# INTRODUCTION TO ARTIFICIAL INTELLIGENCE

IFSA Prague Global Flagship

**U.S. Semester Credit Hours**: 3
**Contact Hours:** 45
**Class Code:** CS 380-09
**Class Length**: Semester
**Delivery Method:** Face to face
**Language of Instruction:** English
**Suggested Prerequisites:** Two years of computer science at a university level, including prior coursework on algorithms and programming language(s), preferably including a procedural one. A semester in discrete mathematics is recommended, as well as a propositional logic.
**Subject Cross-Listings:** Cognitive Science, Data Science, Informatics, Mathematics

## CLASS DESCRIPTION

The class will introduce the basics concepts which have developed in the area of Artificial Intelligence (AI). Since the 1960's, AI has been applied to complex programs which could achieve tasks considered very complicated even for humans (such as optimization problems or face recognition). Today, AI has developed into a fully-fledged field which is connected with big data, data analytics, and machine learning.

The class will introduce the key concepts of intelligent agents, their behavior and environment, and their role in problem solving, and knowledge and reasoning representation. Modeling intelligent behavior of the agents designed to solve problems is a challenging task, and several models have been developed (logical, probabilistic, and/or based on neural networks). The class will survey basic methods, looking for common points and differences.

In particular, the modeling of learning (a characteristic trait of humans) will be discussed with examples from natural language processing, and will be put in the context of machine learning (ML).

## STUDENT LEARNING OBJECTIVES

This class supports IFSA's overarching learning outcomes focused on understanding identity (UI), global awareness (GA), intercultural agility (IA), and enduring impact (EI) through the following learning objectives.

Upon successful completion of this course, students will be able to:

- Understand the motivation and concept of an "intelligent agent", and its role in computation.
- Understand basic problem-solving methods related to AI such as search problems or game theory.

- Gain fluency with concepts related to knowledge representation and understand their limits (first order logic, syntax and semantics distinction).
- Be aware of the importance of ways to formalize the concept of learning, considered by some the key trait of humans. Know the basic learning models. (UI, EI)
- Draw connections and be aware of applications of Machine Learning in Artificial Intelligence.
- Become familiar with resources available for further research on the topic of the class.
- Make cognitive connections between learning in this class and other learning experiences in IFSA Prague.

## CLASS DELIVERY

Students are expected to read or view assigned resources in advance and be prepared to actively discuss them in class. In most meetings, the instructor will overview the topic and then facilitate a group discussion, exercise, or demonstration, drawing out relevant concepts and techniques and helping students to build on and make connections to prior knowledge and practice.

Students are encouraged to bring their prior learning experiences into class discussions (based on experiential learning theory) and to make cognitive connections between this class and others in IFSA Prague whenever possible (based on the philosophy of integrative learning).

## CLASS OUTLINE

| Session | Details on Topics, Activities and Assignments | |
|---|---|---|
| 1 | History and foundation of AI | Research, discussion. |
| 2 | Intelligent agents and their structure.<br>Architecture, agent function, agent program. | Lecture |
| 3-4 | Problem solving.<br>Basic methods and algorithms, the role of agents.<br>Search in under-informed and non-deterministic environments. | Lecture, exercises. |
| 5-6 | Game theory, the concept of a winning strategy.<br>Optimization. | Lecture and exercises. |
| 7-9 | Knowledge representation, logic and inferences (propositional logic, first-order logic, distinction between syntax and semantics).<br>Challenges related to semantics of natural languages. | Lecture, research and discussions. |
| 10 | Company Visit / Guest lecture. | |
| 11-12 | Introduction to ML.<br>Machine learning and related methods.<br>Differences between ML and AI.<br>Limits and methods of interpretability of ML. | Lecture, research, and discussions. |
| 13-14 | Supervised and unsupervised learning, classification problems.<br>Connection to data analytics and methods to search for patterns (pattern recognition).<br>Deep learning and natural language processing. | Lecture and exercises. |

## RESOURCES

Mandatory:

- Stuart Russell. *Artificial Intelligence: A Modern Approach.* Pearson-prentice Hall, 2014.

Optional:

- Mariusz Flasinski. *Introduction to Artificial Intelligence.* Springer, 2016.
- Wolfgang Ertel. *Introduction to Artificial Intelligence.* Springer, 2017.

## EVALUATION METHODS

The assessment instruments of this class are of two types. Firstly, students individually or in small teams research and present a specific topic. Secondly, students in teams work on a complex long-term project that is submitted and assessed in three steps, to ensure logical procession of steps, as well as develop students' skills in teamwork and time-management. The final part of this project is an individual oral exam, where students show and discuss their contribution to the project, and show their ability to enhance, change or defend specific parts of the project, based on the requirements of the lecturer.

Your final grade in the class will be comprised of the following class requirements:

| **Evaluation Method** | **% Total of Final Grade** |
|---|---|
| Research paper oral/poster presentation, week 5 | 20% |
| Team project, week 7: Presentation of chosen problem and model with suggested benchmark for the evaluation of the performance of the model | 20% |
| Team project, week 13: a prototype with implementation of the chosen model | 30% |
| Individual exam based on the team project, week 14 | 30% |

**Academic Accommodations**
If you are a student with a disability and experience academic barriers, please provide a letter from your home institution outlining the accommodations required. The instructor will discuss with you the accommodation plan for the class.

**Timely Submissions**
Assignments submitted after the deadline will be accepted at the discretion of the instructor and generally only in the event of a documented illness or emergency.

## ATTENDANCE POLICY

Academics and learning are at the core of your study abroad experience. Based upon research, studies show that students perform and learn better when they attend class regularly. Therefore, it is IFSA's expectation that students on our programs attend class regularly. Active and engaged

attendance includes regularly scheduled classes, mandatory field visits, studios, recitations, workshops and laboratory sessions. Attendance will be recorded and all absences are treated equally, regardless of reason.

The Resident Directors and instructors of IFSA classes set the specific attendance policy for each location, including how absences impact final grades. Refer to your IFSA Global Policy Handbook for full attendance policies.

**IFSA Class Attendance Standards:**

| **Percentage of Total Class Hours Missed** | **Minimum Penalty** |
|---|---|
| Up to 10% | No academic penalty |
| 10 – 20% | Reduction of final grade |
| More than 20% | Automatic class failure |

- You must notify instructors and the appropriate on site IFSA staff member prior to an absence from class or class-related activities.
- Attendance policies also apply to any required class co-curricular excursion and internship or field/lab study hours.
- If participation is part of the overall class evaluation, you will not earn participation points for classes you are absent.
- Penalties or grade reductions for assignments that are turned in late due to absence are at the discretion of the instructor.
- Late arrivals to class may be considered absenteeism.
- Persistent absenteeism (students approaching 20% or more of total class hours missed) may lead to:
    - A written warning;
    - Notification to the student's home school; and/or
    - Dismissal from the program
- Any requests for exceptions related to IFSA's minimal class attendance expectations should be discussed with the Resident Director for approval.

## GRADING SCALE

IFSA uses the following grading scale for all classes:

| | | |
|---|---|---|
| Excellent | A | 93 – 100% |
| | A- | 90 – 92% |
| Good | B+ | 87 – 89% |
| | B | 83 – 86% |
| | B- | 80 – 82% |
| Acceptable | C+ | 77 – 79% |
| | C | 73 – 76% |
| | C- | 70 – 72% |

| | | |
|---|---|---|
| Unsatisfactory | D+ | 67 – 69% |
| | D | 63 – 66% |
| | D- | 60 – 62% |
| Failing | F | <60% |

## ACADEMIC INTEGRITY

Any academic endeavor must be based upon a foundation of honesty and integrity. Students are expected to abide by principles of academic integrity and must be willing to bear individual responsibility for their work while studying abroad. Any academic work (written or otherwise) submitted to fulfill an academic requirement must represent a student's original work. Any act of academic misconduct, such as cheating, fabrication, forgery, plagiarism, or facilitating academic dishonesty, will subject a student to disciplinary action.

IFSA takes academic integrity very seriously. Students must not accept outside assistance without permission from the instructor. Additionally, students must document all sources according to the guidance of the instructor. Should your instructor suspect you of plagiarism, cheating, or other forms of academic dishonesty, you may receive a failing grade for the class and disciplinary action may result. The incident will be reported to the IFSA resident director as well as your home institution.