Building Lane-Level Maps from Aerial Images

Jiawei Yao*   Xiaochao Pan*   Tong Wu   Xiaofeng Zhang†

UNIVERSITY of WASHINGTON

* Denotes Equal Contribution   † Denotes Corresponding author
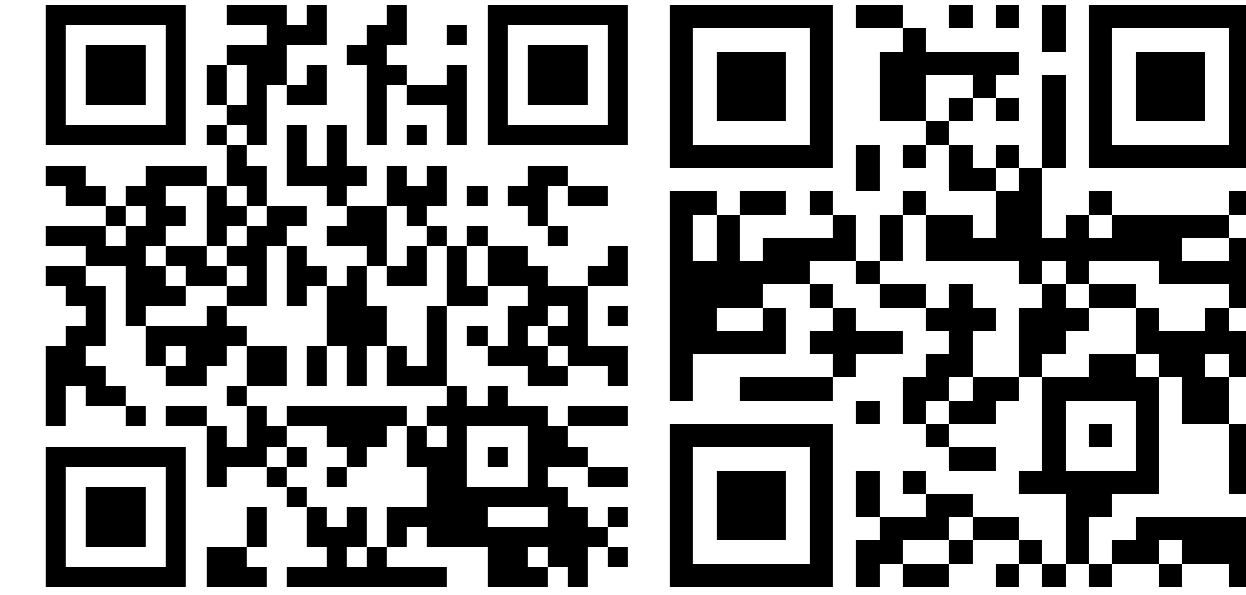
Goal of this Paper

Introduce for the first time a large-scale **aerial image dataset** built for lane detection, with high-quality polyline lane annotations on high-resolution images of around **80 kilometers of road**.

Develop a **baseline** deep learning lane detection method from aerial images:
- The first stage is to produce **coarse-grained** results at point level,
- the second stage exploits the coarse-grained results and feature to perform the vertex-matching task, producing **fine-grained** lanes with topology.

AErial Lane (AEL) Dataset


Valencia   São Paulo   Glasgow

Region	Number of Lanes	Number of Vertices	Total Length (KM)
Cairo	240	2495	3.721
Aucamville	130	4534	17.815
San Paulo	779	14811	26.563
Nevada	29	1134	6.414
Gopeng	13	1011	4.179
Glasgow	157	4428	9.203
Valencia	434	7116	12.044

- Our dataset comprises images from various regions, backgrounds, lane types, topologies, and colors, making the lane detection task challenging
- 11 regions, and each region consists of a road between 3 and 27 kilometers long with various backgrounds and terrain
- 7,763 images together with over 150,000 lane lines in the form of pixel coordinates for training and evaluating the neural network

AerialLaneNet Framework

Results on AEL Dataset

Input Image   GT Lanes   Predicted Vertices   Predicted Lanes
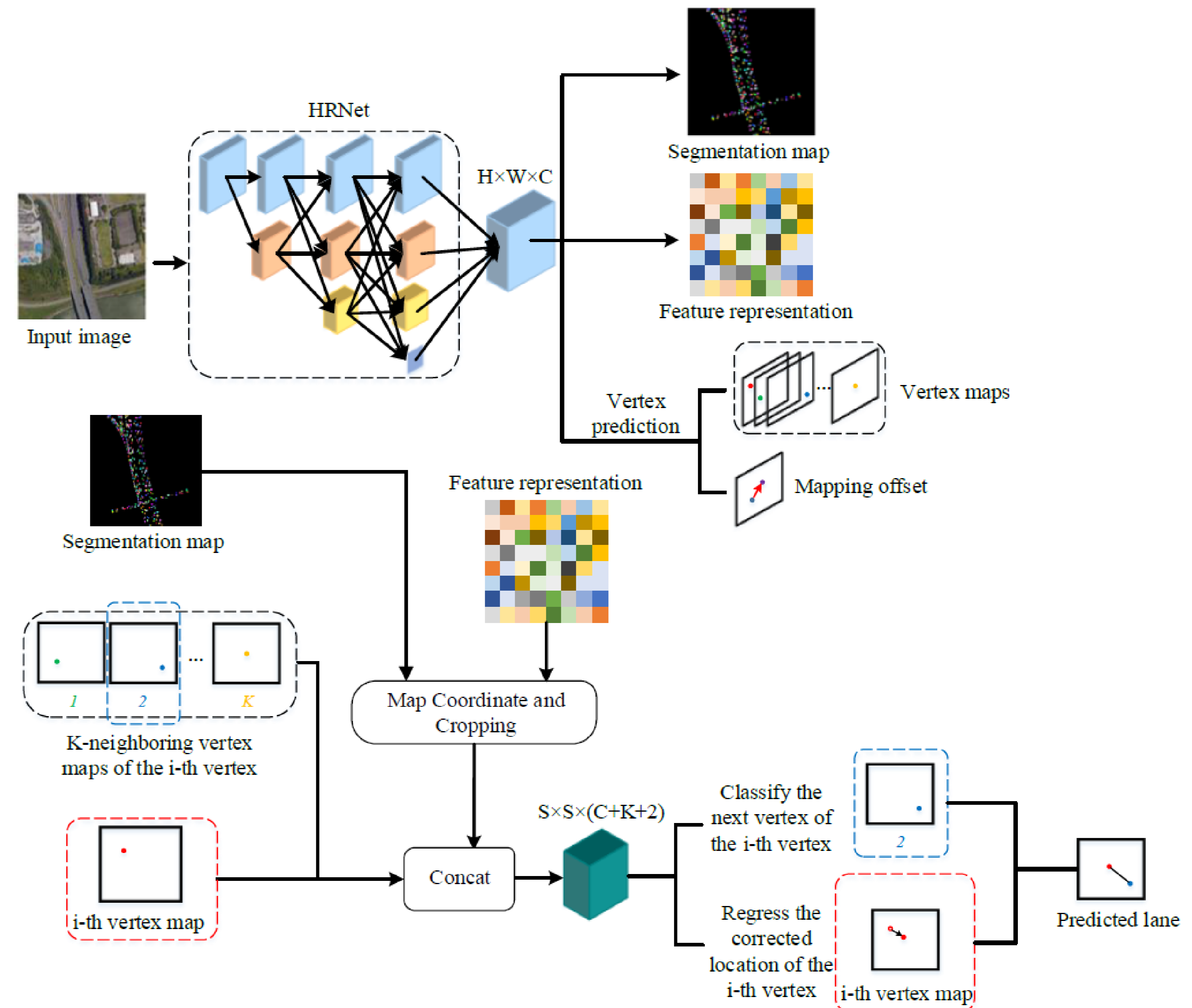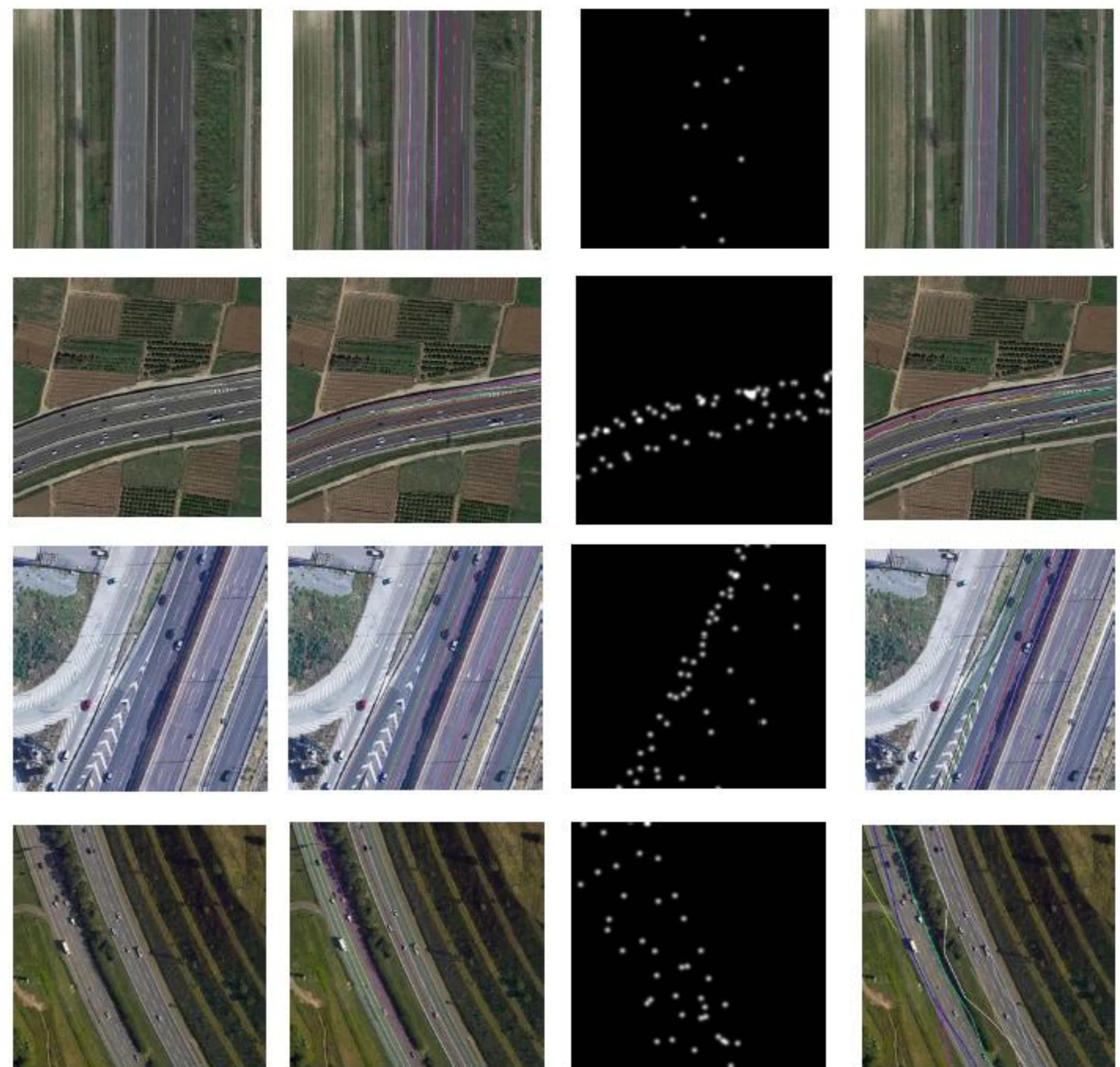
Methods	Precision ↑			Recall ↑			F1-score ↑		
	2.0	5.0	10.0	2.0	5.0	10.0	2.0	5.0	10.0
Naive baseline	0.607	0.890	0.928	0.505	0.736	0.768	0.533	0.778	0.811
RoadTracer [20]	0.391	0.707	0.791	0.416	0.743	0.821	0.533	0.778	0.811
VecRoad [21]	0.461	0.769	0.854	0.459	0.752	0.830	0.458	0.756	0.837
DAGMapper [22]	0.407	0.751	0.868	0.353	0.649	0.747	0.371	0.684	0.787
iCurb [23]	0.550	0.833	0.890	0.538	0.815	0.873	0.542	0.820	0.910
AerialLaneNet	**0.692**	**0.925**	**0.941**	**0.613**	**0.879**	**0.920**	**0.613**	**0.876**	**0.964**

- The performance of AerialLaneNet outperforms all other methods by a considerable margin.
- Our dataset consists of high-resolution images, with typical lane widths larger than 5 pixels and minimal occlusion, making lane detection achievable.