Reasoning and decision making under uncertainty

Module no. or code	4
Module name	Reasoning and decision making under uncertainty
(If applicable) the module's courses	
Module content	1. Basic Reinforcement Learning Concepts - Actions and States - Goals, Rewards, Returns and Episodes - Policies and Value Functions 2. Basic Reinforcement Learning Methods - Finite Markov Decision Processes - Dynamic Programming - Monte Carlo Methods 3. Advanced tabular learning Methods - Temporal-Difference Learning - Bootstrapping Methods 4. Learning in Continuous State and Action Spaces - On-Policy Approximation - Value-function Approximation - Off-Policy Approximation - Approximate Eligibility Traces 5. Value Function Approximation case studies - Computer Vision: Action planning - Mastering Games: Backgammon, Go 6. Practical Applications and Exercises - Training Black Jack - Analysis of trained Black Jack policies
Module's learning outcomes	- Students develop further knowledge and skills on the necessary mathematical foundations for understanding and developing algorithms for AI. - Students can analyse and apply the principles of Reinforcement Learning algorithms - Students can use the principles of modelling agents, environments and rewards to design, evaluate and develop own applications based on reinforcement learning - Students understand the necessity of function approximations in learning and can apply them - Students build on their acquired knowledge to master learning problems.
Semester	1st semester
Duration of module	One semester

<table>
<tr><td>Frequency</td><td>Summer term only</td></tr>
<tr><td>ECTS-Credits</td><td>5</td></tr>
<tr><td>Workload</td><td>
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<tr><td>Workload (Total)</td><td>Attendance time</td><td>Self-Study time (incl. exam preparation)</td></tr>
<tr><td>150</td><td>60</td><td>90</td></tr>
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<tr><td>Type of module</td><td>Compulsory</td></tr>
<tr><td>Applicability of module</td><td>Prerequisite for the robotics modul and related electives</td></tr>
<tr><td>Conditions for participation</td><td></td></tr>
<tr><td>Responsible for module</td><td>Prof. Dr. Frank Deinzer</td></tr>
<tr><td>Lecturer</td><td>Prof. Dr. Frank Deinzer</td></tr>
<tr><td>Language of instruction, L. of examination</td><td>english</td></tr>
<tr><td>Type of examination;
Conditions for the award of CPs</td><td>Portfolio</td></tr>
<tr><td>Teaching and learning formats of the module</td><td>Seminar-based teaching</td></tr>
<tr><td>Literature</td><td>1. Sutton, Barto: Reinforcement Learning - An Introduction. Bradford Books, 2018
2. Thorp: Beat the Dealer. Random House. 1966
Further specialized literature will be announced in the course.</td></tr>
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