

# Advanced Programming in Computational Intelligence in Games

Summer

(in German: Advanced Programming in Computational Intelligence in Games )

**Module-ID: FIN-INF-120495**

| Abbreviation | Credit Points | Semester | Term           | Duration   | Language | Level  |
|--------------|---------------|----------|----------------|------------|----------|--------|
| AP-CIG       | 6             | Summer   | starting at 1. | 1 Semester | english  | Master |

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| <b>Link:</b>                        | <a href="#">LSF</a>                                                                                                                                                                                                       |
| <b>Limited accessibility:</b>       |                                                                                                                                                                                                                           |
| <b>Responsibility:</b>              | Sanaz Mostaghim                                                                                                                                                                                                           |
| <b>Lecturer:</b>                    | Sanaz Mostaghim                                                                                                                                                                                                           |
| <b>Classes:</b>                     | <ul style="list-style-type: none"><li>• Lecture <i>Advanced Programming in Computational Intelligence in Games</i></li><li>• Tutorials <i>Advanced Programming in Computational Intelligence in Games</i></li></ul>       |
| <b>Applicability in curriculum:</b> | <ul style="list-style-type: none"><li>- M.Sc. INF: Informatik</li><li>- M.Sc. INGINF: Informatik</li><li>- M.Sc. WIF: Informatik</li><li>- M.Sc. DKE: Applied Data Science</li><li>- M.Sc. VC: Computer Science</li></ul> |

**Intended learning outcomes:**

Students ...

- carry out a large programming project using the concepts from the theoretical part of the course.
- have a full understanding of the algorithms of computational Intelligence in Games.
- learn to develop new ideas and apply them to new problems in the context of AI and Games.
- learn to program the methodologies from the lectures in teams.

**Content:**

This course addresses the basic and advanced topics in the area of computational intelligence and games and contains three parts: Part 1 addresses the basics in Evolutionary Game Theory (EGT). In this part you will learn about simple games such as scissors/rock/paper and the focus on the strategies for playing games. Part 2 is about learning agents, and we focus on reinforcement learning mechanisms. There are three questions for games:

- How can we use the information from a search mechanism to learn?
- How can we use reinforcement learning to find for a better strategy?
- How can we use reinforcement learning as a search mechanism?

The application is on board games. Part 3 contains the advanced topics in games and artificial intelligence How can we consider physical constraints of a spaceship while moving in an unknown terrain. Other topics are Monte Carlo Tree Search, Procedural Content Generation, Decision Making and Multi-Objective Learning.

**Workload:**

56 contact hours + 94h self study

| Pre-examination requirements: | Type of examination:                                                                                                                                                               | Teaching method / lecture hours per week (SWS):                                                       |
|-------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------|
|                               | <ul style="list-style-type: none"><li>• Hausarbeit (home work containing programming)</li><li>• Exercises and Tutorials</li><li>• Klausur (written Exam)<br/>120 Minuten</li></ul> | <ul style="list-style-type: none"><li>• lectures (2 SWS)</li><li>• exercise classes (2 SWS)</li></ul> |

| Prerequisites according to examination regulations: | Recommended prerequisites: |
|-----------------------------------------------------|----------------------------|
| none                                                | Programming experience     |

| Media: | Literature: |
|--------|-------------|
|--------|-------------|

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|  | <ul style="list-style-type: none"><li>• Ian Millington and John Funge, Artificial Intelligence for Games, CRC Press, 2009</li><li>• Richard S. Sutton and Andrew G. Barto, Reinforcement Learning: An Introduction, MIT Press, Cambridge, MA, 1998</li><li>• Jorgen W. Weibull, Evolutionary Game Theory, MIT Press, 1997</li><li>• Thomas Vincent, Evolutionary Game Theory, Natural Selection, and Darwinian Dynamics, Cambridge University Press, 2005</li><li>• Josef Hofbauer, Karl Sigmund, Evolutionary Games and Population Dynamics, Cambridge University Press, 1998</li></ul> |
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## Comments:

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