Valeo

Point Cloud Up-Sampling and Domain Adaptation

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Structure of the Presentation

- Challenge
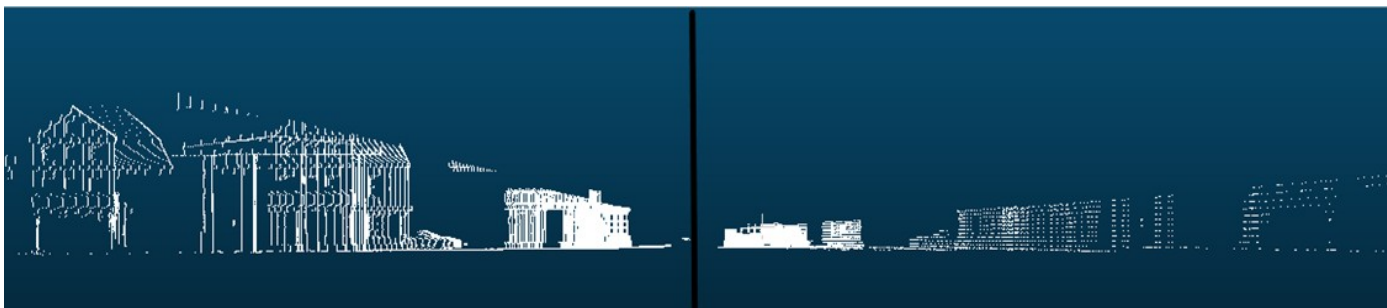
- Results

- Metrics

- Conclusion

Challenge: Comparison of Resolution

		Horizontal		Vertical		Maximum Number Of Points	X to Upsample Vertically
		Angle	Resolution	Angle	Resolution		
SCALA2[2]	Input	133°	701	10°	16	11216	x8.5
	Pruned	120°	600	10°	**16**	**9600**	
SCALA3[1]	Input	****	****	****	****	****	
	Pruned	120°	600	10°	**136**	**81600**	

Comparison of Scala 2 v/s Scala 3 Sensors
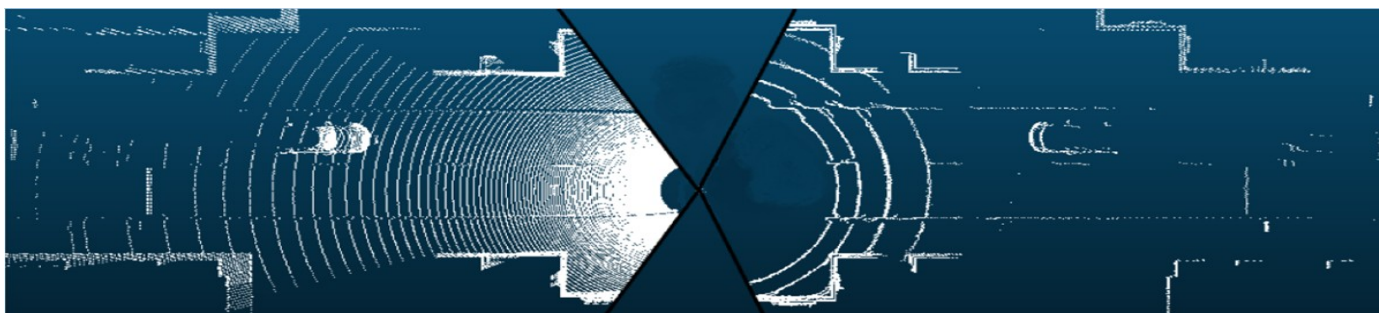
BEV Comparison Scal. 3 (Left), Scala 2 (Right)

Comparison Scala3 (Left), Scala2 (Right)

Comparison Projection Images
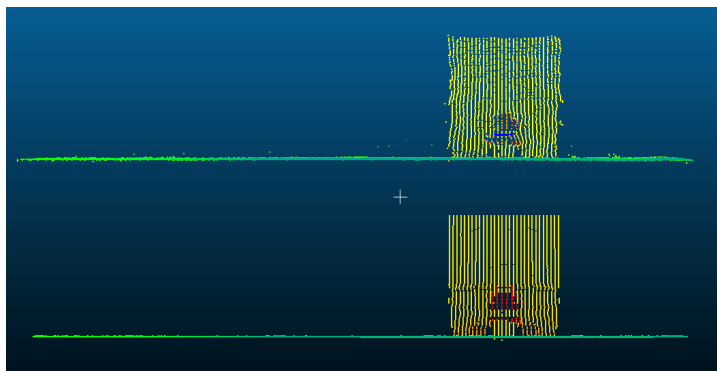

Input to the Model (Scala 2 Trace)
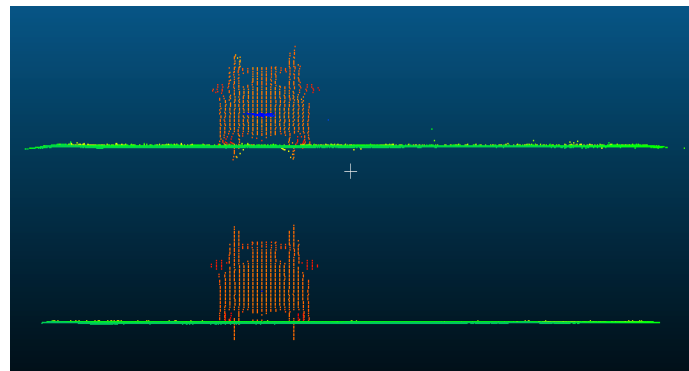

Ground Truth (Scala 3 Trace)

Output of the Model (Prediction)

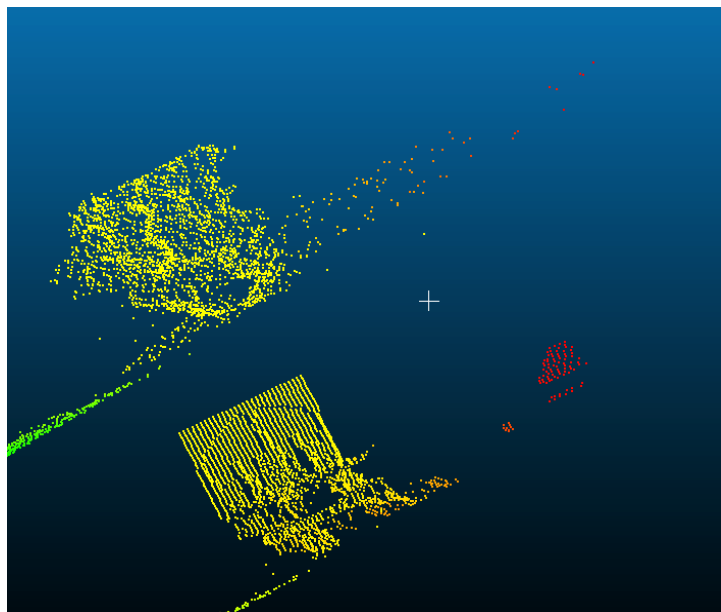# Outputs with Range Images Only

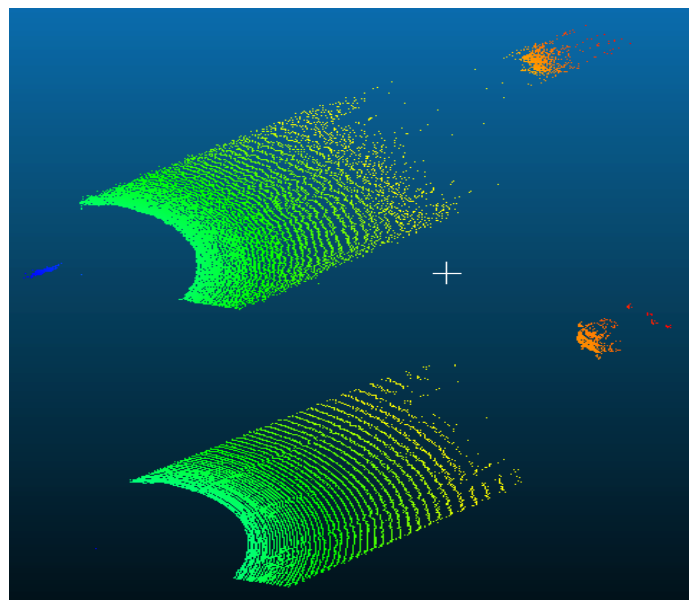TOP: Prediction & Bottom: Ground Truth

Ego view of the Truck

Ego view of the Car

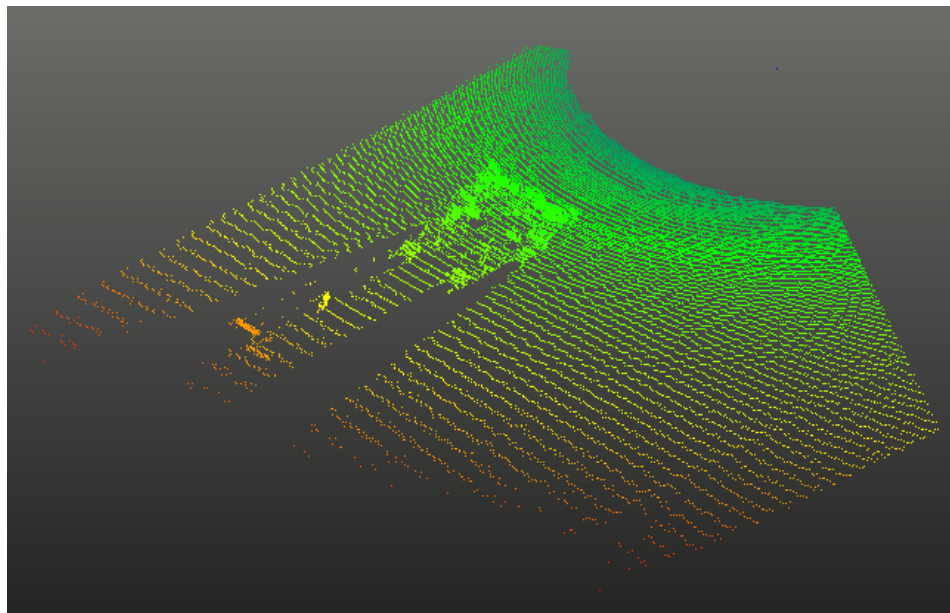Magnified Side view of the above Truck

Side view of the above trace

Output: Single Traffic Object
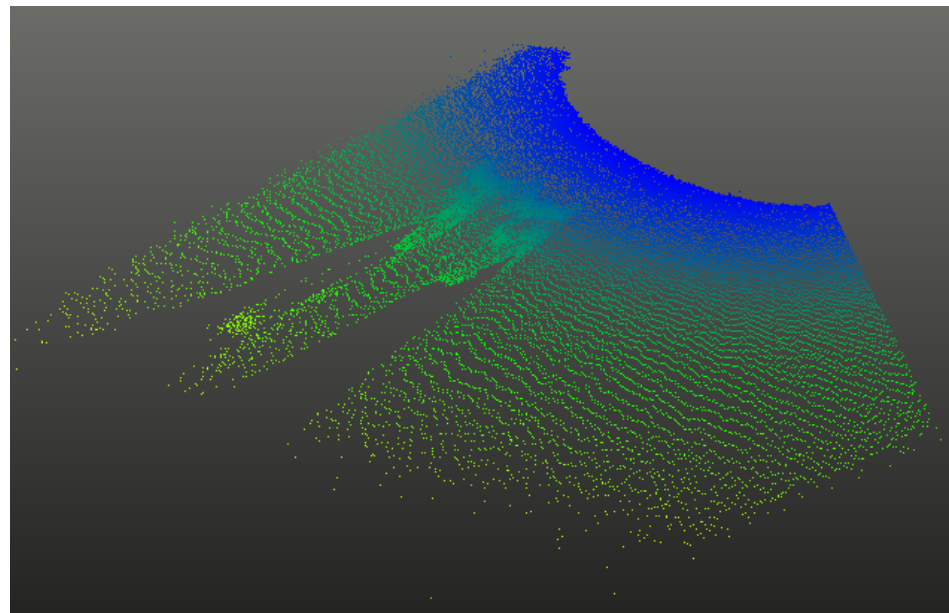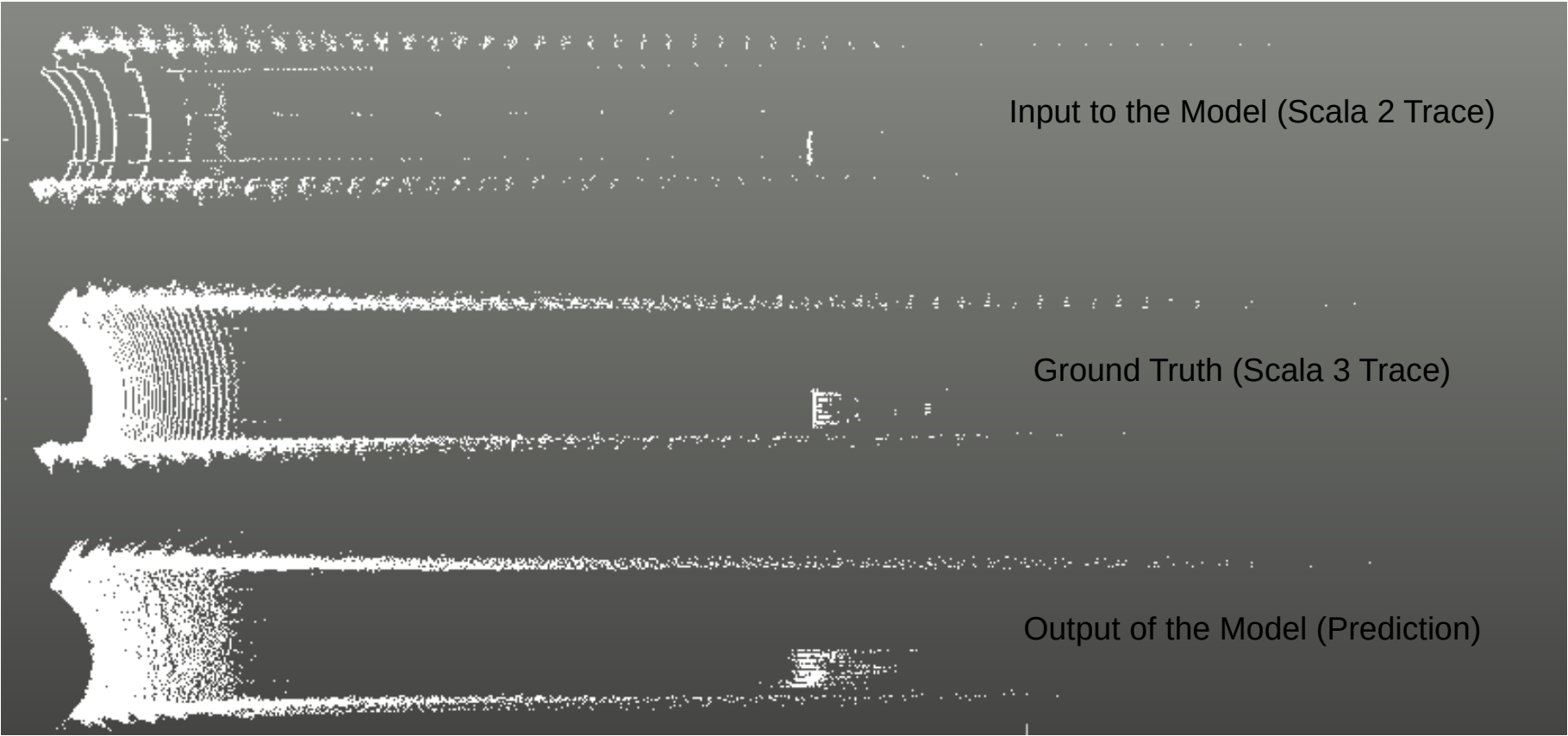

Ground Truth

Output

Output: Bird Eye View

Input to the Model (Scala 2 Trace)

Ground Truth (Scala 3 Trace)
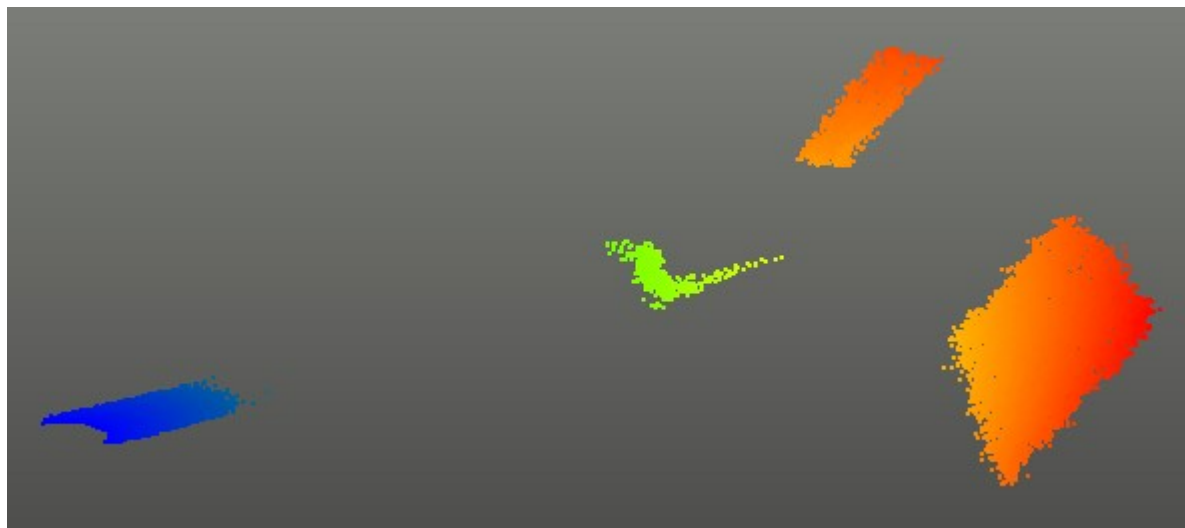
Output of the Model (Prediction)

Output: Clustering

Ground Truth (Scala 3 Trace)

Output of the Model (Prediction)

Pix2PixHD: Metrics

- Frobenius Norm improves the Output of the Pix2PixHD Model.

- Frobenius Norm gives best results with GAN Feature Matching Loss.

Models	PSNR ↑	WSN Loss ↓	F1 Score ↑	EMD ↓	IOU↑
U-Net	64.248	0.00012	0.97	0.04	0.885
VAE	45.94	0.00015	0.84	0.200	0.713
VNL	60.511	0.00015	0.92	0.0512	0.805
GAN	35.541	0.0008	0.74	0.328	0.394
wGAN	15.596	0.0011	0.62	0.489	0.347
Pix2PixHD	**74.244**	**0.00006**	**1.00**	**0.024**	**0.99**

Comparison of the performance of different models against different metrics

Conclusion

Achievements:

- Complex Traffic Object Upsampling (x8.5 times).

- Successfully accomplished Domain Adaptation from SCALA2 to SCALA3.

- Successfully train Deep Learning Model.

- Dataset Creation & Validation pipeline.

- Material Identification via Clustering.

Future Directions:

- Real Traces Integration and Testing.

- Wider Application Exploration in Different Teams.

- Improve the Performance of the model to upsample Lane

  Markings.