

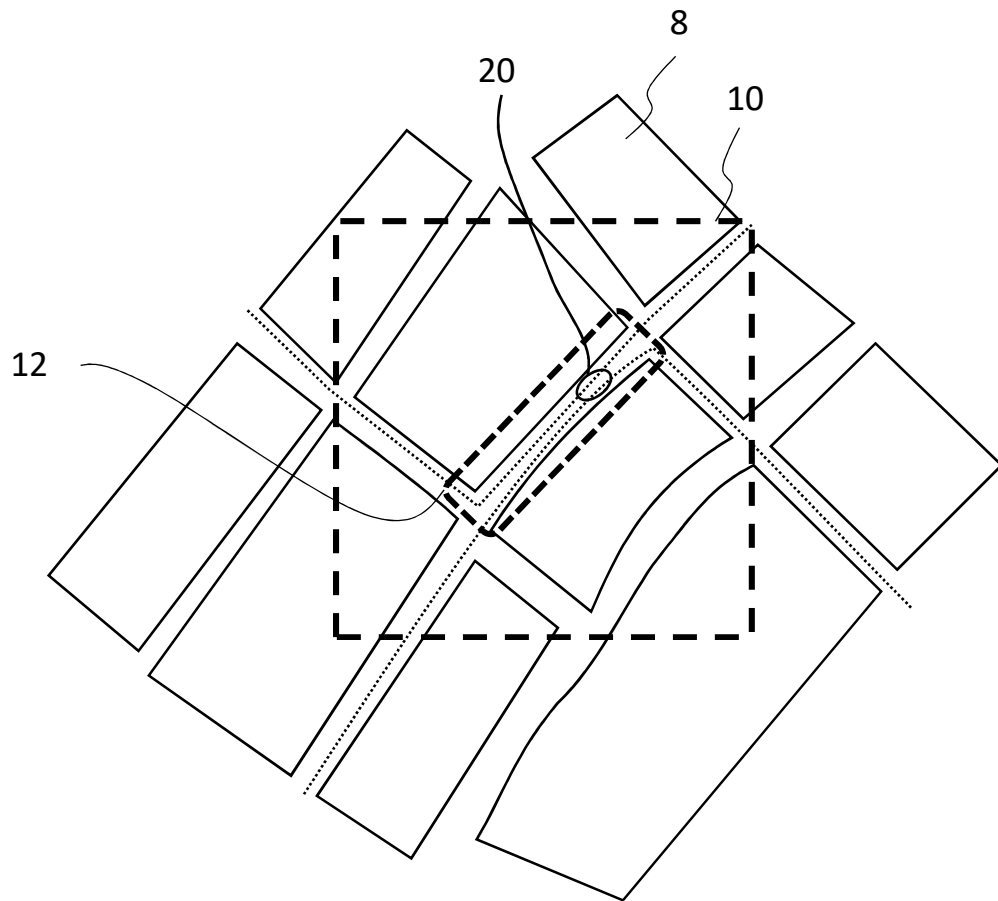


FIG. 1

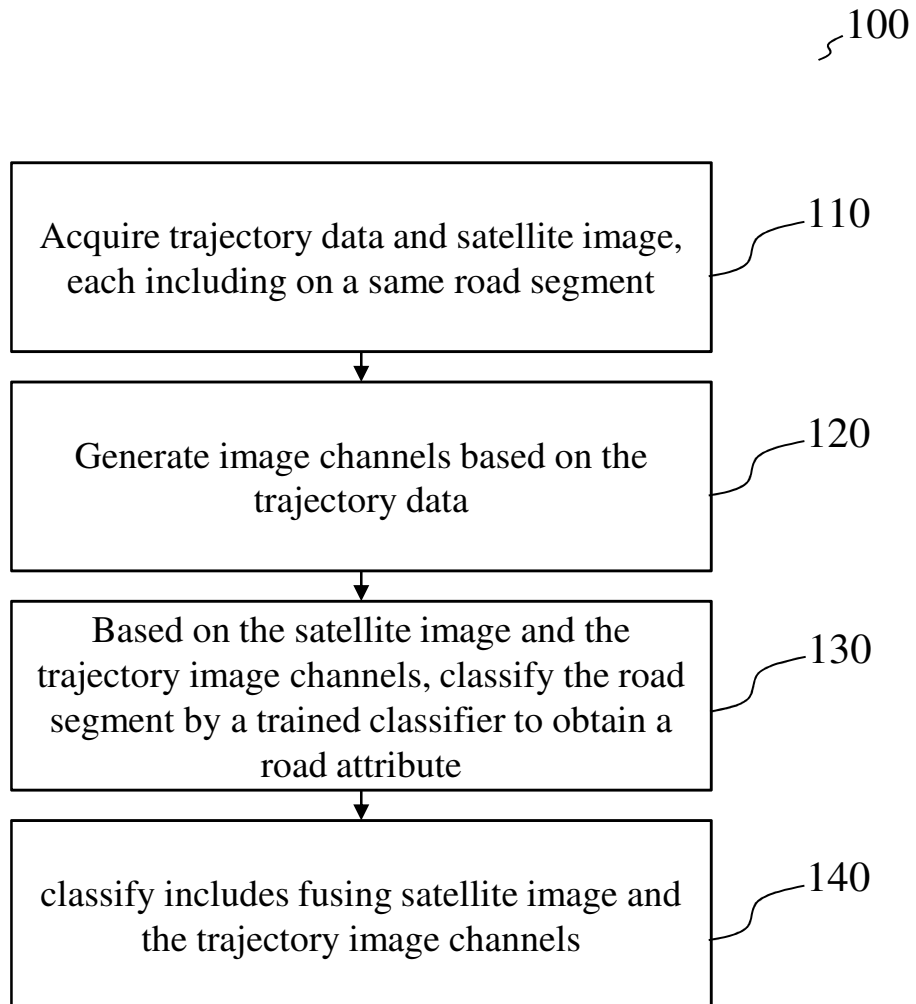


FIG. 2

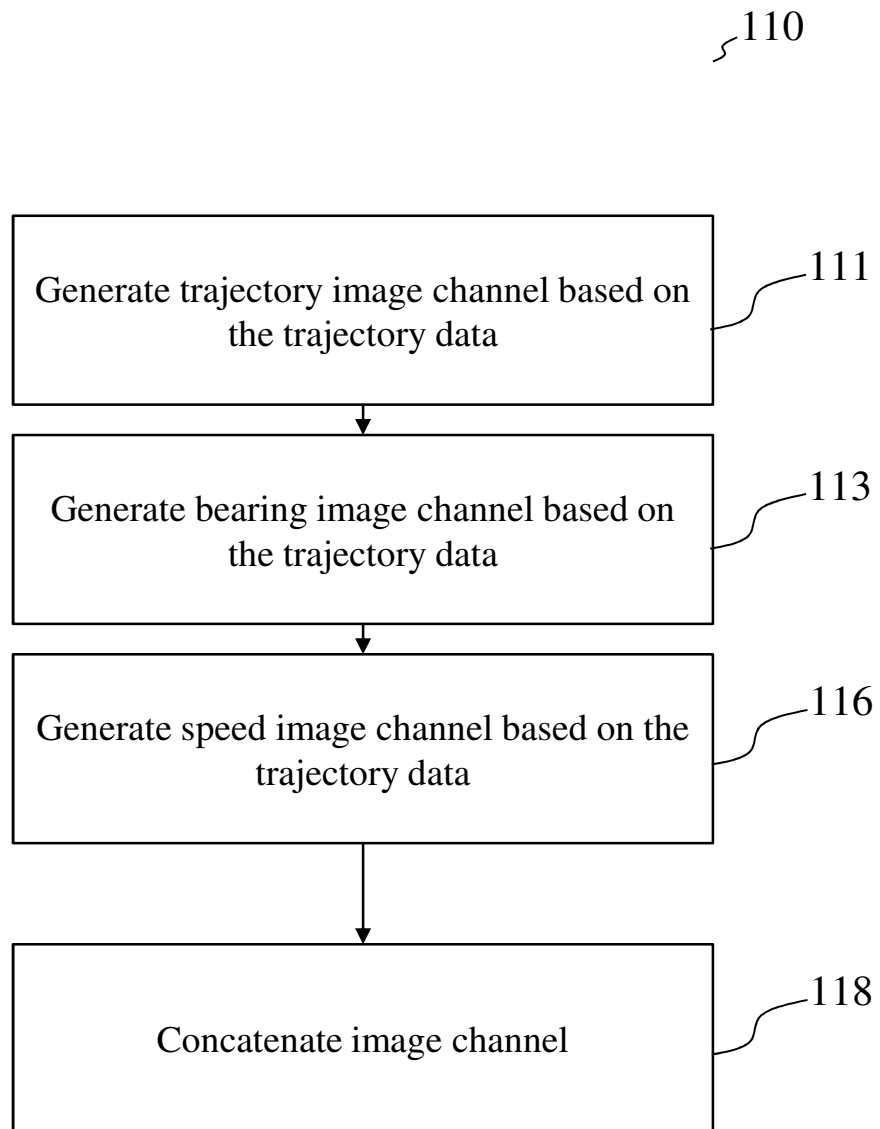


FIG. 3

4/17

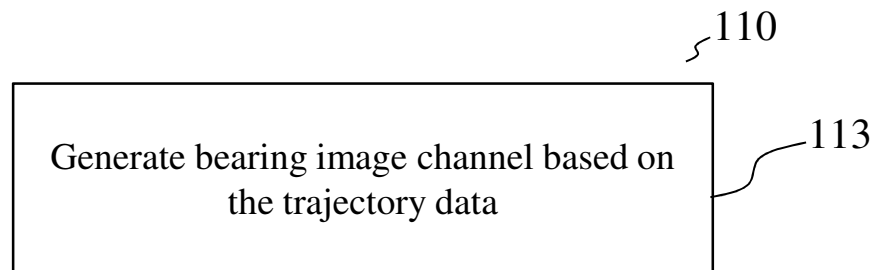


FIG. 4

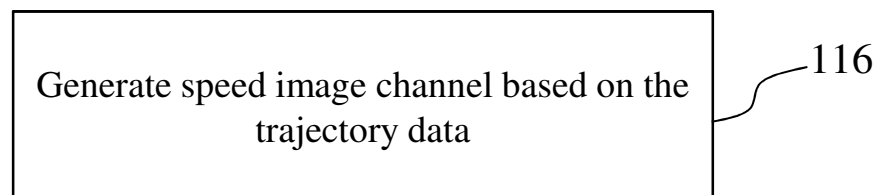


FIG. 5

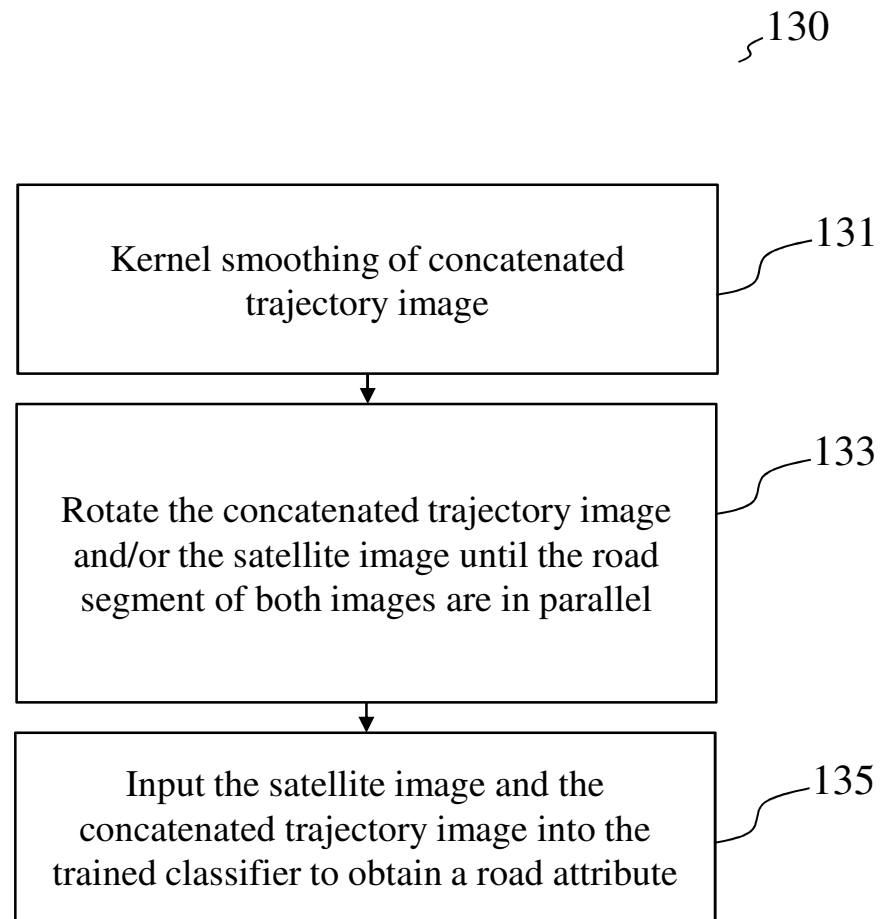


FIG. 6

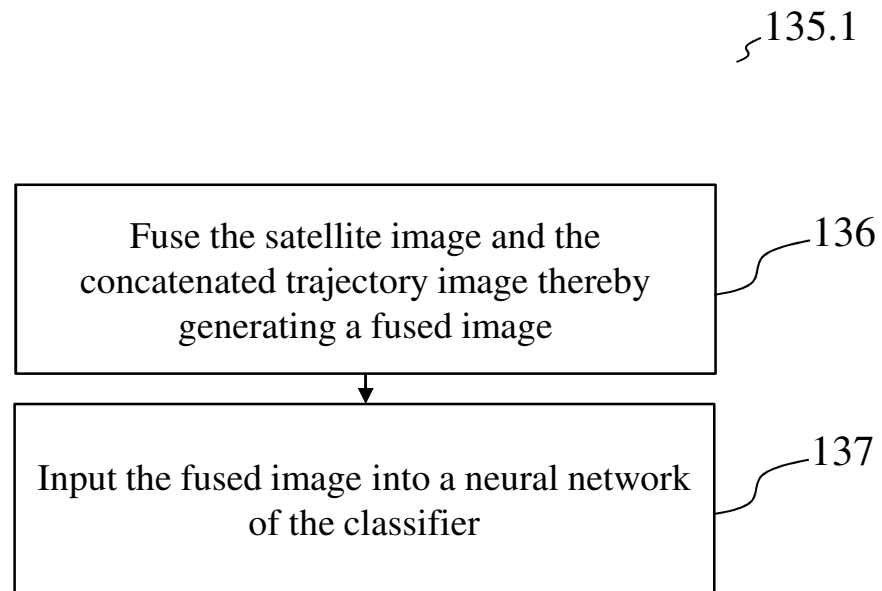


FIG. 7

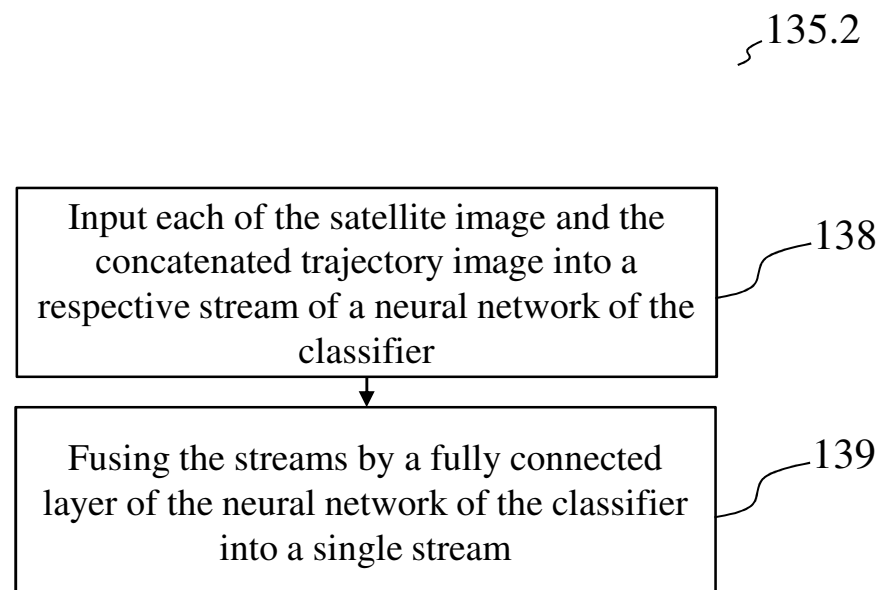


FIG. 8

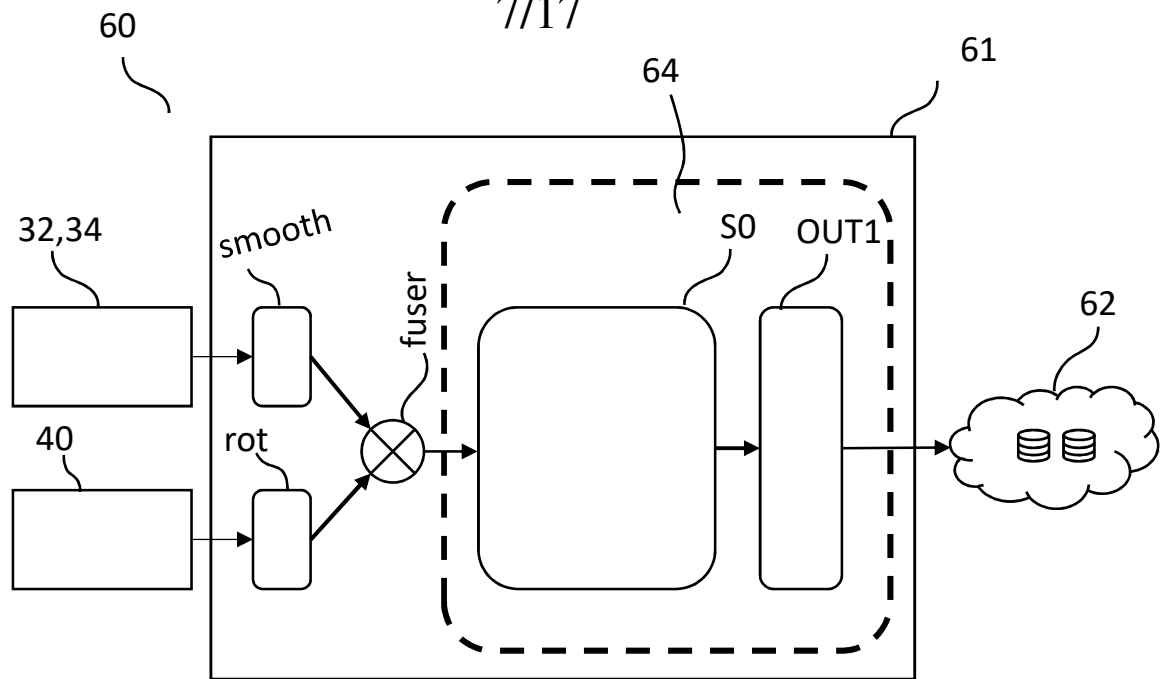


FIG. 9

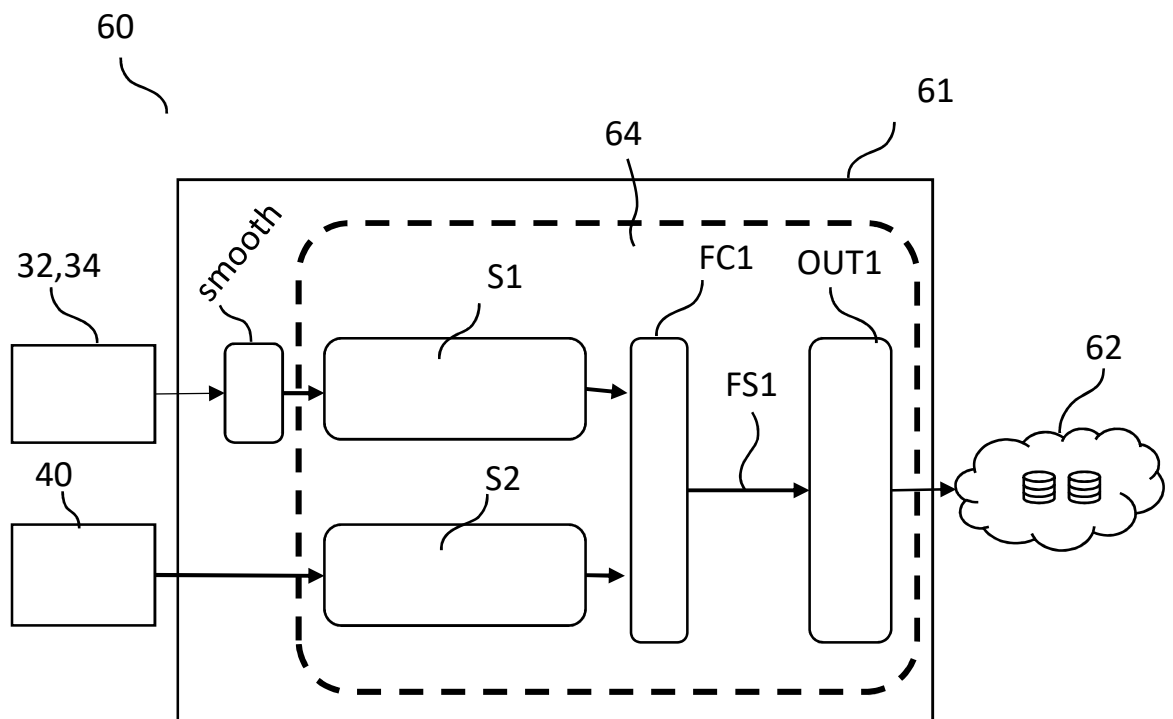


FIG. 10

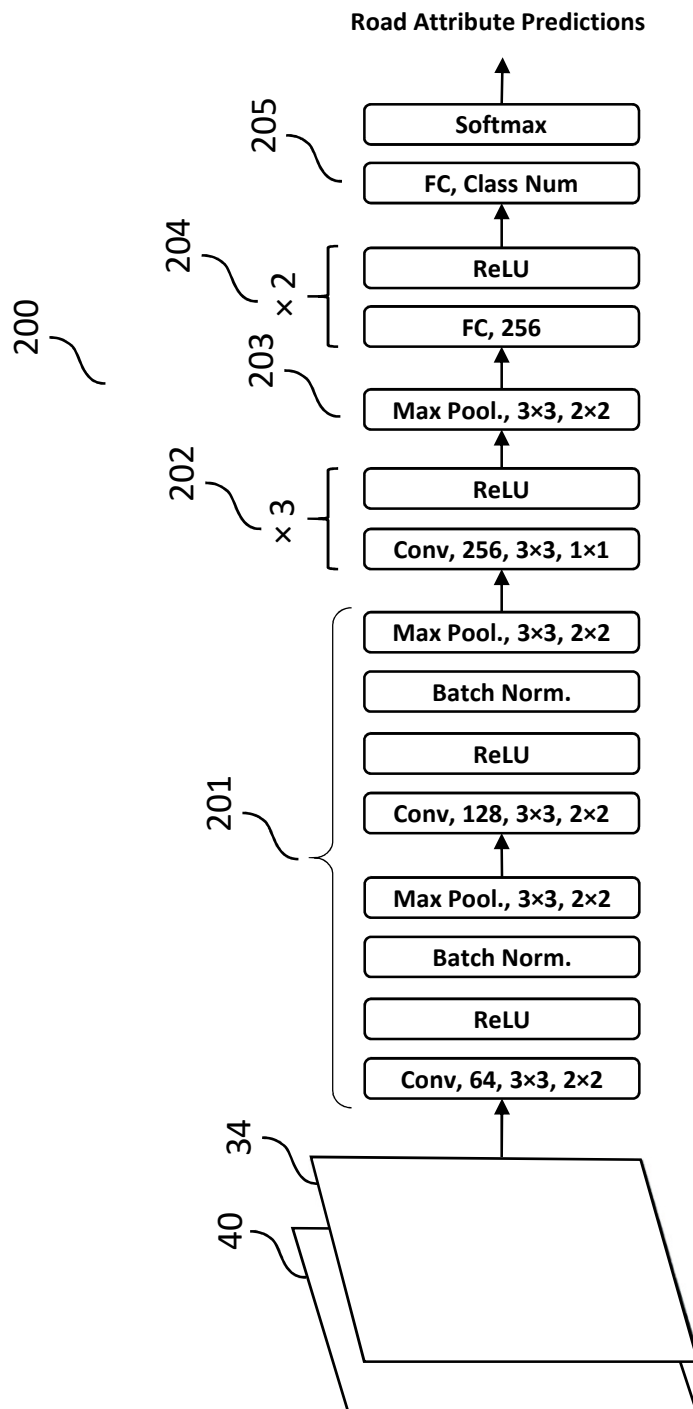


FIG. 11

9/17

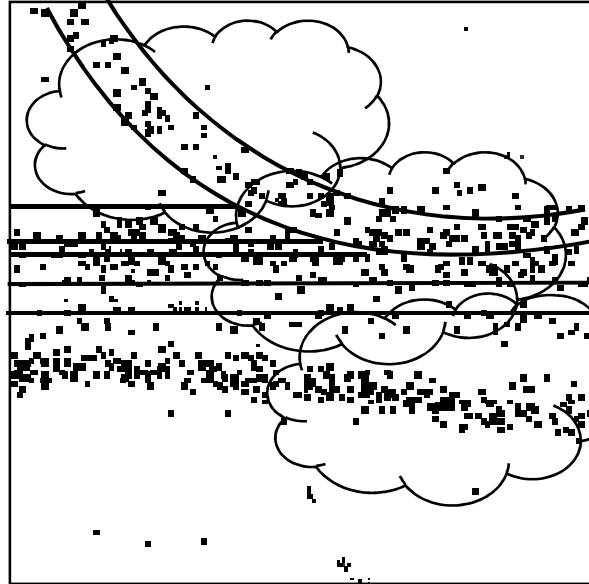


FIG. 12A

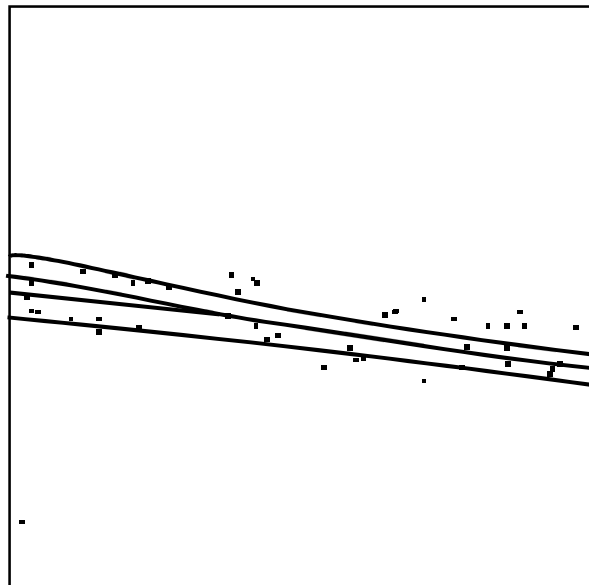


FIG. 12B

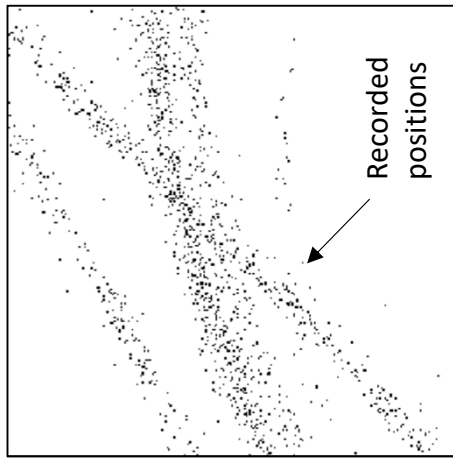


FIG. 13A

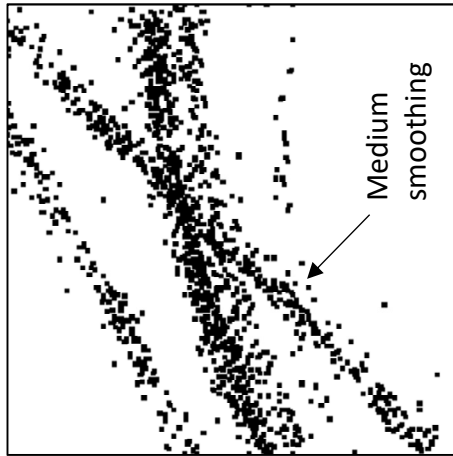


FIG. 13B

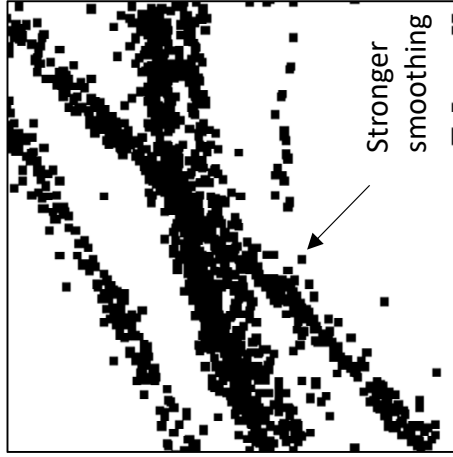


FIG. 13C

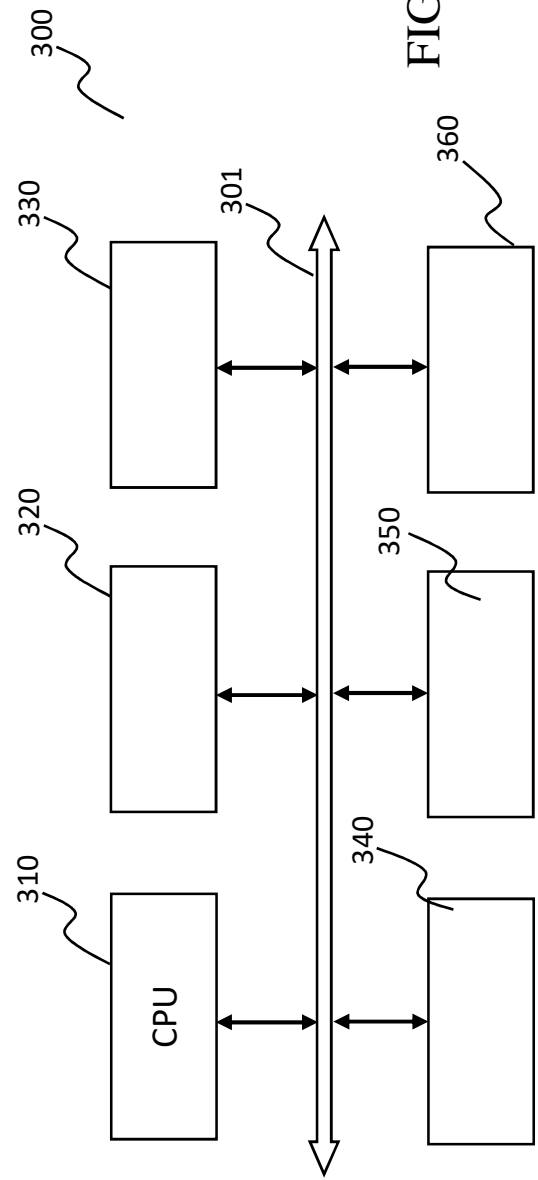


FIG. 14

Dataset	One/Two Way	No. of Lanes	Speed Limit	Road Type
Singapore	15049/3763	10413/2667	7553/1923	13556/3388
Jakarta	5398/1350	3404/881	-	4171/1017

FIG. 15

(a) Singapore

Classifier	One/Two Way	No. of Lanes	Speed Limit	Road Type
Satellite	0.7778	0.6430	0.7374	0.6942
GPS	0.8198	0.6678	0.7722	0.6671
Early Fusion	0.8488	0.6967	0.8045	0.7624
Late Fusion - FC1	0.8257	0.6937	0.8066	0.7559
Late Fusion - FC2	0.8265	0.6937	0.8040	0.7517

(b) Jakarta

Classifier	One/Two Way	No. of Lanes	Road Type
Satellite	0.8200	0.6288	0.6411
GPS	0.8089	0.5970	0.6332
Early Fusion	0.8289	0.6470	0.7178
Late Fusion - FC1	0.8370	0.6468	0.6873
Late Fusion - FC2	0.8326	0.6458	0.6902

FIG. 16

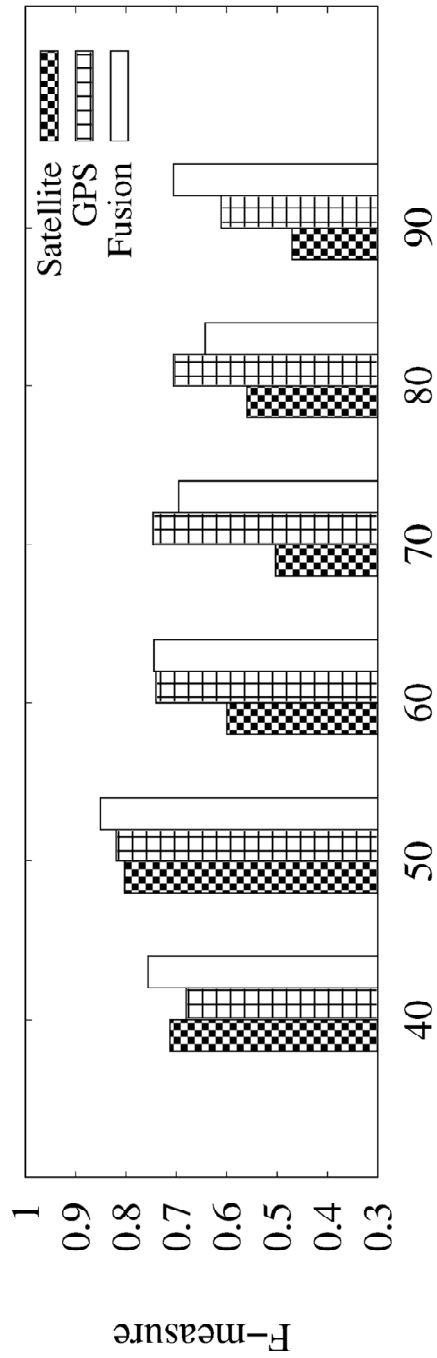


FIG. 17A

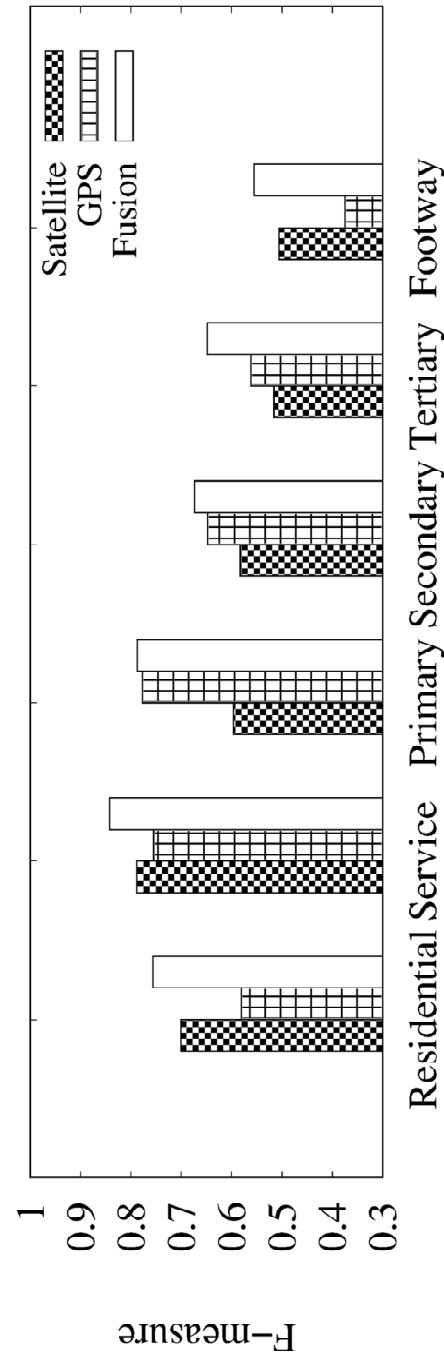


FIG. 17B

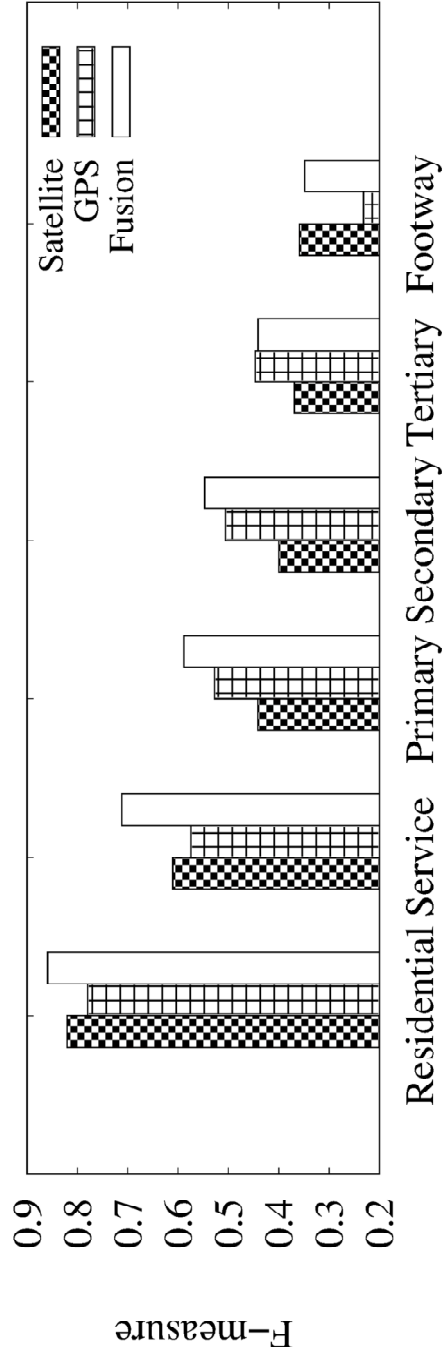


FIG. 18

14/17

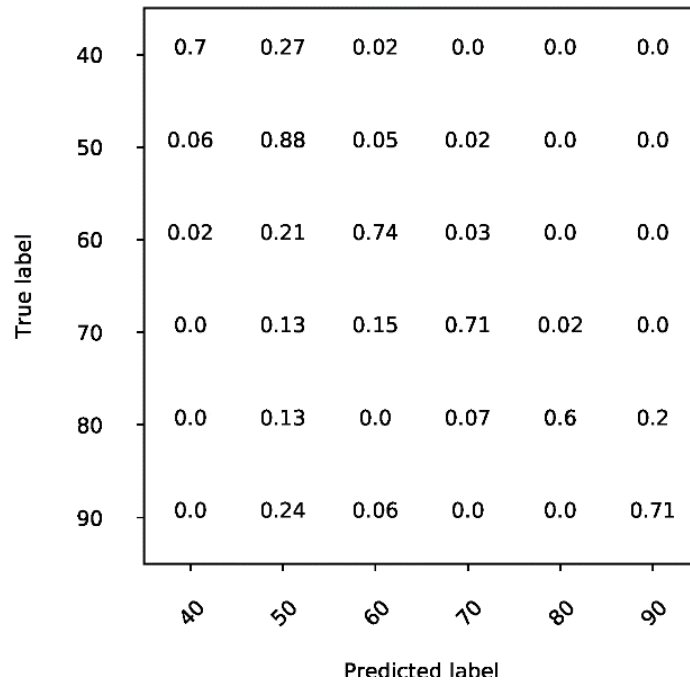


FIG. 19A

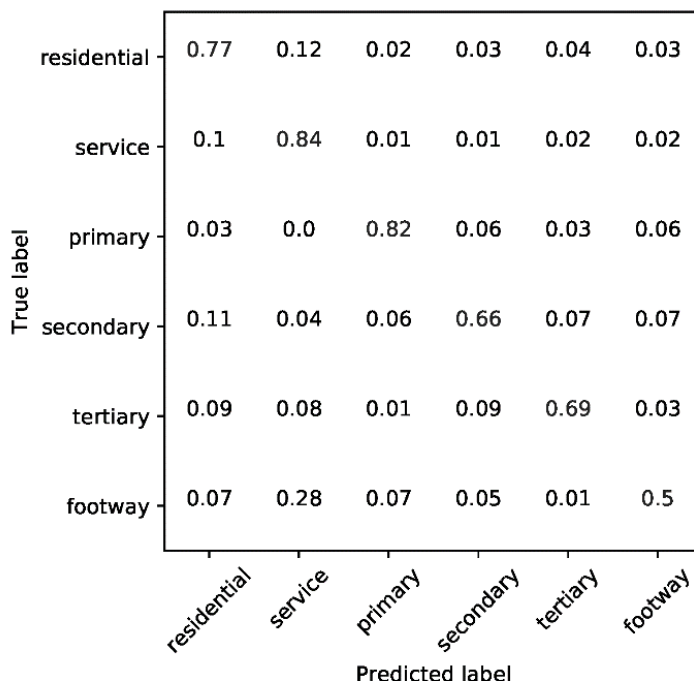


FIG. 19B

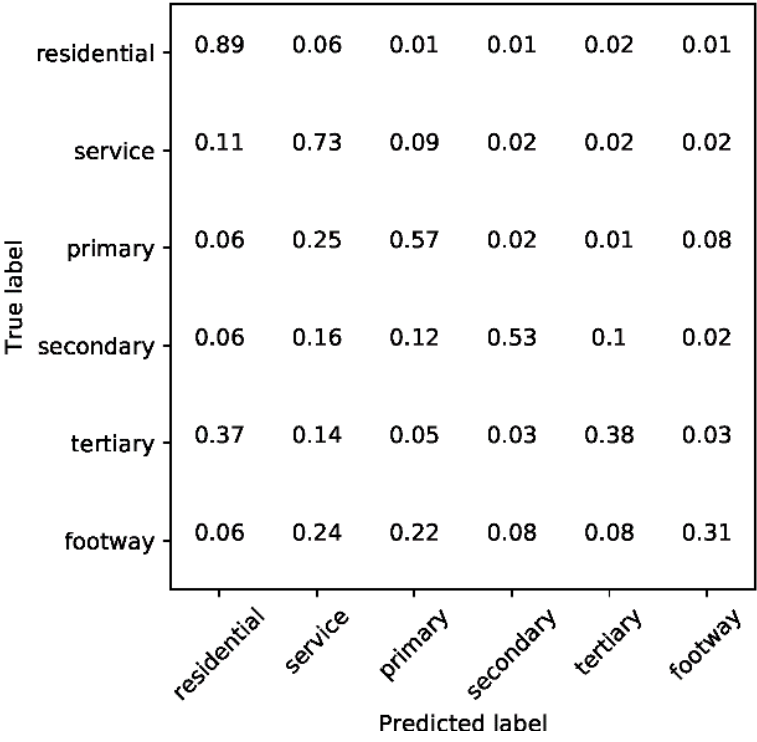


FIG. 19C

Sensor Data	Bin No.	Singapore				Jakarta		
		One/Two Way	No. of Lanes	Speed Limit	Road Type	One/Two Way	No. of Lanes	Road Type
GPS	1	0.7736	0.6393	0.6828	0.6012	0.7933	0.5800	0.6185
Bearing	3	0.8129	0.6423	0.7431	0.6281	0.8081	0.5823	0.6214
Bearing	7	0.8134	0.6562	0.7546	0.6420	0.8059	0.5845	0.6352
Speed	3	0.7962	0.6475	0.7249	0.6434	0.7844	0.5664	0.6155
Speed	7	0.7914	0.6490	0.7421	0.6600	0.7956	0.5834	0.6185
GPS+B.+S.	1+3+3	0.8198	0.6678	0.7722	0.6671	0.8089	0.5970	0.6332

FIG. 20

Table 4: Road attribute detection based on GPS traces smoothed using kernels of different sizes.

Kernel Size	Singapore				Jakarta		
	One/Two Way	No. of Lanes	Speed Limit	Road Type	One/Two Way	No. of Lanes	Road Type
1 × 1	0.7853	0.6123	0.6417	0.5962	0.7837	0.5619	0.5929
3 × 3	0.8023	0.6457	0.7067	0.6346	0.7941	0.5709	0.6028
5 × 5	0.8087	0.6494	0.7343	0.6479	0.7948	0.5811	0.6205
7 × 7	0.8177	0.6530	0.7540	0.6588	0.8059	0.5800	0.6224
9 × 9	0.8198	0.6678	0.7722	0.6671	0.8089	0.5970	0.6332
11 × 11	0.8222	0.6599	0.7618	0.6741	0.8096	0.5959	0.6293

FIG. 21

Input	Size	Method	One/Two Way	No. of Lanes	Speed Limit	Road Type
Satellite	224×224	AlexNet [19]	0.7436	0.6033	0.7276	0.6240
		MobileNet [15]	0.7526	0.6265	0.7135	0.7178
		DenseNet [16]	0.7640	0.6524	0.7410	0.7128
		Ours	0.7778	0.6430	0.7374	0.6942
GPS	224×224	AlexNet [19]	0.8145	0.6487	0.6937	0.6502
		MobileNet [15]	0.8124	0.6517	0.7119	0.6564
		DenseNet [16]	0.8193	0.6633	0.7238	0.6727
		Ours	0.8198	0.6678	0.7722	0.6671
Fusion	224×224	AlexNet [19]	0.8299	0.6610	0.7473	0.7308
		MobileNet [15]	0.8307	0.6742	0.8008	0.7651
		DenseNet [16]	0.8366	0.6775	0.7982	0.7659
		Ours	0.8488	0.6967	0.8045	0.7624

FIG. 22

Calibration	Method	One/Two Way	Gain	No. of Lanes	Gain	Speed Limit	Gain	Road Type	Gain
- image rotation	AlexNet [19]	0.8456	1.9%	0.7019	6.2%	0.7509	0.5%	0.7373	0.9%
	MobileNet [15]	0.8666	4.3%	0.7229	7.2%	0.7826	-	0.7972	4.2%
	DenseNet [16]	0.8538	2.1%	0.7289	7.6%	0.7956	-	0.7952	3.8%
	Ours	0.8669	2.1%	0.7225	3.7%	0.7972	-	0.7881	3.4%
- bearing adjustment	AlexNet [19]	0.8411	1.3%	0.6337	-	0.6984	-	0.7470	2.2%
	MobileNet [15]	0.8469	2.0%	0.6625	-	0.7754	-	0.8076	5.6%
	DenseNet [16]	0.8576	2.5%	0.6757	-	0.8060	1.0%	0.8200	7.1%
	Ours	0.8738	2.9%	0.7019	0.7%	0.8300	3.2%	0.8070	5.8%
- image rotation & bearing adjustment	AlexNet [19]	0.8836	6.5%	0.7278	10.1%	0.7353	-	0.7211	-
	MobileNet [15]	0.8937	7.6%	0.7402	9.8%	0.7852	-	0.8117	6.1%
	DenseNet [16]	0.9091	8.7%	0.7413	9.4%	0.7894	-	0.7869	2.7%
	Ours	0.9059	6.7%	0.7447	6.9%	0.7795	-	0.7834	2.8%

FIG. 23