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Scalable HD Map Creation from Crowdsourced Vision
Raphael Mamane
IMVC 2024

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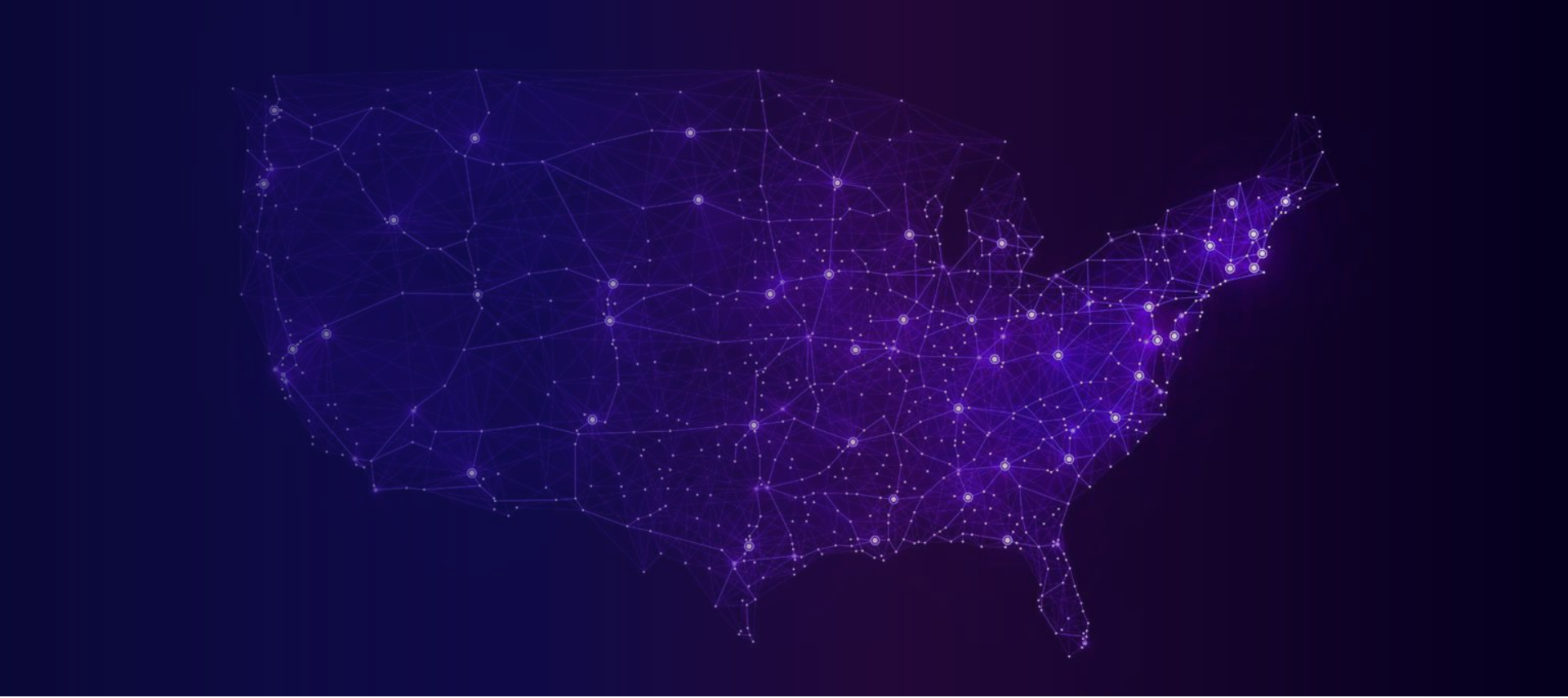
#1
AI Dash Cam Brand
in the US
500K
Active Users



The Nexar network of eyes on the road

94%
of US roads
at least once per month

40M
detections
per day

3B+
miles
of video per year

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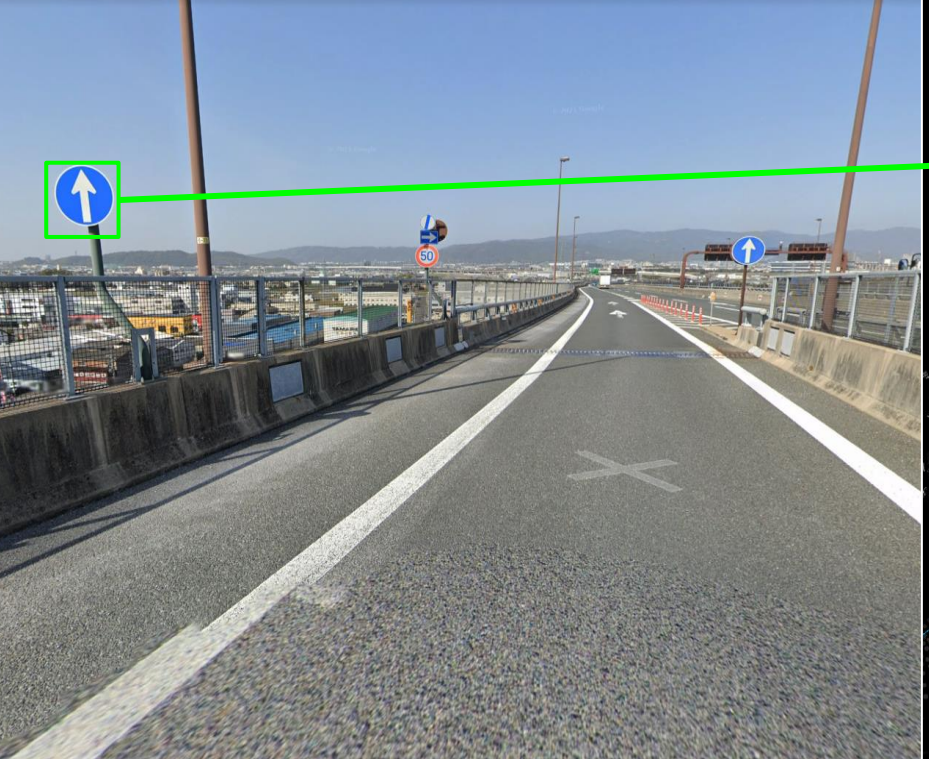

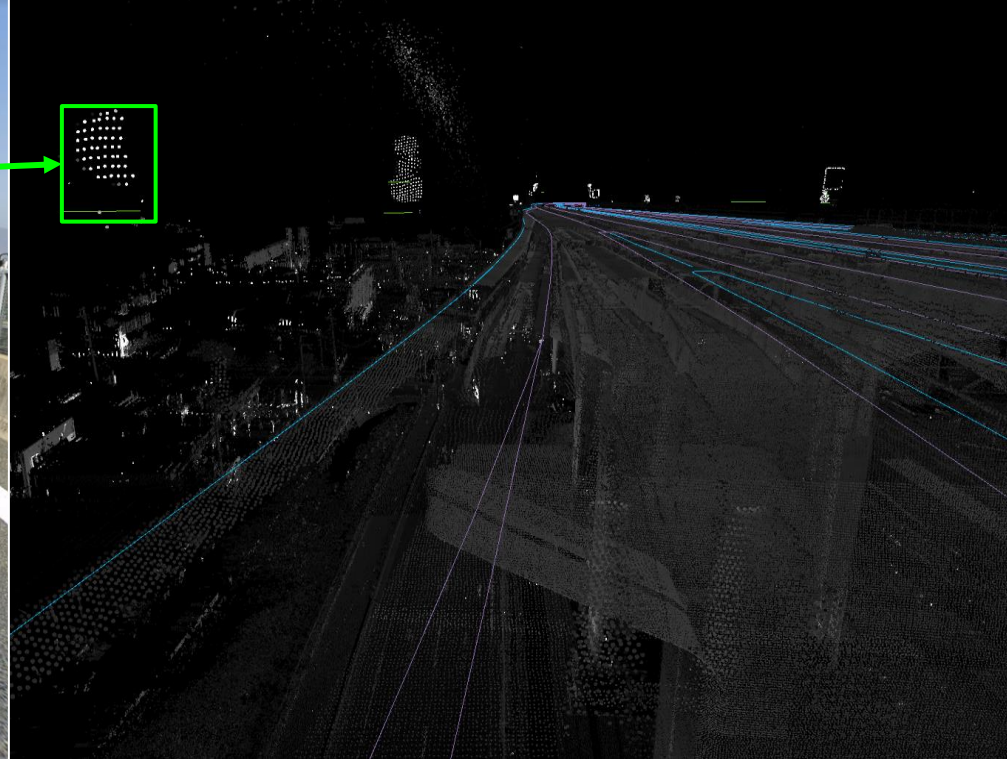

The Future of Autonomous Driving Relies on *HD Maps*

Sub-Meter Accurate | Road Geometries & Assets

The Current Process of HD Map Creation is *Not Scalable*

Expensive Fleets | Manual Annotation | Frequent Updates

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Can We Create High Definition Maps from Consumer Dashcams?

Smart Frame Selection

Edge Detection

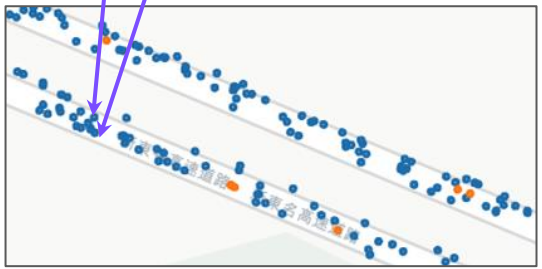
Deep Learning Models running on dashcams

Efficient Image Selection

Maximum Information | Good Lighting

Anonymization

Faces | License Plates | Dashboard



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Structure from Motion

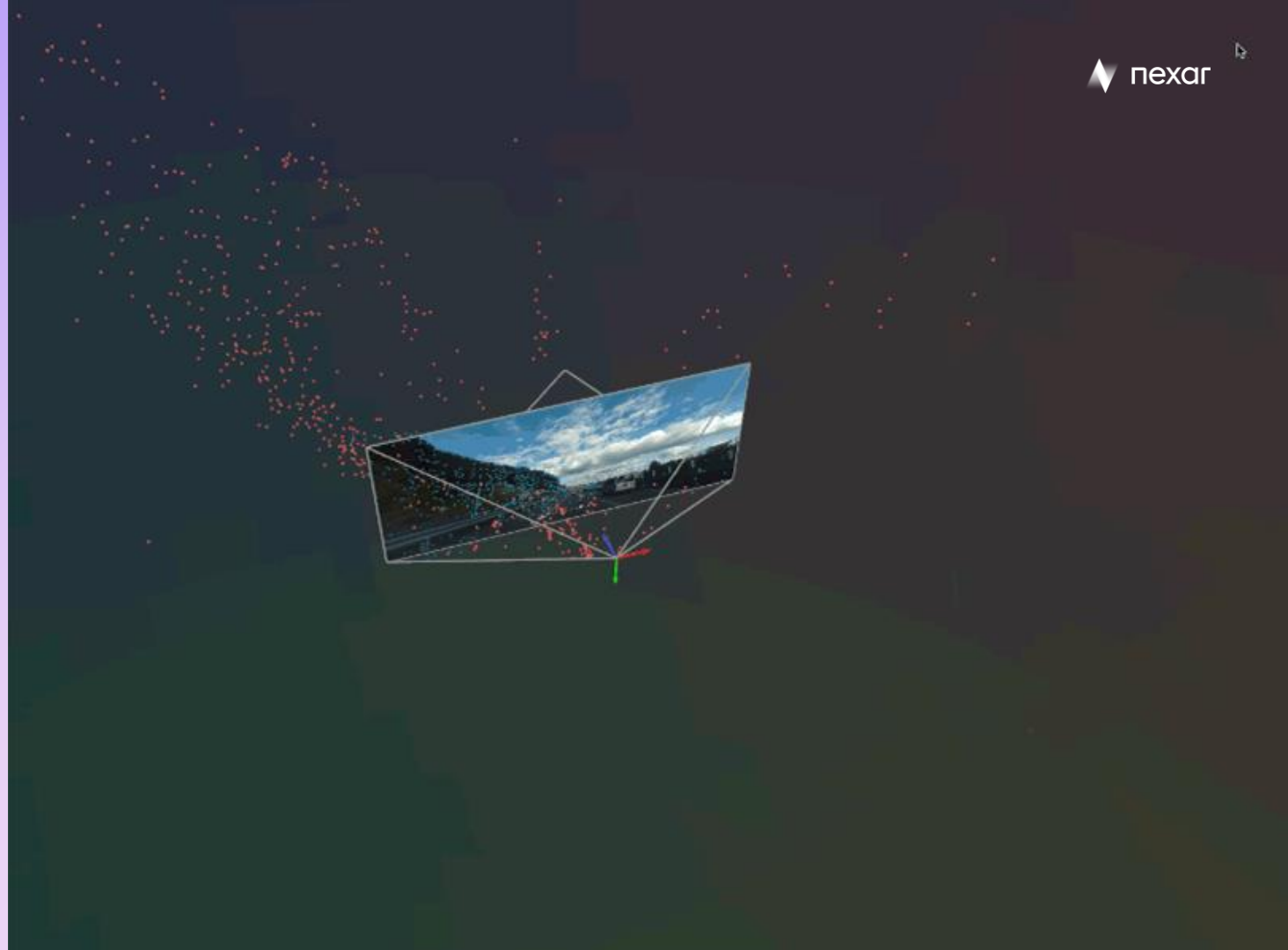
Feature Matching

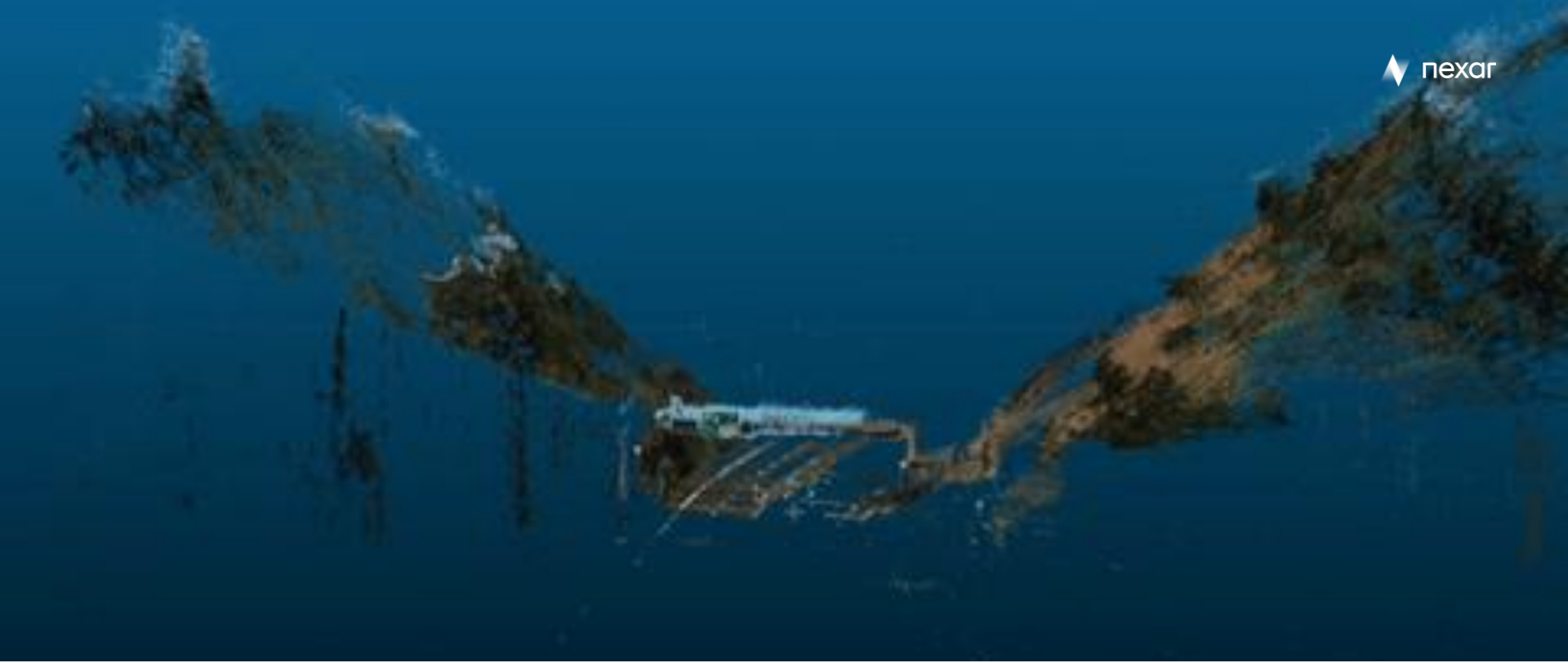
ALIKED | LightGlue

Retrieving Poses

COLMAP

Bundle Adjustment





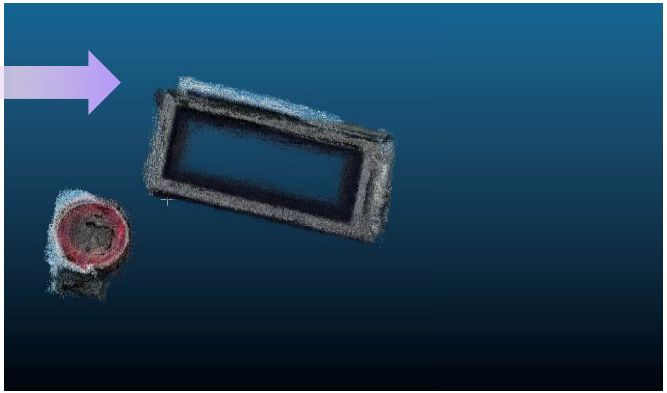
At the end of the process we generate

a dense highly-localized point cloud

Infusing the 3D Point Cloud with **Semantics**

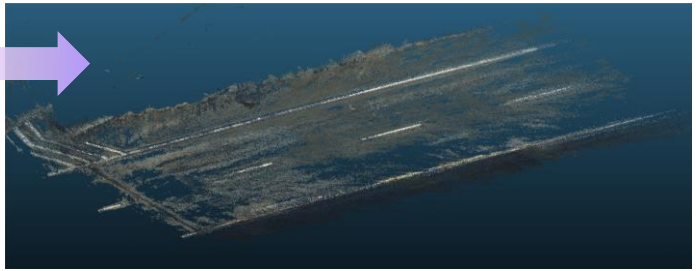
Traffic Sign Detection

Fine-Tuned Object Detector



Road Surface Semantic Segmentation

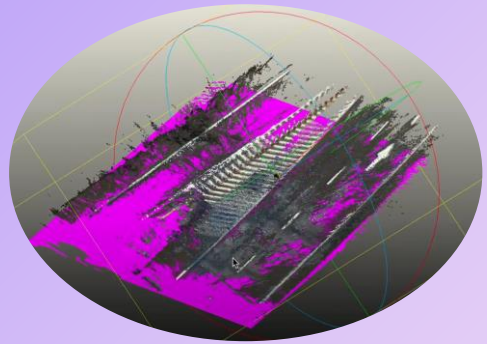
Mask2Former



Getting a Birds-Eye-View for Each Image

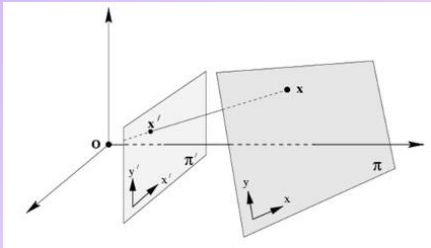
Fit plane to road point cloud

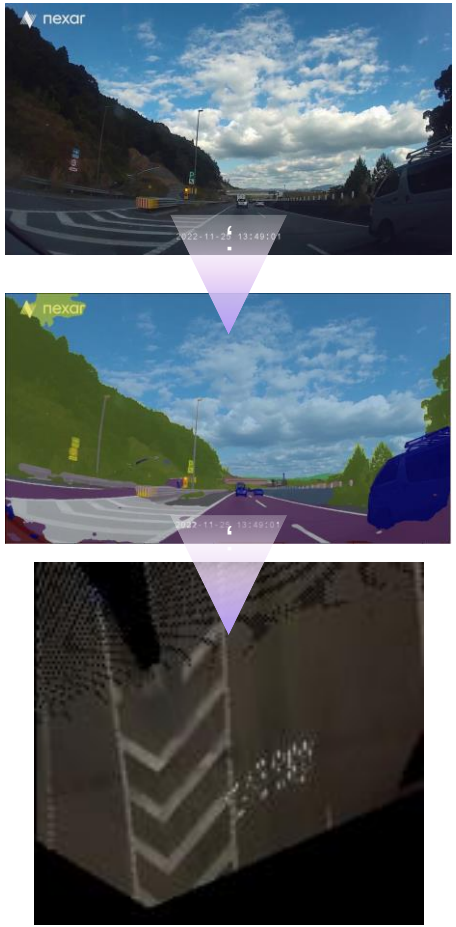
RANSAC



Transform road pixels to Birds Eye View

Homography onto plane





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Stitching into a Combined Birds-Eye-View

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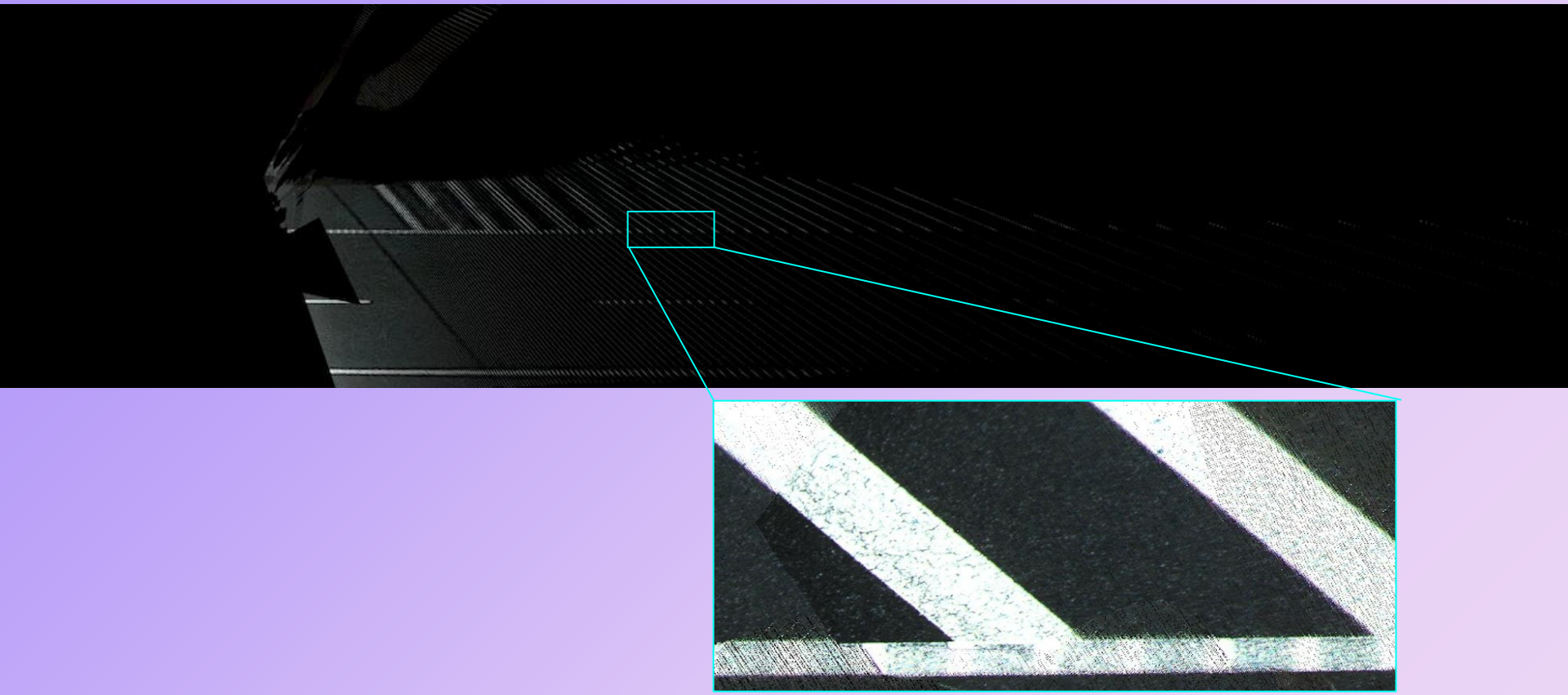
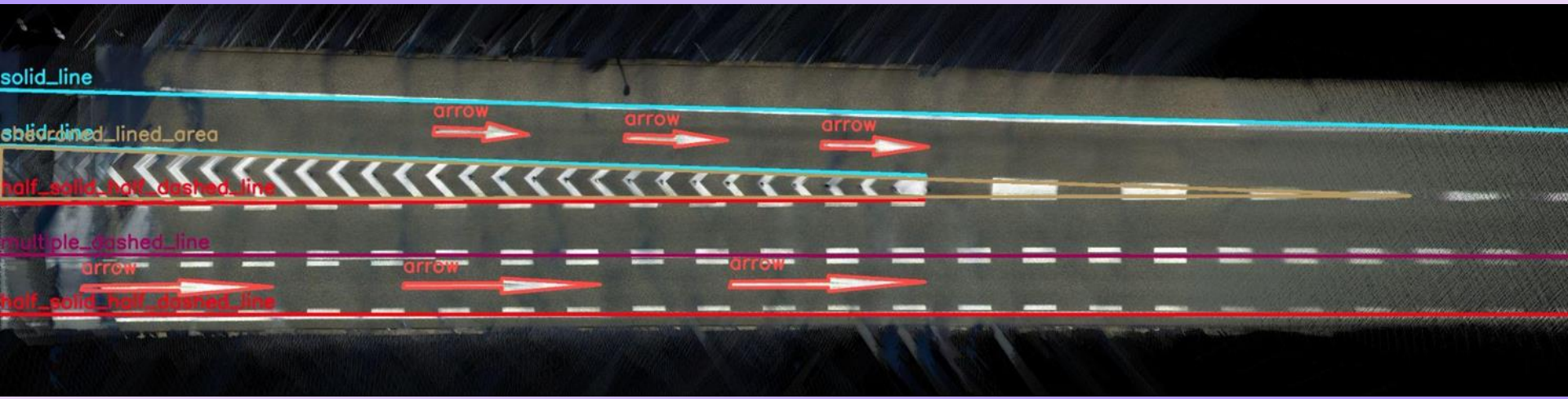
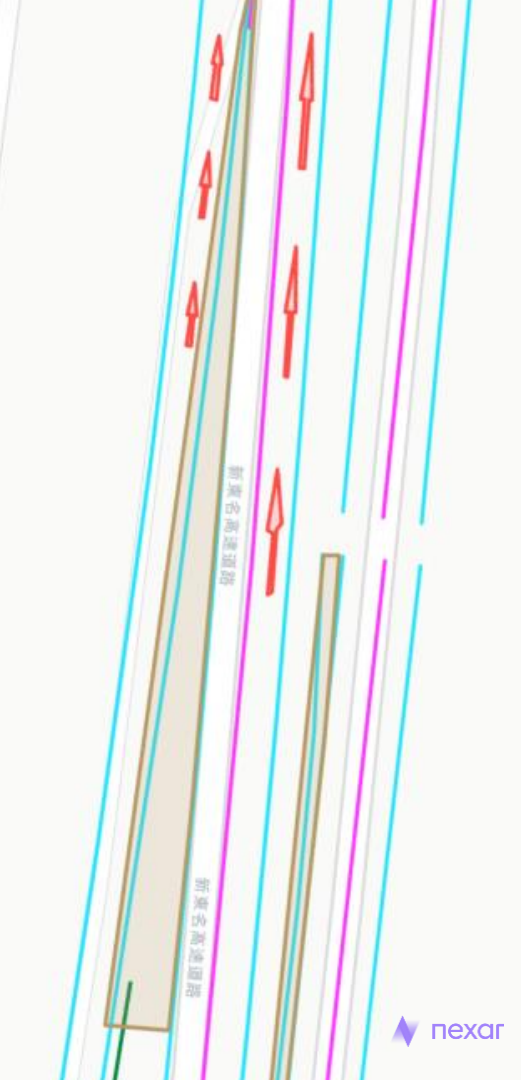


Infer Lane Lines and Road Markings

Obtain final road surface assets using *lane detection* and *instance segmentation*



Scaling our Solution for Whole Regions



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Crowdsourced vision *is* the way forward to making *scalable* and *cost-effective* HD maps

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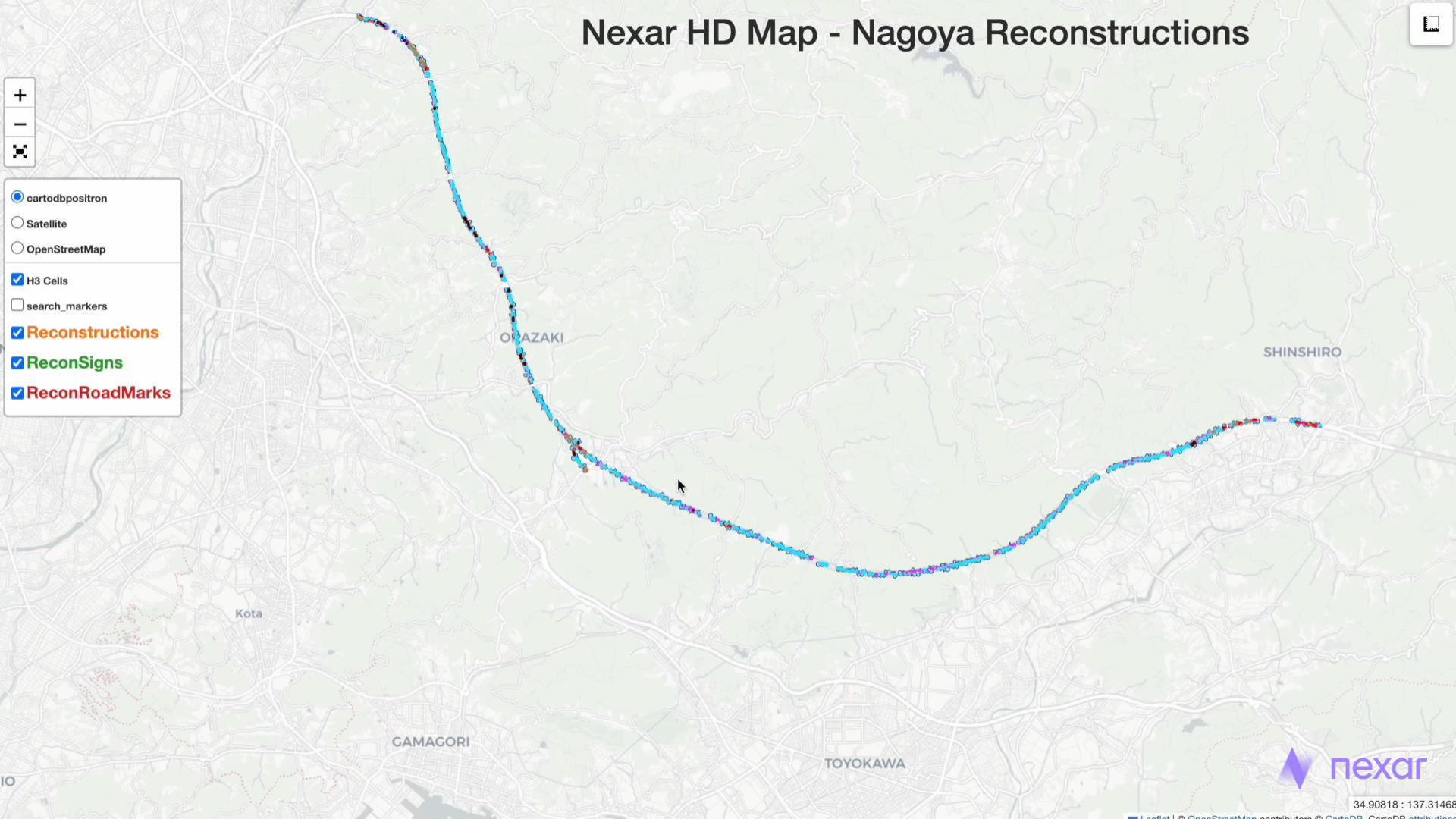
Nexar HD Map - Nagoya Reconstructions
cartodbpositron
Satellite
OpenStreetMap
H3 Cells
search_markers
Reconstructions
ReconSigns
ReconRoadMarks
OKAZAKI
SHINSHIRO
Kota
GAMAGORI
TOYOKAWA
nexar
34.90818 : 137.31468

Special Thanks

Shmuel Rippa

Robert Harrison

Ilan Kadar

nexar
Thank You
Street Sign
Traffic Light
Park Sign
Turn Sign
Cone
Drum
Cone
Drum
Cone
Drum
Only
Only
Lane-Solid
Parking
Road Edge
Parking
Arrow
Arrow
Lane-Double
Lane-Double
Lane-Solid
Lane-Dash
Chevron

Privacy by Design

Nexar maintains users' privacy in accordance with all laws and regulations

utilizing AI to remove all potential Personal Identifiable information (PII) at the source

- Automatic blurring of license plates, faces around the car
- Automatic cropping of image to avoid PII exposure on driver dashboard
- Doesn’t share routes, personal footage
- GDPR and CCPA compliant

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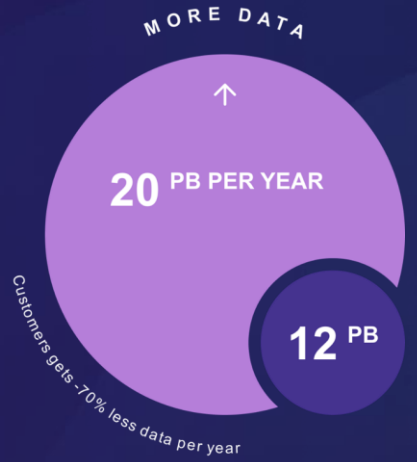
Cost-Effective Data Offloading Through WiFi

Powered by Nexar Edge SDK

Secure and Automatic Connection to Wifi
using millions of hotspots

Smart Data Management
to optimize network selection and delivery guarantees

Smart Data Management
to optimize network selection and delivery guarantees



Get **70% More Data** For The Same Data Connectivity Budget

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