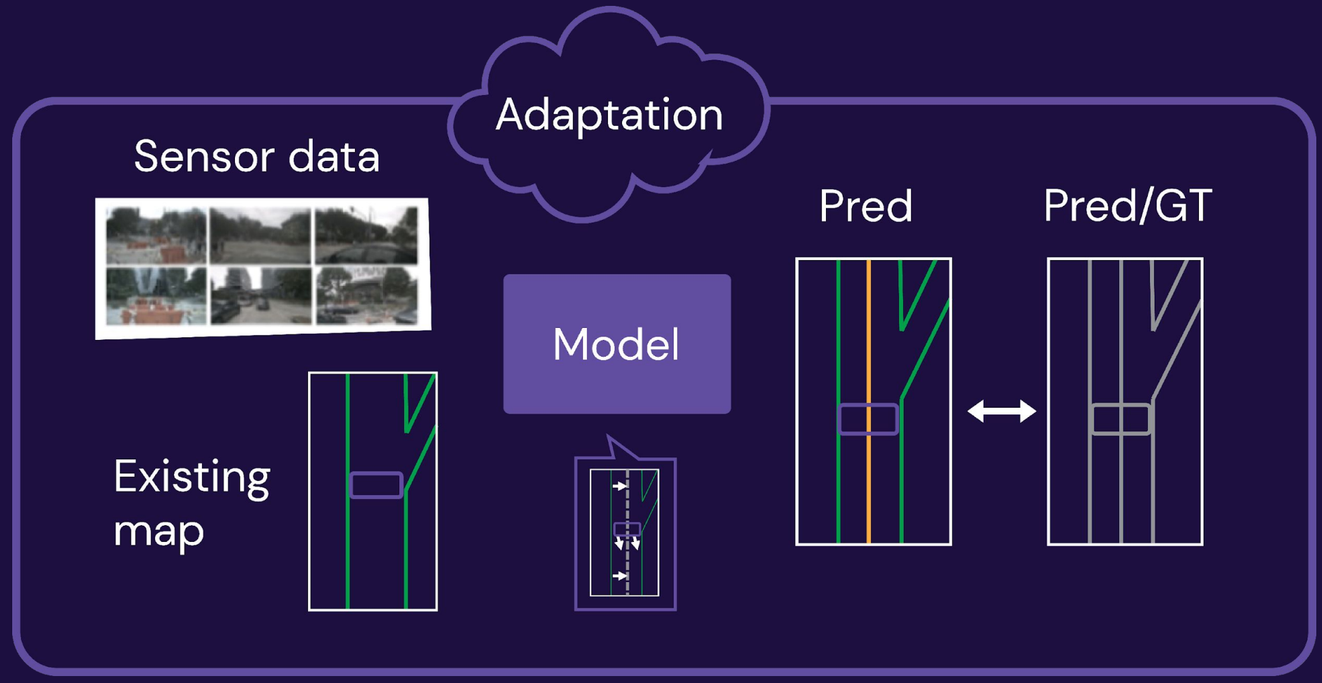
- **SD** (Standard Definition) map
  - E.g., Google / OpenstreetMap
  - **Use case:** scaling / cost saving



[Woven by Toyota blog]

Prior: (old) HD Map

- **(Old)** Previous version of **HD** map
  - Can be partially wrong, inconsistent, outdated, etc.
  - **Use case** : continuous update of maps / providing the correct info for downstream
- Benefits a lot from *repeatable* routes!

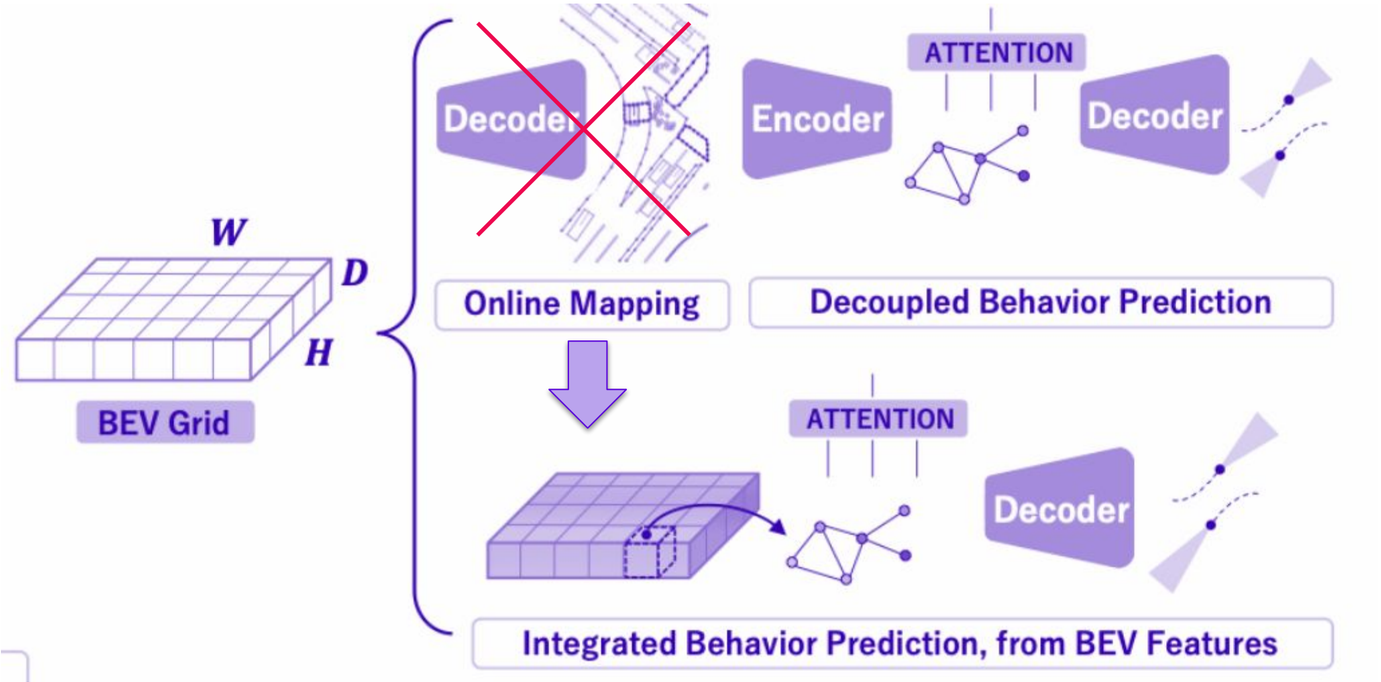


["Mind the map!...", Sum et. al., 2023]

…and even more!

We can even **remove** the **decoding** part and work completely on top of **latent representations:**

- **No explicit map** output
  - Can be applied literally to any method above by cutting out the last decoding stage
  - **Use case:** going toward *end2end* architecture w/o the need in interpretability
  - Can be hard to **validate** the correctness of the internal map representation



["Accelerating Online Mapping…", Gu et. al., 2024]

Conclusion

Mapping

is a very important part of autonomous driving, permeating the whole Driving Stack

Cost, Efficiency, and Safety

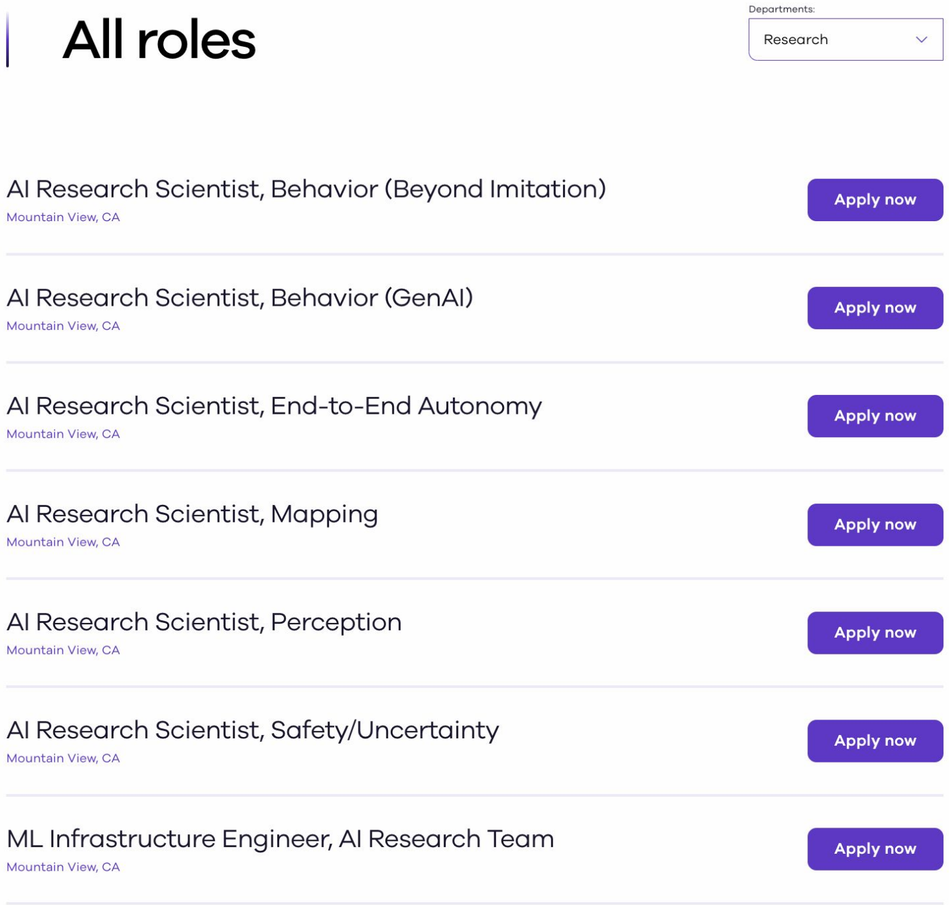
are the axes to consider the right choice of mapping approach

AI-Driven Mapping

helps with the above axes, especially having **repeatable routes**

Research Opportunities

- **We are hiring!**
  - Research Scientists
  - ML Infra Engineers
  - Directions:
    - Mapping
    - Perception
    - Behavior (Prediction and Planning)
    - End-to-end Systems
    - Simulation
    - Safety and Uncertainty
  - Apply here: https://gatik.ai/careers/



Q&A

Your Questions, Our Expertise