2025/2026

# Course: Introduction to Artificial Intelligence

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# Module Objectives:
# To introduce

This module aims to provide students with a foundational understanding of Artificial Intelligence (AI) and its responsible use in academic contexts.

By the end of the module, students will be able to:

- ❖ **Understand core AI concepts**, **types and application domains.**
- ❖ **Assess the benefits**, **limitations and ethical risks of AI technologies**.
- ❖ **Use AI tools effectively for literature review**, **time management and scientific writing.**
- ❖ Apply AI to support academic creativity **and informed decision-making.**

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# Content of the Module:

## Introduction to Artificial Intelligence

## Chapter 1: Definitions of Artificial Intelligence (AI)

- Simple and historical definition
- Differences between weak AI, strong AI, symbolic AI and connectionist AI
- Concrete examples of AI in everyday life
- AI domains:
1. Machine Learning, Natural Language Processing, Computer Vision, Robotics
2. Applications: medicine, transportation, education, industry

## Chapter 2: Advantages and Risks of AI
- Benefits of AI
- Risks and challenges of AI

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# Content of the Module :

## Chapter 3: AI for Literature Review and Research

- Presentation of tools such as Elicit, Scopus AI and Web of Science Research Assistant
- Writing intelligent search queries
- Automatic summarization of scientific articles
- Critical evaluation of AI-recommended sources

## Chapter 4: AI for Time and Task Management

- Personal organization (Notion AI, AI-enhanced Google Calendar)
- Generation of to-do lists, creation of course plans or revision schedules

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# Content of the Module :

## Chapter 5: AI for Scientific Writing

- Assistance with structuring assignments and research projects
- Rewriting and style improvement
- <span style="color:red">Awareness of plagiarism and originality issues</span>
- Translation and multilingual scientific writing

## Chapter 6: AI and Academic Creativity

- Generation of research project ideas
- <span style="color:red">AI-assisted brainstorming</span>
- Creation of scientific presentations or posters

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# Content of the Module :

## Chapter 6: AI and Academic Creativity

## Assessment Method
- Final Exam: 60%
- Continuous Assessment: 40%

## Bibliography

## Online Courses:
- Elements of AI (University of Helsinki) – An accessible introduction to artificial intelligence.
- AI Objective (OpenClassrooms) – A course for everyone on the challenges of AI.

## Practical Guides:
- Laval University Library – Use of AI tools in academic research.
- Polytechnique Montréal – Generative AI tools in the university environment

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❖ **1. Definitions:**

◉ **Artificial intelligence** can be defined as a set of **theories**, **methods** and **techniques** aimed at designing **machines capable of performing tasks** that normally require human intelligence.

◉ These tasks include, for example, **reasoning**, **learning**, **problem solving**, **perception**, pattern recognition, **natural language understanding** and **decision-making**.

# 1. Definitions:

- **Artificial Intelligence (AI)** is a branch of computer science dedicated to the automation of intelligent behavior. It aims to design systems capable of performing tasks that normally require human intelligence, such as problem-solving, decision-making, and learning.

- According to *Minsky (1968)*, *AI is the science of making machines perform tasks that would require intelligence if done by humans*.

- **Boden (1977)** defines *AI as the use of machines to perform actions considered intelligent by human standards*.

❖ **1. Definitions:**

⊙ **Bellman (1978)** describes *AI as the automation of activities associated with human thinking, including reasoning and learning.*

⊙ **(Winston, 1992)** **"The study of the mechanisms that enable an agent to perceive, reason, and act."** *(Nilsson, 1998)***"The study of entities that exhibit intelligent behavior."**

⊙ The term **"artificial"** refers to a human-made creation, designed according to a precise method rather than occurring naturally.

❖ **1. Definitions:**

◉ In computer science, this applies to **artificial systems or agents** capable of simulating intelligent behaviors such as **perceiving**, **reasoning**, **learning** and decision-making.

◉ These agents, whether software or robotic, are designed to be **autonomous, efficient and reliable** illustrating the core role of artificial intelligence in modern computing systems.

## 2. Historical Overview

- The history of AI can be summarized in key stages:
- <span style="color:red">**1950 – Alan Turing proposes the Turing Test**</span>
  - Turing asks: *"Can machines think?"*
  - The test evaluates whether a machine can **imitate human behavior** to the point that a human judge cannot distinguish it from a human.
- <span style="color:red">**1956 – Dartmouth Conference**</span>
  - Organized by John McCarthy and other pioneers.
  - The term **Artificial Intelligence** is officially used for the first time.
  - First programs: solving simple math problems, proving theorems, early chess programs.
  - Marks the **official academic birth of AI**.

## 2.Historical Overview

- **1960-1970: Early successes**
  - Development of **expert systems** and programs for problem-solving and games.

- **1980-1990: Expert systems and AI revival**
  - Commercial and industrial applications emerge.
  - Introduction of **basic machine learning**.

- **2000-today: Modern AI explosion**
  - **Big Data** and increased computing power drive AI growth.
  - Development of **Machine Learning**, **Deep Learning, NLP, Computer Vision and Robotics**.
  - AI becomes ubiquitous in daily life and industry.

# ❖ 3. Types of AI

## ◉ 3.1 Weak AI (Narrow AI)

◉ Designed for **specific tasks only**.

◉ Does not possess general intelligence.

◉ **Examples:**

 **Simple decision system for grading**

```python
def grade_decision(score):
    if score >= 10:
        return "Pass"
    else:
        return "Fail"


print(grade_decision(12))
```

◉ **Explanation**

◉ The system performs **only one task** (pass/fail decision)

◉ No learning, no reasoning

◉ Works only in a **specific context**

◉ This is **Weak AI** because it imitates decision-making without intelligence.

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❖ **3. Types of AI**

◉ **3.2 Strong AI (General AI) :**

◉ **Strong AI** refers to a machine that can:

◉ Understand

◉ Reason

◉ Learn any task

◉ Adapt like a human

◉ Strong AI is a **theoretical concept** and does not exist today.

◉ **Example:** Still theoretical, not yet realized.

## ❖ 3. Types of AI

### ◉ 3.3 Symbolic AI

◉ Based on **logic, rules, and symbols**.

◉ Used in **expert systems** to solve complex problems using predefined rules.

◉ **Example:** University expert system: student orientation

```python
def orientation(avg):
    if avg >= 15:
        return "Scientific Studies"
    elif avg >= 10:
        return "Technical Studies"
    else:
        return "Vocational Training"

print(orientation(14))
```

◉  Rules are clear and explainable

◉ No learning from data

◉ Easy to validate and modify

# ❖ 3. Types of AI

## ◉ 3.3 Symbolic AI

◉ **Example 02:** Logical reasoning (AND operator)

◉

```python
def access_allowed(card, password):
    if card and password:
        return "Access Granted"
    else:
        return "Access Denied"


print(access_allowed(True, True))
```

◉ This represents **logical reasoning**, a core idea of Symbolic AI.

# ❖ 3. Types of AI

## ◉ 3.4 Connectionist AI

◉ **Examples:** Learning a logical AND function using a Perceptron

◉

```python
from sklearn.linear_model import Perceptron

# Input data
X = [[0,0], [0,1], [1,0], [1,1]]
y = [0, 0, 0, 1]


model = Perceptron(max_iter=1000)
model.fit(X, y)


print(model.predict([[1, 1]]))
```

◉ The system **learns from examples**

◉ No IF–THEN rules are written

◉ Knowledge is stored in **weights**

This is **Connectionist AI.**

# 4. Concrete Examples of Artificial Intelligence in Everyday Life

- Artificial Intelligence (AI) is present in many everyday activities. It helps machines perform tasks that normally require human intelligence, such as learning, understanding language, recognizing images, and making decisions.

## Everyday life examples

- **1. Smartphones :** Face recognition (Apple Face ID, Samsung)

- Voice assistants (Siri, Google Assistant),Predictive text and auto-correction

- **2. Online Services :** Recommendations (Netflix, YouTube, Amazon), Email spam detection (Gmail, Outlook)

- **3. Transportation :** GPS traffic prediction (Google Maps, Waze)

- Autonomous driving (Tesla, Waymo) Smart traffic lights.

# 4. Concrete Examples of Artificial Intelligence in Everyday Life

## Everyday life examples

- **4. Healthcare :** Medical image analysis (X-rays, MRI),Predictive analytics (disease risk) ;Robotic surgery

- **5. Education :** Intelligent tutoring systems ,Automatic grading , Learning analytics

- **6. Industry :** Predictive maintenance , Quality control (defective product detection), Warehouse robots (Amazon)

## ⊙ 5. AI Domains

## 5.1 Machine Learning (ML)

- ⊙ **Definition**
  Machine Learning enables computers to learn from data and improve their performance without explicit programming.

- ⊙ **Concrete examples**

- ⊙ Email spam detection

- ⊙ Movie and product recommendation systems

- ⊙ Fraud detection in banking systems

- ⊙

◉ **5. AI Domains**

**5.2 Natural Language Processing (NLP)**

◉ **Definition**
Natural Language Processing allows computers to understand, process, and generate human language.

◉ **Concrete examples**

◉ Voice assistants (Siri, Google Assistant)

◉ Automatic translation systems

◉ Chatbots for customer service

◉

- **5. AI Domains**
- **5.3 Computer Vision (CV)**
- **Definition**
  Computer Vision enables machines to interpret and analyze visual information from images and videos.
- **Concrete examples**
- Face recognition on smartphones
- Traffic sign recognition
- Medical image analysis

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- **5. AI Domains**
- **5.4 Robotics**
- **Definition**
  Robotics combines AI with mechanical systems to create intelligent machines capable of interacting with the physical world.
- **Concrete examples**
- Robot vacuum cleaners
- Industrial robotic arms
- Autonomous delivery robots
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# 5. AI Applications in Different Sectors

## Medicine

- Disease diagnosis support
- Medical image analysis (X-rays, MRI)
- Robot-assisted surgery

## Transportation

- Autonomous vehicles
- Traffic management systems
- Intelligent navigation (GPS)

## Education

- Intelligent tutoring systems
- Automatic exam grading
- Student performance analysis

# 5. AI Applications in Different Sectors

## Industry

- Predictive maintenance of machines
- Quality control using computer vision
- Smart factories and automation

- # 1. Benefits of AI

AI brings many advantages in daily life, industry, and research:

- **a. Efficiency and Automation**
- Automates repetitive tasks (e.g., data entry, manufacturing robots)
- Reduces human effort and time
- **b. Accuracy and Precision**
- High accuracy in medical diagnosis (e.g., detecting tumors)
- Reduces human errors in finance, industry, and transportation

- # 1. Benefits of AI

- ## c. Decision Support

- Helps in complex decisions using data analysis (e.g., predicting student performance or traffic patterns)

- Supports professionals in medicine, engineering, and management

- ## d. Personalization

- Personalized recommendations (Netflix, Spotify, Amazon)

- Tailored education using intelligent tutoring systems

- ## e. Innovation and Discovery

- Accelerates scientific research (e.g., drug discovery using AI models)

- Creates new products and services (e.g., autonomous vehicles)

# 2. Risks and Challenges of AI

Despite its benefits, AI also brings risks and challenges:

◉ **a. Job Displacement**

- Automation may replace some jobs in manufacturing, services, and administration

◉ **b. Bias and Fairness**

- AI systems may inherit biases from training data
- Can lead to unfair or discriminatory decisions (e.g., in hiring or loan approvals)

◉ **c. Privacy Concerns**

- Collection and use of personal data (e.g., surveillance, social media analytics)
- Risk of misuse of sensitive information

- **2. Risks and Challenges of AI**
- **d. Security Risks**
  - AI systems can be attacked or misused (e.g., autonomous cars, drones)
  - Cybersecurity threats with AI-powered hacking
- **e. Dependence and Errors**
  - Over-reliance on AI can be risky if systems fail
  - Errors in AI decisions can have serious consequences (e.g., medical misdiagnosis)
- **f. Ethical and Legal Issues**
  - Who is responsible for AI decisions?
  - Challenges in regulating AI use in society