

Corso di Laurea in Ingegneria e Scienze Informatiche

# Integrazione di RAG e LLM nello Sviluppo del Software

Tesi di laurea in:  
PROGRAMMAZIONE AD OGGETTI

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# Abstract

Max 2000 characters, strict. La Retrieval-Augmented Generation (RAG) è il processo di ottimizzazione dell'output di un modello linguistico di grandi dimensioni, per permettergli di utilizzare una base di conoscenza autorevole al di fuori delle sue fonti di dati di addestramento prima di generare una risposta. I modelli linguistici di grandi dimensioni (LLM) vengono addestrati su vasti volumi di dati e utilizzano miliardi di parametri per generare output originali per attività come rispondere a domande, tradurre lingue e completare frasi. La RAG estende le capacità già avanzate degli LLM a domini specifici o alla knowledge base interna di un'organizzazione, il tutto senza la necessità di riaddestrare il modello. È un approccio conveniente per migliorare l'output LLM in modo che rimanga pertinente, accurato e utile in vari contesti.

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*A Giulia ed ai miei figli grazie di tutto. Non arrendetevi mai e sempre con  
entusiasmo impegnatevi per realizzare tutti i vostri sogni.*

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# Contents

<b>Abstract</b>	<b>iii</b>
<b>1 Introduzione</b>	<b>1</b>
1.1 Essere programmatori nel 2025 . . . . .	1
<b>2 State of the art</b>	<b>3</b>
2.1 Some cool topic . . . . .	3
<b>3 Contribution</b>	<b>5</b>
3.1 Fancy formulas here . . . . .	5
	<b>7</b>
<b>Bibliography</b>	<b>7</b>

## CONTENTS

---



---

# List of Figures

2.1	Some random image . . . . .	3
-----	-----------------------------	---

## LIST OF FIGURES

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# List of Listings

listings/HelloWorld.java . . . . .	5
------------------------------------	---

## LIST OF LISTINGS

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# Chapter 1

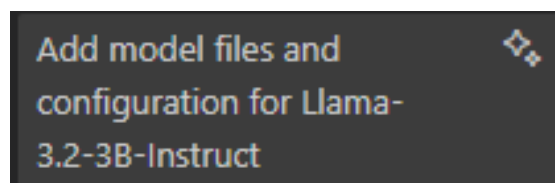
## Introduzione

Write your intro here. \_\_\_\_\_

**Bollini Simone:** Add sidenotes in this way. They are named after the author of the thesis

### 1.1 Essere programmatori nel 2025

È il 05 Gennaio 2025, e lavorando utilizzando **Visual Studio Code** dove ho appena eseguito il Pull di modifiche fatte nel mio progetto salvato su Github, queste modifiche però sono state fatte utilizzando COLAB perchè la memoria disponibile in locale non è sufficiente per processare il codice, ora essendo presenti anche cambiamenti in locale mi preparo ad eseguirne il Commit. Le modifiche sono di qualche giorno fa ed il mio obiettivo è solo allinearli, non è per me importante impostare con accuratezza la destrizione al Commit, per questo provo ad utilizzare la funzione di **Github Copilot** 'Generate Commit Message with Copilot' ottenendo il seguente risultato:



```
Add model files and  
configuration for Llama-  
3.2-3B-Instruct
```

Ho accettato quanto proposto ed eseguito il Commit. Quanto è riuscito a fare Copilot è strabiliante e allo stesso tempo un poco avvilente, in pochi istanti ha analizzato il contesto dando come output una risposta semplice ma coerente rispetto

a quanto cambiato. Lavorare in questo modo mi ricorda quando diversi anni fa, compilando La settimana enigmistica, cercavo di risolvere **senza nessun aiuto** i vari cruciverba ma avendo sempre la consapevolezza di poter guardare la soluzione se necessario.

L'intelligenza artificiale sta rivoluzionando il modo in cui il software viene sviluppato, dando la possibilità a strumenti come Copilot di esplodere tutto il loro potenziale permettono di creare la spina dorsale di un progetto lasciando al programmatore il compito di verificare e correggere solo in parte il codice perché indirizzati e condizionati da quanto proposto. In progetti complessi questo non riduce il ruolo del programmatore, anzi lo eleva a compiti più precisi e complessi lasciando la stesura di parti del codice semplici e ripetitive al software stesso. Sapere cosa chiedere e formulare correttamente le domande al LLM è fondamentale, non dando nulla per scontato esplicitando nel dettaglio con parole chiave mirate come deve essere realizzato il codice. Altro compito complesso per il programmatore è non farsi troppo ammaliare dalle soluzioni proposte perché non sempre necessarie per quanto richiesto oppure diversa da quanto già conosciuto per realizzare una determinata funzione. Conoscere nuovi modo di operare è molto stimolante ma comporta test e tempo che a volte non è sempre disponibile. Il programmatore deve sempre cercare di avere il giusto controllo del progetto accettando generazione del codice automatica solo dove consapevole di quanto proposto e gestibile anche in casi di revisione e manutenzione.

### Structure of the Thesis

**Bollini Simone:** At the end, describe the structure of the paper

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# Chapter 2

## State of the art

I suggest referencing stuff as follows: fig. 2.1 or Figure 2.1

### 2.1 Some cool topic

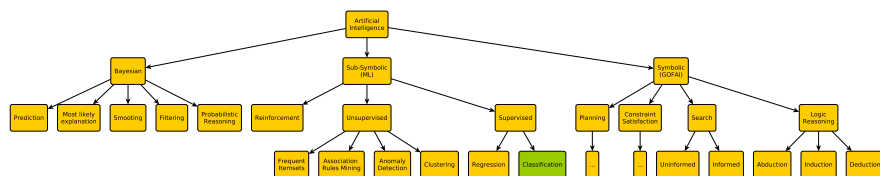


Figure 2.1: Some random image





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# Chapter 3

## Contribution

You may also put some code snippet (which is NOT float by default), eg: chapter 3.

### 3.1 Fancy formulas here

```
1 public class HelloWorld {
2     public static void main(String[] args) {
3         // Prints "Hello, World" to the terminal window.
4         System.out.println("Hello, World");
5     }
6 }
```



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# Acknowledgements

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