



Awesome Radar Perception

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Surveys

- 2023 - Reviewing 3D Object Detectors in the Context of High-Resolution 3+1D Radar [CVPRW](#) [[Paper](#)]
- 2023 - Radar-Camera Fusion for Object Detection and Semantic Segmentation in Autonomous Driving: A Comprehensive Review [TIV](#) [[Paper](#)] [[Website](#)] [[GitHub](#)]
- 2023 - Radars for Autonomous Driving: A Review of Deep Learning Methods and Challenges [ACCESS](#) [[Paper](#)]
- 2023 - Vehicle Detection for Autonomous Driving: A Review of Algorithms and Datasets [TITS](#) [[Paper](#)]
- 2023 - An Overview of Algorithms for Contactless Cardiac Feature Extraction from Radar Signals: Advances and Challenges [TIM](#) [[Paper](#)]

Datasets

Id	Name	Year	Task	Annotation	Data Representation	Link
1	nuScenes	2019	Object Detection Object Tracking	3D box	Point Cloud	Paper Website Github
2	Astyx	2019	Object Detection	3D box	Point Cloud	Website
3	SeeingThroughFog	2020	Object Detection	2D box 3D box	Point Cloud	Website
4	CARRADA	2020	Object Detection Semantic Segmentation Object Tracking Trajectory Prediction	2D box 2D pixel	Range-Doppler Tensor Range-Azimuth Tensor	Website
5	HawkEye	2020	Semantic Segmentation	3D point	Point Cloud	Website
6	Zendar	2020	Object Detection Mapping Localization	2D box	Range-Doppler Tensor Range-Azimuth Tensor Point Cloud	Website
7	RADIATE	2020	Object Detection Object Tracking SLAM Scene Understanding	2D box	Range-Azimuth Tensor	Website
8	AIODrive	2020	Object Detection Object Tracking Semantic Segmentation Trajectory Prediction Depth Estimation	2D box 3D box	Point Cloud	Website
9	CRUW	2021	Object Detection	2D box	Range-Azimuth Tensor	Website

Id	Name	Year	Task	Annotation	Data Representation	Link
10	RaDlCaL	2021	Object Detection	2D box	ADC Signal	Website
11	RadarScenes	2021	Object Detection Semantic Segmentation Object Tracking	2D pixel 3D point	Point Cloud	Website
12	RADDet	2021	Object Detection	2D box 3D box	Range-Azimuth-Doppler Tensor	Github
13	FloW	2021	Object Detection	2D box	Range-Doppler Tensor Point Cloud	Website Github
14	RADlal	2021	Object Detection Semantic Segmentation	2D box	ADC Signal Range-Azimuth-Doppler Tensor Range-Azimuth Tensor Range-Doppler Tensor Point Cloud	Github
15	VoD	2022	Object Detection	2D box 3D box	4D Point Cloud	Website
16	Boreas	2022	Object Detection Localization Odometry	2D box	Range-Azimuth Tensor	Website
17	TJ4DRadSet	2022	Object Detection Object Tracking	3D box	4D Point Cloud	Website
18	K-Radar	2022	Object Detection Object Tracking SLAM	3D box	4D Range-Azimuth-Doppler Tensor	Github
19	aiMotive	2022	Object Detection	3D box	Point cloud	Website

Id	Name	Year	Task	Annotation	Data Representation	Link
20	WaterScenes	2023	Instance Segmentation		4D Point cloud	Paper Website GitHub
			Semantic Segmentation	2D box		
			Free-space Segmentation	2D pixel		
			Waterline Segmentation	2D line		
			Panoptic Perception	3D point		
21	ThermRad	2023	Object Detection	3D box	4D Point Cloud	Paper
22	Dual Radar	2023	Object Detection	3D box	4D Point Cloud	Paper GitHub
			Object Tracking			

Representations

ADC Signal

Classification/Motion Recognition

- 2020 - Radar Image Reconstruction from Raw ADC Data using Parametric Variational Autoencoder with Domain Adaptation **ICPR** [[Paper](#)]
- 2021 - Improved Target Detection and Feature Extraction using a Complex-Valued Adaptive Sine Filter on Radar Time Domain Data **EUSIPCO** [[Paper](#)]
- 2021 - Data-Driven Radar Processing Using a Parametric Convolutional Neural Network for Human Activity Classification **IEEE Sensors** [[Paper](#)]
- 2021 - Spiking Neural Network-Based Radar Gesture Recognition System Using Raw ADC Data **IEEE Sensors Letters** [[Paper](#)]
- 2022 - Detection of Human Breathing in Non-Line-of-Sight Region by Using mmWave FMCW Radar **TIM** [[Paper](#)]
- 2023 - **CubeLearn**: End-to-End Learning for Human Motion Recognition From Raw mmWave Radar Signals **IEEE IOT** [[Paper](#)]

Object Dection

- 2023 - **ADCNet**: End-to-end perception with raw radar ADC data **arXiv** [**RADIAL**] [[Paper](#)]
- 2023 - **T-FFTRadNet**: Object Detection with Swin Vision Transformers from Raw ADC Radar Signals **arXiv** [**RADIAL**] [[Paper](#)]
- 2023 - **Echoes Beyond Points**: Unleashing the Power of Raw Radar Data in Multi-modality Fusion **NeurIPS** [**RADIAL**][[Paper](#)]
- 2023 - Azimuth Super-Resolution for FMCW Radar in Autonomous Driving **CVPR** [**RADIAL**] [[Paper](#)]

Vital Sign

- 2016 - RF-based child occupation detection in the vehicle interior **IRS** [\[Paper\]](#)
- 2019 - A Theoretical Investigation of the Detection of Vital Signs in Presence of Car Vibrations and RADAR-Based Passenger Classification **TVT** [\[Paper\]](#)
- 2020 - Non-Contact Vital Signs Monitoring for Multiple Subjects Using a Millimeter Wave FMCW Automotive Radar **IMS** [\[Paper\]](#)
- 2023 - Sparsity-Based Multi-Person Non-Contact Vital Signs Monitoring via FMCW Radar **JBHI** [\[Paper\]](#)
- 2023 - Radar-Based Monitoring of Vital Signs: A Tutorial Overview **JPROC** [\[Paper\]](#)

Radar Tensor

Detection

- 2019 - Experiments with mmWave Automotive Radar Test-bed **RA ACSSC** [\[Paper\]](#)
- 2019 - Vehicle Detection With Automotive Radar Using Deep Learning on Range-Azimuth-Doppler Tensors **RAD ICCVW** [\[Paper\]](#)
- 2020 - Probabilistic oriented object detection in automotive radar **RA CVPRW** [\[Paper\]](#)
- 2020 - RODNet: Radar Object Detection Using Cross-Modal Supervision **RA WACV** [\[CRUW\]](#) [\[Paper\]](#)
- 2020 - RODNet: A Real-Time Radar Object Detection Network Cross-Supervised by Camera-Radar Fused Object 3D Localization **RA JSTSP** [\[CRUW\]](#) [\[Paper\]](#)
- 2020 - Range-Doppler Detection in Automotive Radar with Deep Learning **RD IJCNN** [\[Paper\]](#)
- 2020 - RAMP-CNN: A Novel Neural Network for Enhanced Automotive Radar Object Recognition **RAD IEEE Sensors** [\[Paper\]](#)
- 2020 - CNN Based Road User Detection Using the 3D Radar Cube **RAD RAL** [\[Paper\]](#)
- 2021 - **[GTR-Net]** Graph Convolutional Networks for 3D Object Detection on Radar Data **RAD ICCV Workshop** [\[Paper\]](#)
- 2021 - RADDet: Range-Azimuth-Doppler based Radar Object Detection for Dynamic Road Users **RAD CRV** [\[RADDet\]](#) [\[Paper\]](#) [\[Code\]](#)
- 2022 - DAROD: A Deep Automotive Radar Object Detector on Range-Doppler maps **RD IV** [\[CARRADA RADDet\]](#) [\[Paper\]](#)
- 2022 - K-Radar: 4D Radar Object Detection for Autonomous Driving in Various Weather Conditions **RADE NeurIPS** [\[K-Radar\]](#) [\[Paper\]](#) [\[GitHub\]](#)
- 2023 - Enhanced K-Radar: Optimal Density Reduction to Improve Detection Performance and Accessibility of 4D Radar Tensor-based Object Detection **RADE arXiv** [\[K-Radar\]](#) [\[Paper\]](#)

Segmentation

- 2020 - RSS-Net: Weakly-supervised multi-class semantic segmentation with FMCW radar **RAD IV** [\[Paper\]](#)
- 2020 - Deep Open Space Segmentation using Automotive Radar **RAD ICMIM** [\[Paper\]](#)
- 2021 - PolarNet: Accelerated Deep Open Space Segmentation using Automotive Radar in Polar Domain **RAD VEHITS** [\[Paper\]](#)
- 2021 - Multi-view Radar Semantic Segmentation **RAD ICCV** [\[Paper\]](#) [\[GitHub\]](#)

Multi-Task

- 2022 - [FFT-RadNet] Raw High-Definition Radar for Multi-Task Learning **CVPR** [**RADIAL**] [[Paper](#)]
- 2023 - Cross-Modal Supervision-Based Multitask Learning With Automotive Radar Raw Data **RD TIV** [**RADIAL**][[Paper](#)]

Point Cloud

Classification

- 2017 - Comparison of random forest and long short-term memory network performances in classification tasks using radar **SDF** [[Paper](#)]
- 2018 - Radar-based Feature Design and Multiclass Classification for Road User Recognition **IV** [[Paper](#)]
- 2020 - Off-the-shelf sensor vs. experimental radar - How much resolution is necessary in automotive radar classification? **FUSION** [[Paper](#)]
- 2022 - Radar-PointGNN: Graph Based Object Recognition for Unstructured Radar Point-cloud Data **RadarConf** [[Paper](#)]

Detection

- 2019 - 2D Car Detection in Radar Data with PointNets **ITSC** [[Paper](#)]
- 2020 - Detection and Tracking on Automotive Radar Data with Deep Learning **FUSION** [[Paper](#)]
- 2020 - Seeing Around Street Corners: Non-Line-of-Sight Detection and Tracking In-the-Wild Using Doppler Radar **CVPR** [[Paper](#)]
- 2021 - RPFA-Net: a 4D RaDAR Pillar Feature Attention Network for 3D Object Detection **ITSC** [[Paper](#)] [[Code](#)]
- 2021 - Comparison of Different Approaches for Identification of Radar Ghost Detections in Automotive Scenarios **RadarConf** [[Paper](#)]
- 2022 - Contrastive Learning for Automotive mmWave Radar Detection Points Based Instance Segmentation **ITSC** [[Paper](#)]
- 2023 - 3-D Object Detection for Multiframe 4-D Automotive Millimeter-Wave Radar Point Cloud **IEEE Sensors** [**TJ4DRadSet**][[Paper](#)]
- 2023 - SMURF: Spatial Multi-Representation Fusion for 3D Object Detection with 4D Imaging Radar **TIV** [**VoD TJ4DRadSet**][[Paper](#)]
- 2023 - MVFAN: Multi-View Feature Assisted Network for 4D Radar Object Detection **ICONIP** [**Astyx VoD**][[Paper](#)]

Segmentation

- 2018 - Semantic Segmentation on Radar Point Clouds **FUSION** [[Paper](#)]
- 2018 - Supervised Clustering for Radar Applications: On the Way to Radar Instance Segmentation **ICMIM** [[Paper](#)]
- 2019 - 2D Car Detection in Radar Data with PointNets **ITSC** [[Paper](#)]
- 2020 - RSS-Net: Weakly-Supervised Multi-Class Semantic Segmentation with FMCW Radar **IV** [[Paper](#)]
- 2022 - Panoptic Segmentation for Automotive Radar Point Cloud **RadarConf** [[Paper](#)]
- 2023 - Deep Instance Segmentation With Automotive Radar Detection Points **TIV** [**RadarScenes**] [[Paper](#)]

Tracking

- 2020 - Detection and Tracking on Automotive Radar Data with Deep Learning **FUSION** [Paper]
- 2023 - Which Framework is Suitable for Online 3D Multi-Object Tracking for Autonomous Driving with Automotive 4D Imaging Radar? **arXiv** [Paper]

Odometry

- 2023 - Efficient Deep-Learning 4D Automotive Radar Odometry Method **TIV** [Paper]
- 2023 - DRIO: Robust Radar-Inertial Odometry in Dynamic Environments **RAL** [Paper]

Gait Recognition

- 2021 - Person Reidentification Based on Automotive Radar Point Clouds **TGRS** [Paper]
- 2020 - Gait Recognition for Co-Existing Multiple People Using Millimeter Wave Sensing **AAAI** [Paper]

Grid Map

Detection

- 2015 - Automotive Radar Gridmap Representations **ICMIM** [Paper]
- 2015 - Detection of Arbitrarily Rotated Parked Cars Based on Radar Sensors **IRS** [Paper]
- 2016 - 3D Occupancy Grid Mapping Using Statistical Radar Models **IV** [Paper]
- 2017 - Semantic Radar Grids **IV** [Paper]
- 2018 - Adaptions for Automotive Radar Based Occupancy Gridmaps **ICMIM** [Paper]
- 2018 - High Resolution Radar-based Occupancy Grid Mapping and Free Space Detection **VEHITS** [Paper]
- 2019 - Semantic Segmentation on Automotive Radar Maps **IV** [Paper]
- 2019 - Occupancy Grids Generation Using Deep Radar Network for Autonomous Driving **ITSC** [Paper]
- 2020 - Semantic Segmentation on 3D Occupancy Grids for Automotive Radar **IEEE ACCESS** [Paper]
- 2023 - **NVRadarNet**: Real-Time Radar Obstacle and Free Space Detection for Autonomous Driving **RA ICRA** [Paper]

Segmentation

- 2019 - Road Scene Understanding by Occupancy Grid Learning from Sparse Radar Clusters using Semantic Segmentation **ICCV** [Paper]
- CNN based road course estimation on automotive radar data with various gridmaps **ICMIM** [Paper]
- 2020 - Scene Understanding With Automotive Radar **TIV** [Paper]
- 2023 - Semantic Segmentation-Based Occupancy Grid Map Learning With Automotive Radar Raw Data **TIV [RADIAL]** [Paper]

Micro-Doppler Signature

Motion (Gait/Gestures/Activity) Classification

- 2016 - Human Detection and Activity Classification Based on Micro-Doppler Signatures Using Deep Convolutional Neural Networks **IEEE Geoscience and Remote Sensing Letters** [Paper]
- 2017 - New Analysis of Radar Micro-Doppler Gait Signatures for Rehabilitation and Assisted Living **ICASSP** [Paper]
- 2018 - Human Motion Classification with Micro-Doppler Radar and Bayesian-Optimized Convolutional Neural Networks **ICASSP** [Paper]
- 2018 - Radar-Based Human-Motion Recognition With Deep Learning: Promising Applications for Indoor Monitoring **IEEE Signal Processing Magazine** [Paper]
- 2019 - Radar-Based Human Gait Recognition Using Dual-Channel Deep Convolutional Neural Network **TGRS** [Paper]
- 2019 - Experiments with mmWave Automotive Radar Test-bed **ACSSC** [Paper]
- 2022 - Attention-Based Dual-Stream Vision Transformer for Radar Gait Recognition **ICASSP** [Paper]

Calibration

- 2019 - Extrinsic 6DoF calibration of a radar–LiDAR–camera system enhanced by radar cross section estimates evaluation [Paper]
- 2021 - A Joint Extrinsic Calibration Tool for Radar, Camera and Lidar **TIV** [Paper]
- 2021 - 3D Detection and Tracking for On-road Vehicles with a Monovision Camera and Dual Low-cost 4D mmWave Radars **ITSC** [Paper]
- 2022 - 3DRadar2ThermalCalib: Accurate Extrinsic Calibration between a 3D mmWave Radar and a Thermal Camera Using a Spherical-Trihedral **ITSC** [Paper]
- 2022 - K-Radar: 4D Radar Object Detection for Autonomous Driving in Various Weather Conditions **NeurIPS** [Paper] [GitHub]

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