

Artificial Intelligence in Robotics

Module no. or code	8
Module name	Artificial Intelligence in Robotics
(If applicable) the module's courses	
Module content	<ol style="list-style-type: none"> 1 Advanced Embedded Systems <ul style="list-style-type: none"> - Edge Computing, - CPU, GPU computing - Wireless communication - Cameras, Sensors, OLEDs, Storage 2 Comprehensive SDK by NVIDIA (JetPack) <ul style="list-style-type: none"> - Accelerated libraries for deep learning, computer vision, ... 3 Recapitulation of ANN <ul style="list-style-type: none"> - Feed forward, gradient descent, delta rule, backpropagation - RNN, LSTM, Auto Encoder - CNN - Neural networks training 4 Specialised Tasks <ul style="list-style-type: none"> - Train model - Collision Avoidance - Object following - Line tracking - Road following 5 Recapitulation of OpenCV <ul style="list-style-type: none"> - Object Detection - Hough Transformation 6 Basic Applications for AI systems <ul style="list-style-type: none"> - Linear Regression - Dimensionality Reduction with Principal Component Analysis (PCA) - Density Estimation with Gaussian Mixture Models
Module's learning outcomes	<ul style="list-style-type: none"> - Students refresh and develop further their knowledge and skills on machine learning, especially on ANNs and computer vision. - Students evaluate and assess the challenges developers of self-driving vehicles have to face, among others auto line following, object tracking, collision avoidance. - Students build their own vehicle based on NVIDIA's entry-level edge computing hardware, and overcome a given track with situational awareness, object detection and collision avoidance.

Semester			
Duration of module	One semester		
Frequency	Winter term only		
ECTS-Credits	5		
Workload	Workload (Total)	Attendance time	Self-Study time (incl. exam preparation)
	150	60	90
Type of module	Compulsory		
Applicability of module	Advanced course to make use of machine learning and AI techniques in robotics and for other mobile systems. Useful in particular for the second part of the practical module.		
Conditions for participation	Core modules of the first semester		
Responsible for module	Prof. Dr. Arndt Balzer		
Lecturer	Prof. Dr. Arndt Balzer		
Language of instruction, L. of examination	English		
Type of examination; Conditions for the award of CPs	SoP (G) Portfolio		
Teaching and learning formats of the module	Seminar-based teaching		
Literature	<ol style="list-style-type: none"> 1 K. Murphy, Machine learning 2 T. Hastie et al: An Introduction to Statistical Learning 3 S. Thrun et al., Probabilistic Robotics 4 T. Rashid, Make Your Own Neural Network 		