جامعة بجاية
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Computer Science Department
First year of Bachelor's degree

Chapter 2 - AI for Document Retrieval

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Introduction

- **Literature review** is a **key step** in any **scientific project**.

With the rise of **AI**, it is **now** possible to automate and optimize **many tasks** related to the **collection**, **analysis** & **synthesis** of scientific information.

This chapter :

- **presents AI-based tools**,
- **explains how to write intelligent** queries,
- automatically **summarize articles**, and
- critically **evaluate** the **sources suggested** by these **tools**.

Presentation of AI tools

Several platforms use **AI** to facilitate **documentary research** :

Elicit : allows you to automatically **extract** key information from scientific publications, **generate** summaries, and **suggest** relevant articles

Scopus AI : Integrated into the Scopus database, it helps **analyze** publications, **identify** scientific trends, and **recommend** articles for further exploration of a topic

Web of Science Research Assistant : This intelligent assistant **suggests** relevant articles, **creates** reference lists, and **allows** you to quickly filter results based on **quality**, **impact**, and **relevance**

Designing Smart Requests

To get the most out of **AI tools**, it is essential to know how to write **effective queries** :

- **Define precise** & **relevant keywords** for the **research topic**

- **Use advanced filters** (dates, publication types, scientific field)

- **Combine keywords** with **logical operators** (**AND**, **OR**, **NOT**) to **refine** the results

- **Test** different **formulations** & **adjust** the **queries** based on the **results obtained**

Automated Abstract of Scientific Articles

AI makes it possible to **quickly generate summaries** of **large articles** :

- **Identification** of **key points** and **main conclusions**

- **Creating** **comparative summaries** when several articles deal with the same subject

- **Saving** **time** for **researchers** wishing to focus on **critical analysis** rather than exhaustive reading

Critical Evaluation of AI Proposed Sources

Even though **AI** is very useful, it's **important** to **verify** the **quality** of the **sources**:

- **Check** the **reliability** and **credibility** of the **suggested articles**

- **Analyze** the **potential biases** of the **AI tool** (e.g., some platforms favor certain publishers or disciplines)

- **Select** only the **relevant** & **rigorous sources** for the **scientific project**

Conclusion

AI is **transforming** **information retrieval** by offering **powerful tools** for information gathering and analysis.

However, the researcher's role **remains** **crucial** in

- **formulating** the **right queries**,
- **interpreting** **results**, and
- **selecting** **reliable sources**.

By combining **AI** with a **critical approach**, it is possible to significantly **improve** the **quality** & **efficiency** of **scientific research**.

How use Elicit?

What is Elicit?

Elicit is an **AI Tool** that **enables** to :

- **Retrieve Relevent Scientific Articles**

- **Abstract Publications**

- **Extract Key information** :
  - * **Methodology**,
  - * **Results**,
  - * **Echantillon**,
  - * **etc**.

- **Automatically compare** many **studies**

Unlike Google Scholar, **Elicit** does more than just display links :

☞ it **Analyzes** **Contents** of **Articles** and **Extract** **Important Information**

Steps of Utilisation

Step 1 : Formulate a Net Question

Elicit method **works** **best** with a **specific question**, and not just with **keywords**

Bad Example:

- Artificial Intelligence education

Good Example:

- What is the impact of artificial intelligence on student academic performance in higher education?

Step 2 : Launching the Research

While input the question :

- **Elicit displays** a List of **Relevent Scientific Articles**, **generating** a table containing :
  - Title
  - Year
  - Type of study
  - Methodology
  - Main Results
  - Automated Abstract

Step 3 : Analysizing & Comparing

We can:

- Add Columns (such as: sample size)

- Sort studies by date

- Comparing the results

- Export data

Concrete Example

Imagine you are preparing an Article :

The impact of deep learning on epidemiological surveillance

In **Elicit**, we put the following question :

How does deep learning improve infectious disease surveillance systems?

Article	Method	Data	Main Result
Study A (2023)	CNN	Twitter data	Early detection 2 weeks before official reports
Study B (2022)	LSTM	Hospital data	18% improvement in accuracy
Study C (2021)	Hybrid DL	Multi-source data	Reduction of the alert period

In some minutes, we obtain:

- A Comparative view

  Methodological trends

  Calculated performance

  The limitations mentioned

Without reading all 30 articles manually

Why it is Stong for Researchers ?

- ✓ Huge time saving
- ✓ Can Structure a Literature Review
- ✓ Enabling quick identification of gaps
- ✓ Ideal for preparing an introduction or a state-of-the-art review

Important Limitations

- ✓ **Elicit** does not replace reading the articles in their entirety
- ✓ It can summarize in simplified terms
- ✓ **It must always check the original sources**

PS:

Always Check the Original Sources

Practical Exercise
Using Elicit for AI-assisted scientific research

Educational objectives

At the end of this exercise, the student will be able to :

- **Formulate** a precise research question
- **Use Elicit** to identify relevant scientific articles
- **Compare** multiple studies
- **Summarize** and critically **analyze** results
- **Evaluate** the reliability of sources suggested by AI

Part 1: Formulation of the question

Instructions

Choose a theme related to artificial intelligence

Examples of themes

- AI and academic performance

Deep learning and public health

AI and climate change

Generative AI and education

Formulate a clear scientific question

PS: Formulate a clear scientific question

Formulate a clear scientific question

❌ **Bad example:**

- Artificial Intelligence in health

✅ **Good example**

- How does deep learning improve early detection of infectious diseases?

✍ **Task**

- Write the question
- Justify why it is clear and precise (5–6 lines)

Part 2: Search with Elicit

Instructions

1. Log in to Elicit (www.Elicit.com)

2. Enter your question

3. Select the 5 most relevant articles

Complete the following table

Article	Year	Used Method	Data Type	Main Result	Limitations

Part 3: Comparative Analysis

Answer the following questions :

1. **Which AI method is most frequently used?**
2. **Are the results consistent across studies?**
3. **Are the sample sizes sufficient?**
4. **Are there any contradictions?**
5. **Which study seems the most robust? Why?**

(1-2 pages maximum)

Part 4: Critical evaluation of AI

Answer :

1. Are the summaries generated by Elicit complete?

2. Did you find any missing information after checking?

3. Did Elicit suggest any irrelevant articles?

4. Can the tool be trusted blindly? Justify your answer.

Part 5: Mini-Summary

Write a 300–400 word summary:

- Summarize the main trends
- Indicate the identified limitations
- Suggest a direction for future research

Evaluation methods (example)

Criteria	Points
Quality of the question	/4
Relevance of the selected articles	/4
Comparative analysis	/6
Critical thionine	/4
Editorial quality	/2
Total	/20

Advanced Exercise

Methodological Evaluation of an AI Tool for Systematic Review (Elicit)

General objective

To scientifically evaluate the performance of Elicit in the context of a structured literature review and analyze its methodological limitations

Context

AI tools are now assisting literature searches.

But can they be considered reliable for rigorous scientific review?

Your mission is to conduct a comparative methodological mini-review.

Part 1: Protocol definition (research level)

Instructions

Choose a specific research question

Examples of themes

The question must be formulated according to a scientific structure :

- PICO (Population – Intervention – Comparison – Outcome)

or

- SPIDER (qualitative)

Example

- In low-resource healthcare settings, does deep learning improve early detection of infectious diseases compared to traditional statistical models?

Required Tasks

- Justify the choice of wording
- Identify the keywords
- Define inclusion and exclusion criteria

Part 2: Comparative Search (Elicit vs. Traditional Method)

Step A: Search with Elicit

- Enter the complete query
- Export the first 15 articles returned
- Identify:
    - o Source database
    - o Year
    - o Journal impact factor
    - o Study type (experimental, review, meta-analysis, etc.)

•Step B: Manual Search

Perform the same search on:

- Google Scholar, or
- Scopus, or
- Web of Science, With:
    - Clear Boolean strategy
    - Identical time filtering

Part 3: Quantitative Analysis

Compare:

Criteria	Elicit	Classic search
Number of relevant articles		
Duplicates		
Off-topic articles		
Time required (minutes)		
Access to full text		

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

Facts

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Syntax: fact

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Statistical analysis required

- Calculate the relevance rate
- Calculate the false positive rate
- Analyze thematic coverage

Part 4: In-depth qualitative analysis

Answer the following questions:

1. **Does Elicit bias the results towards certain disciplines?**

2. **Is there a geographical bias?**

3. **Are very recent articles correctly identified?**

4. **Does the tool favor certain methodological approaches?**

5. **Does the algorithm appear transparent?**

Part 5: Critical Audit of AI

Analyze:

- **Risk of algorithmic bias**
- **Risk of omitting major articles**
- **Reproducibility of results**
- **Problem of dependence on indexed databases**

Part 5: Scientific report (8–12 pages)

Expected structure:

1. **Introduction**
2. **Methodology**
3. **Quantitative results**
4. **Qualitative results**
5. **Critical discussion**
6. **Limitations**
7. **Conclusion**

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

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Academic year : 2025 - 2026

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