

## H7AI: Artificial Intelligence

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|-----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| Module Code:                                                                | H7AI                                                                                                                                              |
| Long Title                                                                  | Artificial Intelligence <b>APPROVED</b>                                                                                                           |
| Title                                                                       | Artificial Intelligence                                                                                                                           |
| Module Level:                                                               | LEVEL 7                                                                                                                                           |
| EQF Level:                                                                  | 6                                                                                                                                                 |
| EHEA Level:                                                                 | First Cycle                                                                                                                                       |
| Credits:                                                                    | 10                                                                                                                                                |
| Module Coordinator:                                                         | KEITH MAYCOCK                                                                                                                                     |
| Module Author:                                                              | Arghir Moldovan                                                                                                                                   |
| Departments:                                                                | School of Computing                                                                                                                               |
| Specifications of the qualifications and experience required of staff       | MSc and/or PhD degree in computer science or cognate discipline. May have industry experience also.                                               |
| <b>Learning Outcomes</b>                                                    |                                                                                                                                                   |
| <i>On successful completion of this module the learner will be able to:</i> |                                                                                                                                                   |
| #                                                                           | <b>Learning Outcome Description</b>                                                                                                               |
| LO1                                                                         | Describe the theory and concepts underpinning Artificial Intelligence (AI) and outline the historical evolution of AI.                            |
| LO2                                                                         | Apply the technical and practical skills for constructing algorithms used in various real world applications such as natural language processing. |
| LO3                                                                         | Demonstrate the use of structures for knowledge representation and logical reasoning systems while solving practical AI problems.                 |
| LO4                                                                         | Evaluate the architecture of intelligent agents to solve real world problems.                                                                     |
| <b>Dependencies</b>                                                         |                                                                                                                                                   |
| <b>Module Recommendations</b>                                               |                                                                                                                                                   |
| No recommendations listed                                                   |                                                                                                                                                   |
| <b>Co-requisite Modules</b>                                                 |                                                                                                                                                   |
| No Co-requisite modules listed                                              |                                                                                                                                                   |
| <b>Entry requirements</b>                                                   | Learners should have attained the knowledge, skills and competence gained from stage 2 of the BSc (Hons) in Data Science                          |

# H7AI: Artificial Intelligence

| Module Content & Assessment                                                                                                                                                                                                                                                                                                        |                       |                           |            |
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| Indicative Content                                                                                                                                                                                                                                                                                                                 |                       |                           |            |
| <b>Introduction to Artificial Intelligence</b><br>Foundations of AI: philosophy, maths, psychology, computing, linguistics, logic, probability theory. Historical evolution of the field. Weak vs Strong AI. Ethical implications of AI                                                                                            |                       |                           |            |
| <b>Agents</b><br>Precepts, actions, goals, environment. Rational agents. Environments. Agent functions and programs. Simple reflex agents. Reflex agents with state. Goal based agents. Utility based agents                                                                                                                       |                       |                           |            |
| <b>Search-Based Problem Solving</b><br>Utility based agents. Performance. State space search. Uninformed Search strategies: Uniform Cost, Depth-First, Depth-Limited, Iterative Deepening                                                                                                                                          |                       |                           |            |
| <b>Search-Based Problem Solving</b><br>Informed Search strategies: Greedy Best First Search, A* Search; Heuristic functions; Iterative Improvement algorithms • Hill climbing & Simulated Annealing                                                                                                                                |                       |                           |            |
| <b>Reasoning</b><br>Propositional Logic. First Order Logic. Inference in First Order Logic                                                                                                                                                                                                                                         |                       |                           |            |
| <b>Knowledge representation</b><br>Ontological Engineering. Categories, objects and events. Semantic networks                                                                                                                                                                                                                      |                       |                           |            |
| <b>Bayesian Networks</b><br>Quantifying Uncertainty. Bayes' Rules and its use                                                                                                                                                                                                                                                      |                       |                           |            |
| <b>Bayesian Networks</b><br>Probabilistic Reasoning; The semantics of Bayesian Networks; Conditional distributions and efficient representation of them; Inference in Bayesian Networks; Dynamic Bayesian Network                                                                                                                  |                       |                           |            |
| <b>Natural Language Processing</b><br>Language models. Retrieval, extraction and classification for natural language processing                                                                                                                                                                                                    |                       |                           |            |
| <b>Natural Language Processing</b><br>Natural language for communication (phrase structures, syntactic analysis, augmented, grammars and semantic interpretation, machine translation, speech recognition) Practical problems, for example using systematic functional linguistics for the identification of latent dehumanisation |                       |                           |            |
| <b>Recommender Systems</b><br>Recommender systems introduction and examples . Basic models of recommender systems                                                                                                                                                                                                                  |                       |                           |            |
| <b>Recommender Systems</b><br>AI techniques for recommender systems; Recommender systems challenges: scalability, sparsity, cold-start, etc                                                                                                                                                                                        |                       |                           |            |
| Assessment Breakdown                                                                                                                                                                                                                                                                                                               |                       |                           | %          |
| Coursework                                                                                                                                                                                                                                                                                                                         |                       |                           | 40.00%     |
| End of Module Assessment                                                                                                                                                                                                                                                                                                           |                       |                           | 60.00%     |
| Assessments                                                                                                                                                                                                                                                                                                                        |                       |                           |            |
| Full Time                                                                                                                                                                                                                                                                                                                          |                       |                           |            |
| Coursework                                                                                                                                                                                                                                                                                                                         |                       |                           |            |
| <b>Assessment Type:</b>                                                                                                                                                                                                                                                                                                            | Continuous Assessment | <b>% of total:</b>        | Non-Marked |
| <b>Assessment Date:</b>                                                                                                                                                                                                                                                                                                            | n/a                   | <b>Outcome addressed:</b> | 1,2,3,4    |
| <b>Non-Marked:</b>                                                                                                                                                                                                                                                                                                                 | Yes                   |                           |            |
| <b>Assessment Description:</b><br>Formative assessment will be provided on the in-class individual or group activities. Feedback will be provided in written or oral format, or on-line through Moodle. In addition, in class discussions will be undertaken as part of the practical approach to learning.                        |                       |                           |            |
| <b>Assessment Type:</b>                                                                                                                                                                                                                                                                                                            | Project (0050)        | <b>% of total:</b>        | 40         |
| <b>Assessment Date:</b>                                                                                                                                                                                                                                                                                                            | n/a                   | <b>Outcome addressed:</b> | 3,4        |
| <b>Non-Marked:</b>                                                                                                                                                                                                                                                                                                                 | No                    |                           |            |
| <b>Assessment Description:</b><br>Project where the students need to implement AI into an application of their choice (e.g., chess game, chat bot, etc.). This project would built on students' previous skills in programming (e.g. Python), and machine learning.                                                                |                       |                           |            |
| <b>Assessment Type:</b>                                                                                                                                                                                                                                                                                                            | Easter Examination    | <b>% of total:</b>        | 60         |
| <b>Assessment Date:</b>                                                                                                                                                                                                                                                                                                            | n/a                   | <b>Outcome addressed:</b> | 1,2,3,4    |
| <b>Non-Marked:</b>                                                                                                                                                                                                                                                                                                                 | No                    |                           |            |
| <b>Assessment Description:</b><br>Written examination held during final terminal exams examining all learning outcomes                                                                                                                                                                                                             |                       |                           |            |
| No End of Module Assessment                                                                                                                                                                                                                                                                                                        |                       |                           |            |
| No Workplace Assessment                                                                                                                                                                                                                                                                                                            |                       |                           |            |
| Reassessment Requirement                                                                                                                                                                                                                                                                                                           |                       |                           |            |
| <b>Repeat examination</b><br><i>Reassessment of this module will consist of a repeat examination. It is possible that there will also be a requirement to be reassessed in a coursework element.</i>                                                                                                                               |                       |                           |            |
| <b>Reassessment Description</b><br>The repeat strategy for this module is an examination. Students will be afforded an opportunity to repeat the examination at specified times throughout the year and all learning outcomes will be assessed in the repeat exam.                                                                 |                       |                           |            |

## H7AI: Artificial Intelligence

| Module Workload                      |                                    |       |              |                                 |
|--------------------------------------|------------------------------------|-------|--------------|---------------------------------|
| Module Target Workload Hours 0 Hours |                                    |       |              |                                 |
| Workload: Full Time                  |                                    |       |              |                                 |
| Workload Type                        | Workload Description               | Hours | Frequency    | Average Weekly Learner Workload |
| Lecture                              | Classroom & Demonstrations (hours) | 24    | Per Semester | 2.00                            |
| Tutorial                             | Other hours (Practical/Tutorial)   | 24    | Per Semester | 2.00                            |
| Independent Learning                 | Independent learning (hours)       | 202   | Per Semester | 16.83                           |
| Total Weekly Contact Hours           |                                    |       |              | 4.00                            |

| Module Resources                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |
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| <i>Recommended Book Resources</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |
| <p>Russell, S., and Norvig, P.. (2010), Artificial Intelligence: A Modern Approach (3rd ed), Pearson.</p> <p>Koski, T. &amp; Noble, J.. (2009), Bayesian Networks: An Introduction, Wiley.</p> <p>Bird, S., Klein, E. &amp; Loper, E.. (2009), Natural Language Processing with Python: Analyzing Text with the Natural Language Toolkit, O'Reilly.</p> <p>Jannach, D., Zanker, M., Felfernig, A. &amp; Friedrich, G.. (2010), Recommender Systems: An Introduction, Cambridge University Press.</p> |  |
| <i>Supplementary Book Resources</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |  |
| <p>Funge, J. D.. (2004), Artificial Intelligence for Computer Games: An Introduction, CRC Press.</p>                                                                                                                                                                                                                                                                                                                                                                                                 |  |
| <i>Supplementary Article/Paper Resources</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |
| <p>Gabrani G., Sabharwal S., Singh V.K.. (2017), Artificial Intelligence Based Recommender Systems: A Survey, Advances in Computing and Data Sciences. ICACDS 2016, p.50-59,<br/> <a href="https://doi.org/10.1007/978-981-10-5427-3_6">https://doi.org/10.1007/978-981-10-5427-3_6</a></p>                                                                                                                                                                                                          |  |
| <i>This module does not have any other resources</i>                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |
| Discussion Note:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |  |