I. Advantages of Artificial Intelligence (In-Depth Development)

Artificial Intelligence (AI) has become a major driver of technological innovation and socio-economic transformation. Its impact extends beyond the field of computer science to influence all strategic sectors of society.

جامعة بجاية
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First year of Bachelor's degree

Chapter 2 - ADVANTAGES & RISKS of ARTIFICIAL INTELLIGENCE

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SUMMARY

Advantages of AI

- Intelligent Automation and Increased Productivity
- Advanced Data Analysis (Big Data)
- Advances in Healthcare
- Improvement of Educational Systems
- Optimization of Transportation and Smart Cities
- Acceleration of Scientific Research
- Personalization of Digital Services
- Contribution to Sustainable Development

SUMMARY

Risks of AI

- Economic Risks and Labor Market Transformation
- Algorithmic Bias and Discrimination
- Lack of Transparency and the “Black Box” Problem
- Privacy Violations and Mass Surveillance
- Information Manipulation and Disinformation
- Security and Military Risks
- Excessive Dependence and Loss of Human Skills
- Concentration of Technological Power

Advantages of Artificial Intelligence (In-Depth Development)

- Artificial Intelligence (AI) has become a major driver of technological innovation and socio-economic transformation. Its impact extends beyond the field of computer science to influence all strategic sectors of society.

Intelligent Automation and Increased Productivity

One of the primary advantages of AI is its ability to automate repetitive, complex, or large-scale tasks.

- **Benefits:**
  - Reduction of human errors
  - 24/7 operational capability
  - Acceleration of decision-making processes
  - Decrease in operational costs

In industry (Industry 4.0), intelligent systems optimize production lines, detect defects in real time, and anticipate failures (predictive maintenance).

AI does not merely replace human labor; it enhances human capabilities (the concept of “augmented intelligence”).

Advanced Data Analysis (Big Data)

AI systems can process massive volumes of data that are impossible to analyze manually.

- **Applications:**
  - Banking fraud detection
  - Economic forecasting
  - Climate modeling
  - Behavioral analysis

Through machine learning, models learn patterns and improve their performance over time.

AI transforms raw data into actionable knowledge for strategic decision-making.

Advances in Healthcare

The medical sector significantly benefits from AI:

- Imaging-assisted diagnosis (radiology, MRI)
- Early disease detection
- Personalized medicine based on genetic data
- Accelerated drug discovery

AI systems can identify complex correlations invisible to the human eye, contributing to improved diagnostic accuracy.

Improvement of Educational Systems

AI enables:

- Personalized adaptive learning
- Intelligent tutoring systems
- Analysis of student performance
- Early detection of school dropout

It promotes learner-centered education by adapting to each student’s pace & level.

Optimization of Transportation and Smart Cities

- Intelligent traffic management
- Reduction of traffic congestion
- Autonomous vehicles
- Energy consumption optimization

Intelligent systems contribute to more efficient and sustainable mobility.

Acceleration of Scientific Research

AI has become a fundamental tool for:

- Molecular simulation
- Space exploration
- Genomic analysis
- Complex physical modeling

It enables researchers to explore hypotheses faster than traditional methods allow.

Personalization of Digital Services

In commerce and digital platforms:

- Product recommendation systems
- Targeted advertising
- Optimized user experience

This personalization improves user satisfaction and economic efficiency.

Contribution to Sustainable Development

AI can support environmental objectives:

- Energy consumption optimization
- Precision agriculture
- Environmental monitoring
- Intelligent management of natural resources

It enables better resource allocation and waste reduction.

Conclusion

The advantages of AI lie in its capacity to:

- Increase human efficiency
- Improve decision-making accuracy
- Stimulate innovation
- Sustainably transform economic and social systems

However, these benefits can only be fully realized if AI development is guided by responsible and ethical frameworks.

Risks of Artificial Intelligence

- Despite its impressive performance, AI raises major economic, ethical, social, and security concerns. These risks require regulation and multidisciplinary reflection.

Economic Risks and Labor Market Transformation

AI can support environmental objectives:

- Repetitive industrial tasks
- Administrative services
- Call centers
- Transportation (autonomous vehicles)

Associated challenges:

- Technological unemployment
- Growing inequalities between skilled and unskilled workers
- Concentration of wealth within major technology companies

However, AI also creates new professions (data scientist, AI engineer, AI ethicist). The main challenge lies in adaptation and professional reskilling.

Algorithmic Bias and Discrimination

AI systems learn from historical data.

If these datasets contain biases, AI may reproduce or even amplify these injustices.

Examples:

- Automated recruitment favoring certain profiles
- Facial recognition systems with uneven accuracy across groups
- Discriminatory credit-scoring systems

Core issue:

AI is not neutral. It reflects both data and human design choices.

This raises fundamental questions:

- How can fairness be ensured?
- Who is responsible in case of error?

Lack of Transparency and the “Black Box” Problem

Many advanced models (particularly deep learning systems) are difficult to interpret.

Consequences:

- Decisions that cannot be clearly explained
- Difficulty in auditing systems
- Loss of user trust

In sensitive fields such as healthcare, justice, and finance, explainability becomes essential.

Privacy Violations and Mass Surveillance

AI relies on the collection and analysis of vast amounts of data:

- Biometric data
- Behavioral data
- Browsing data
- Images and videos

Risks:

- Generalized surveillance
- Abusive commercial exploitation
- Infringement of individual freedoms

Facial recognition and intelligent tracking systems raise significant societal concerns.

Information Manipulation and Disinformation

Generative systems can produce:

- Deepfakes
- Fake news articles
- Fabricated speeches
- Highly realistic artificial images

Impacts:

- Political manipulation
- Large-scale disinformation
- Erosion of trust in media

The ability to distinguish truth from falsehood becomes a central challenge.

Security and Military Risks

AI can be used in:

- Autonomous weapons
- Automated cyberattacks
- Military surveillance systems

The development of autonomous weapons raises major ethical concerns:

- Who controls the decision to use lethal force?
- Who is responsible in case of error?

Excessive Dependence and Loss of Human Skills

Overreliance on AI may lead to:

- Reduced critical thinking
- Decline in analytical skills
- Automation of moral decision-making

AI should remain a decision-support tool rather than a complete substitute for human judgment.

Concentration of Technological Power

AI development is dominated by a small number of corporations and states.

Possible consequences:

- Geopolitical imbalances
- Data monopolization
- Technological dependency of developing countries

Conclusion

The risks of AI do not imply that its development should be halted, but rather that it must be accompanied by:

- Robust regulatory frameworks
- Promotion of ethical and responsible AI
- Algorithmic transparency
- Digital literacy and public awareness

The challenge of AI is not only technological but profoundly human & societal.

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Prolog
Basic Concepts
COURSE of PROLOG: INTELLIGENCE ARTIFICIELLE (IA)

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FIRST STEPS IN PROLOG

- How it works
- Using it for knowledge bases
- Listes of application

LOGIC PROGRAMMING

- **Origins:**
  - 1970, Marseille, Colmerauer
  - Listes of application
- **Bibliography**
  - L. Sterling, E. Shapiro, The Art of Prolog, Masson
  - Clocksin, Mellish, Programming in Prolog, Eyrolles

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Prolog

What is PROLOG?

PROLOG = **PRO**graming **LOG**ic

* It's a language that is:

- declarative (it describes what, not how)
- based on first-order logic
- widely used in symbolic AI

Application areas:

- Artificial Intelligence,
- Expert systems
- Automated reasoning
- Natural language processing
- Problem solving

THE PROLOG LANGUAGE

- A language for expressing knowledge based on the **language of predicates** (**first order Logic**)

- **Declarative Programming:**
  - The user defines **a knowledge base**
  - **The Prolog interpreter** uses this **knowledge base** to answer **questions**

Constants & Variables

- **Constants**
  - Numbers : 12, 3.5
  - Atoms :
    - Strings of characters beginning with a lowercase letter
    - Strings of characters between " "
    - Empty list []
- **Variables**
  - Strings of characters beginning with a capital letter
  - Strings of characters beginning with _
  - The variable "indeterminate" : _

A Prolog program consists of:

Facts

Horn's clause reduced to a positive literal

P(…), where P is a predicate.

father(ali,meziane). father(larbi,saadi).

Rules

Complete Horn clause

P(…) :- Q(…), … , R(…).

grand_father(X, Y) :- father(X,Z), father(Z,Y).

Questions

Horn clause without positive literal

father (ali,X), mother(ania,X).

father(ali,X). mother(ania,X).

Facts

A fact describes a truth.

Syntax: fact

Example: man (ali).

woman (sara).

parent (sli, ahmed).

parent (sara, ahmed).

* ali is a man

* ali is ahmed's parent

Rules

A **rule** allows us to deduce new knowledge.

Syntax

```
conclusion :- condition1, condition2.
```

Example

```
father(X, Y) :-
     man(X),
     parent(X, Y).
```

X is the father of Y **if** :

- X is a man

  X is a parent of Y

Requests (questions)

Requests are submitted to the system **Prolog**.

Example

```
father(ali, ahmed).
```

Answer :

```
true. %We have this fact.
```

Example

```
father(leila, ahmed).
```

Answer :

```
false.%We have not this fact.
```

Variables

- Begining with a **capital letter**
- Representing unknown values

Example

```
?- parent(X, ahmed).
```

Answer :

```
X = ali ;
X = sara.
```

The inference mechanism

Prolog uses:

- **Unification**
- **Backtracking**
  - **It tries:**

1. **a solution**
2. **if unsuccessful → backtracking**
3. **searches for another solution _**

Factorial

```
fact(0,1).
fact(N,F) :- N > 0, N1 is N-1, fact(N1,F1),
             F is N * F1.
```

Testing :

?- fact(0,F). F = 1.

?- fact(1,F). F = 1.

?- fact(2,F). F = 2.

?- fact(3,F). F = 6.

?- fact(4,F). F = 24.

?- fact(5,F). F = 120.

Member of a list

```
member(X,[X|_]).
member(X,[_|T])  :-
     member(X,T).
```

Testing :

```
?- member(b,[a,b,c]).
true.
```

Sum of a list

```
sum([],0).
sum([H|T],S) :-
     sum(T,S1),
     S is H + S1.
```

Testing :

```
?- sum([5,11,25], S).
S = 46.
```

Maximum

```
max([X],X).
max([H|T],M)  :-
      max(T,M1),
       (H > M1  -> M = H  ;
        M = M1).
```

Testing :

```
?- max([6,15,3],M).
M = 15.
```

How do we run a program?

Step 1 — Write the program

1.-Open an editor

You can use :

- **Notepad (Bloc-notes)**
- **Notepad++**
- **VS Code (better)**

2.- Write a short program ‘test.pl’

Example : test.pl

```
% Facts
man(ali).
man(karim).
woman(sara).
 % Rules
father(X,Y) :-
    man(X),
    parent(X,Y).
 parent(ali, karim).
```

3.- Save the file

Important :

. Name : test.pl

. Type : **All the files**

. Encodage : UTF-8

. Extension : .pl

P.S. : Do Not Save in **‘.txt’**

Step 2 — Launching SWI-Prolog

We have two possibilities:

- **Method 1 (easy)**

1. Click on SWI-Prolog
2. A black window will open:

?-

Method 2 (command line)

In the folder where your file is located:

swipl

Step 3 — Load the file

In Prolog:

?- [test].

or

?- consult('test.pl').

If all goes well:

true.

Step 4 — Run a query

Example:

?- man(ali).

Answer :

true.

Or :

?- man(X).

Result :

X = ali ;

X = karim.

The ';' allows you to search for another solution

Step 5 — Modifying the program

If you modify the file:

1. Save

2. Reload in Prolog:

?- make.

or

?- [test].

Example AI

```
fact(0,1).
fact(N,F) :-    N > 0,     N1 is N-1,
   fact(N1,F1),     F is N * F1.
```

Testing :

?- fact(5,F).

Result :

F = 120.

Common Mistakes

1. Forgetting the period at the end
2. Using a capital letter in the wrong place
3. Saving as a .txt file
4. Not reloading after editing