THÈSE DE DOCTORAT

DE L'ÉTABLISSEMENT UNIVERSITÉ DE TECHNOLOGIE DE BELFORT-MONTBÉLIARD

École doctorale n°37

Sciences Physiques pour l'Ingénieur et Microtechniques

Doctorat d'Intelligence Artificielle

par

FIRSTNAME LASTNAME

Titre en francais

Subtitle

Thèse présentée et soutenue à Belfort, le 20 avril 2025

Composition du Jury :

HULK INCROYABLE	Professeur à l'Université de Gotham City Commentaire secondaire	Président
AMERICA CAPTAIN	Professeur à l'Université USA	Rapporteur
MAN SUPER	Professeur à l'Université de Gotham City	Examinateur
M. MAN BAT	Professeur à l'Université de Gotham City	Directeur
M. VOLWERINE THE	Professeur à l'Université de Gotham City	Co-Directeur
Mme MAN PAC	Professeure quelque part	Invité

N° X X X

DOCTORAL THESIS

OF BELFORT-MONTBÉLIARD UNIVERSITY OF TECHNOLOGY

Doctoral School #37

Physical Sciences for Engineering and Microtechnologies

Doctor in Artificial Intelligence

by

FIRSTNAME LASTNAME

Title in English

Subtitle

Thesis defended the April 20, 2025 at Belfort

Doctoral Committee Members:

HULK INCROYABLE	Professor at Gotham City University	President
	Additional comment	
AMERICA CAPTAIN	Professor at USA University	Reviewer
MAN SUPER	Professor at Gotham City University	Examiner
M. MAN BAT	Professor at Gotham City University	Director
M. VOLWERINE THE	Professeur à l'Université de Gotham City	Codirector
Mme MAN PAC	Professor somewhere	Invitee

N° X X X

ACKNOWLEDGEMENTS

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RÉSUMÉ LONG

You must write here a long summary of your PhD thesis in French language. According to the SPIM rules, the length of this long summary must be of minimum 3 pages for people who is not native-french speaker, and of minimum 20 pages for who is native-french speaker.

ACRONYMS

- **MAS:** Multi-Agent System

I

Context and Issues

1

Introduction

This is an acronym: Multi-Agent System (MAS). This is the same acronym: MAS.

Research Question 1 (RQ1) – a name

Description of the research question.

Objective 1 (O1) – a name

Description of the objective.

Contribution 1 (C1) – a name

Description of the contribution.

1.1 Context

This template describes some elements that can help you write your thesis. A typical outline for a scientific thesis is also proposed.

1.2 Thesis Objectives

The main objective of your thesis can be highlighted using the environment below:

Propose a model that does something!

1.3 Thesis Outline

2

State of the Art

2.0 Contents

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To help you write your thesis, several tools are described below. Many other macros are available in the LaTeX package set `tex-upmethodology` on which the style of this thesis is based. Examples include environments for automatically creating subfigures and macros for defining unnumbered sections that appear in the table of contents.

2.1 Propose a Definition

Definition 1 illustrates the proposal of a definition.

Definition 1: A Thesis

Document presented to a university jury for obtaining a doctorate.

2.2 Include a Figure

Including a figure is done using standard LaTeX tools (environment `figure`, `\includegraphics`, etc.).

We propose a macro to simplify the inclusion of a figure.

```
\mfigure[position]{options}{filename}{title}{labelid}
```

This is equivalent to (note the addition of `fig:` as a prefix to the label):

```
\begin{figure}[position]
 \begin{center}
  \includegraphics[options]{filename}
  \label{fig:labelid}
  \caption{title}
 \end{center}
\end{figure}
```

Referencing the figure can be done using the macros:

```
\figref{labelid}
\figpageref{labelid}
```

2.3 Include a Table

Including a table is done using standard LaTeX tools (environment `table`, environment `tabularx`, etc.).

We propose a macro to simplify the inclusion of a table.

```
\begin{mtable}[options]{width}{numberofcolumns}{columnspec}{title}{labelid}
 content
\end{mtable}
```

This is equivalent to (note the addition of `tab:` as a prefix to the label):

```
\begin{table}[options]
 \begin{center}
  \begin{tabularx}{width}{columnspec}
   content
  \end{tabularx}
  \label{tab:labelid}
  \caption{title}
 \end{center}
\end{table}
```

Referencing the table can be done using the macros:

```
\tabref{labelid}
\tabpageref{labelid}
```

2.3.1 Example 1

Table 2.1 is an example of a table with 4 columns, with a title added at the top.

Col1	*Col2*	*Col3*	*Col4*
a	b	c	d
e	f	g	h

Table 2.1: Table Title

2.3.2 Example 2

Table 2.2 is an example of a table with 5 columns, with the table title also added at the top.

Col1	*Col2*	*Col3*	*Col4*	*Col5*
a	b	c	d	x
e	f	g	h	z

Table 2.2: Table Title
Source:This is a source

2.4 Inline Enumeration

You can enumerate elements in a paragraph: *(i)* element 1, *(ii)* element 2, *(iii)* element 3;and continue your text.

2.5 Description

The `description` environment provided by LaTeX has been extended:

- **Element 1:** Text 1
- **Element 2:** Text 2
- **Element 3:** Text 3

Omitting an item header is not a problem:

- **Element 1:** Text 1
- Text 2
- **Element 3:** Text 3

2.6 Enumeration

The `enumerate` environment provided by LaTeX has been extended to combine the advantages of the `enumerate` and `description` environments in a single LaTeX environment:

1. **Element 1:** Text 1
2. **Element 2:** Text 2

3. Element 3: Text 3

You can specify the type of enumeration by switching to Arabic numerals:

1Element 1: Text 1

2Element 2: Text 2

3Element 3: Text 3

Or in Roman numerals:

iElement 1: Text 1

iiElement 2: Text 2

iiiElement 3: Text 3

Or in alphabetical numerals:

aElement 1: Text 1

bElement 2: Text 2

cElement 3: Text 3

Omitting an item header is not a problem:

1. Element 1: Text 1

2. Text 2

3. Element 3: Text 3

2.7 Format Text

You can place text $^{\text{as a superscript}}$. You can place text $_{\text{as a subscript}}$.

You can highlight text, or highlight it **even more**.

You can format people's names uniformly, for example STÉPHANE GALLAND (other macros are available).

2.8 Mathematical Symbols

- $\mathbb{R}$
- $\mathbb{N}$
- $\mathbb{Z}$
- $\mathbb{Q}$
- $\mathbb{C}$
- $\mathcal{P}a$
- $\mathrm{sgn}(a)$
- $\min(a, b)$
- $\max(a, b)$

2.9 Theorems

You can define your own environment to describe a theorem, lemma, etc. This type of environment must be declared in the preamble of your document with the macro `\declareupmtheorem` (see the example in the preamble of this template).

My Theorem 1: Some Theorem

This is the description of this theorem.

This is my optional source

At the end of your document, you can then add a chapter listing the theorems present in your document: `\listofmytheorems`

2.10 Conclusion

II

Contribution

3

Contribution

3.1 Introduction

3.2 Details of the Contribution

3.3 Conclusion

4

IMPLEMENTATION

4.1 Introduction

4.2 Presentation of the Implementation

4.3 Experimental Results

4.4 Conclusion

III

Conclusion

5

General Conclusion

5.1 Summary

5.2 Perspectives

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IV

APPENDICES

A

First Appendix Chapter

B

Second Appendix Chapter

Document generated with LaTeX, the LaTeX template for PhD dissertations https://www.arakhne.org/latex/tex-templates and the `tex-upmethodology` suite http://www.arakhne.org/tex-upmethodology

SPIM

Title: Title in English

Keywords: Keyword 1, Keyword 2

Abstract:

This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English. This is the abstract in English.

Titre : Titre en francais

Mots-clés : Mot-clé 1, Mot-clé 2

Résumé :

Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français. Ceci est un résumé en français.

Université de Technologie de Belfort Montbéliard
90010 Belfort cedex, France