

# Software Analysis, Design, and Implementation: Enhancing Public Administration Services through Software Solutions

Facoltà di Ingegneria dell'Informazione, Informatica e Statistica  
Corso di Laurea in Informatica Applicata e Intelligenza Artificiale



**SAPIENZA**  
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# Introduction

- Italian multinational company
- Parent to so many **Subsidiaries**
  - Whitehall Reply

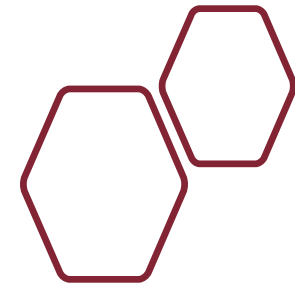
## Company Overview stats (2022)

People	14,300+
Nationalities	38
Partnerships with Universities	152
Net Zero Goal	2030
Revenue (2021)	1.48 billion

## Competitions in AI & ML



- Conducts **consulting services**, **Developing solutions/systems**, **Execution of extensive application projects for Public administration**
- The company's specialties encompass:
  - Big Data & Open Data
  - Data Broker
  - Blockchain
  - Cloud Computing
  - Public Data Services
  - Metaverse
  - **Web Application**
  - **Artificial Intelligence**
  - **Machine Learning**



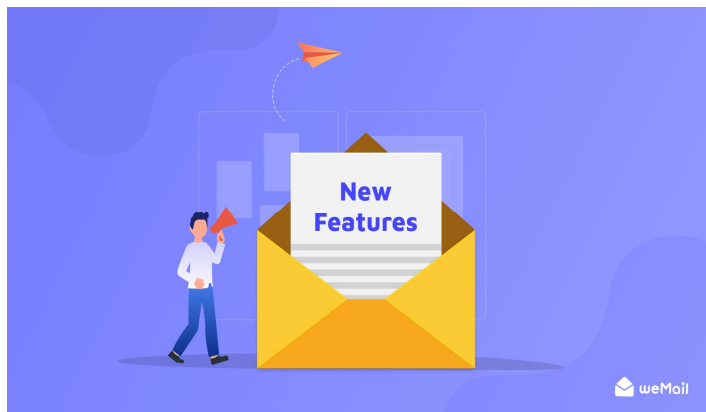
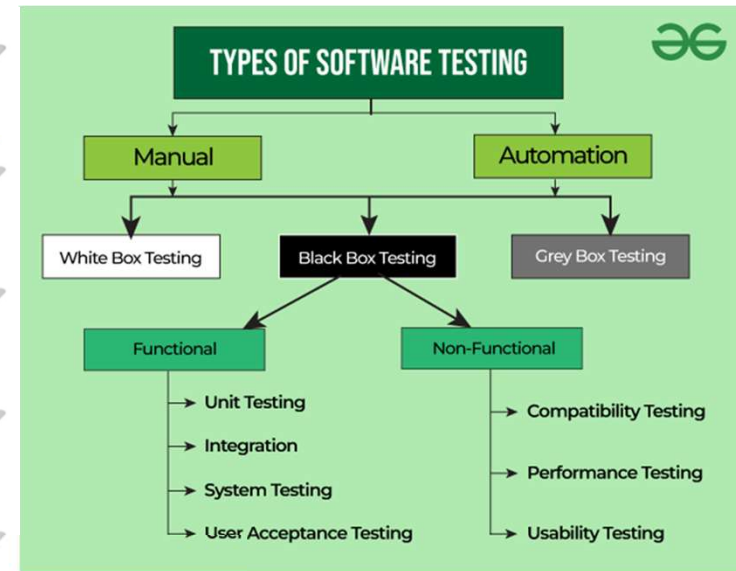
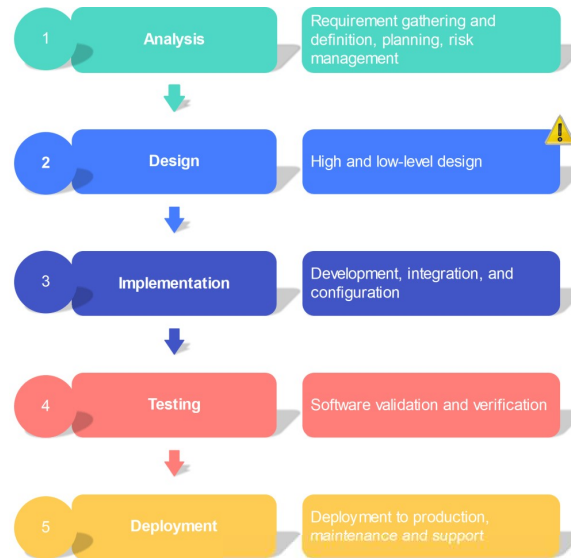


# SOFTWARE DEVELOPMENT

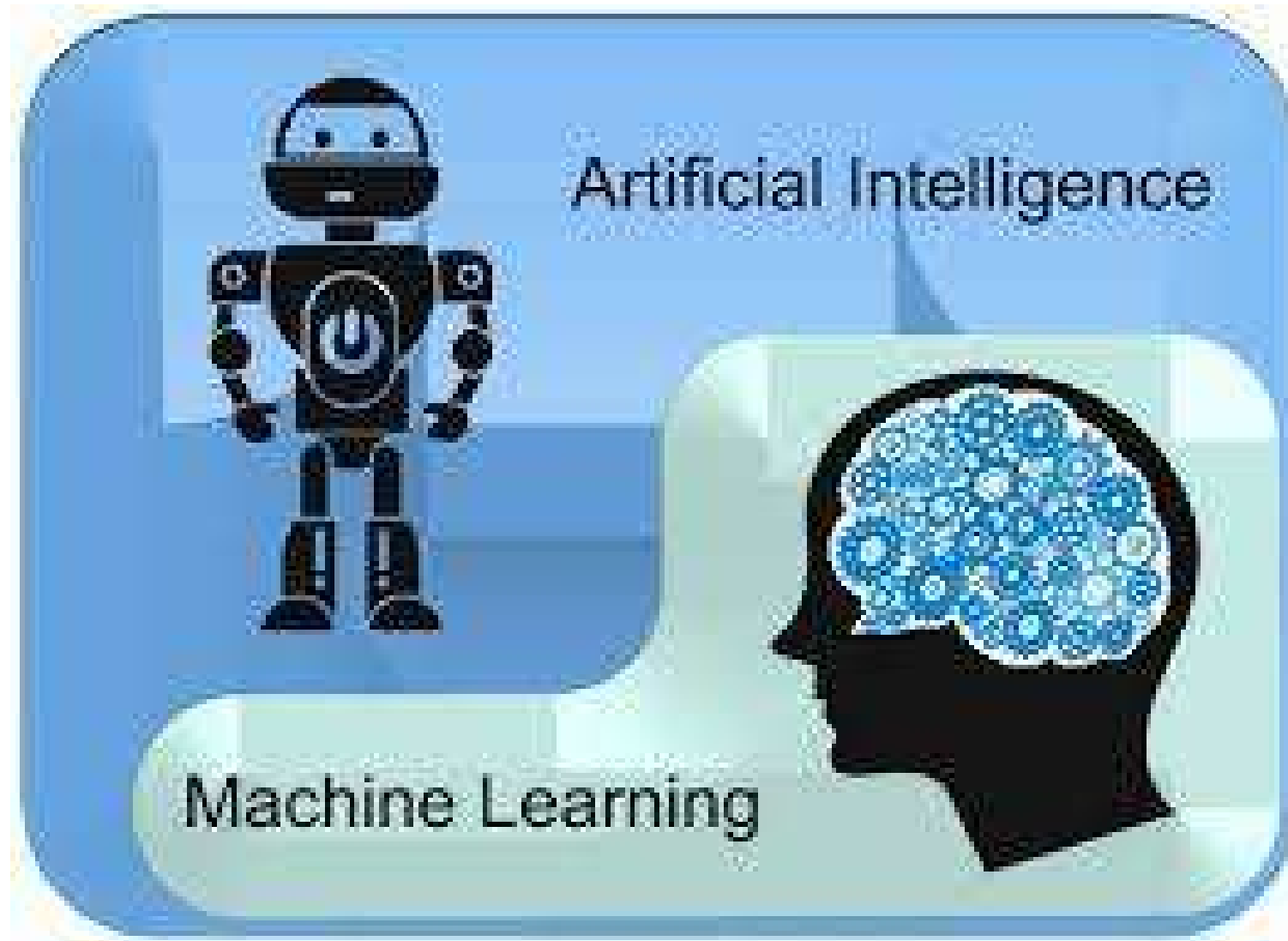


# Software Development

- Requirements analysis, Software solutions design, and Implementation of very large projects
- Test development
  - Ensuring reliability and quality of software components
- New features and functionalities
  - Multi-Language Support
  - Accessibility Features for disables

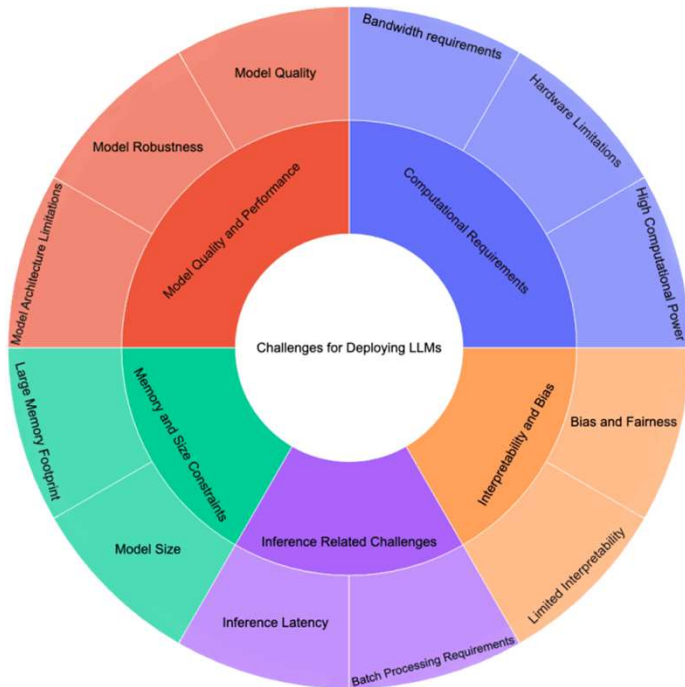


# Artificial Intelligence (AI) and Machine Learning (ML)

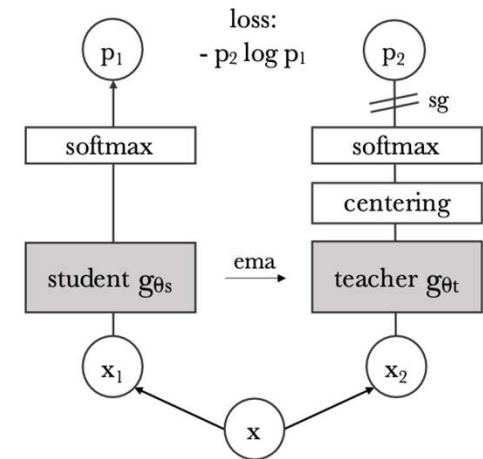
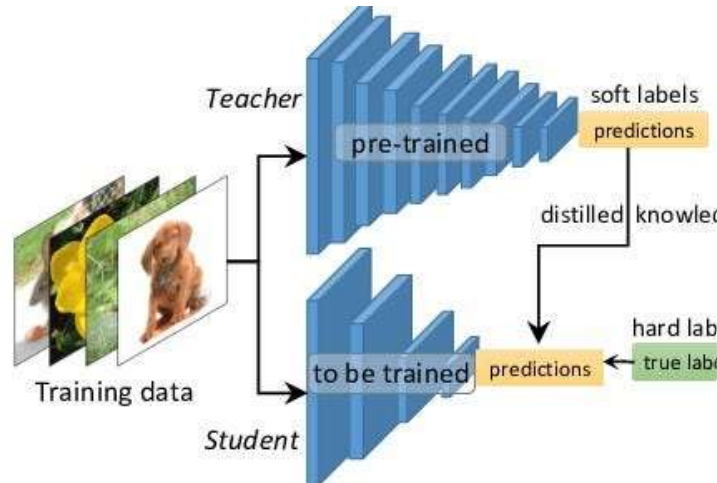


# Research

- Cutting-edge models and their intricacies



- Studying model architectures, algorithms
  - Grounding Dino → next slides
  - Knowledge Distillation
    - Reduces computational requirements
    - Suitable for deployment on resource-constrained devices

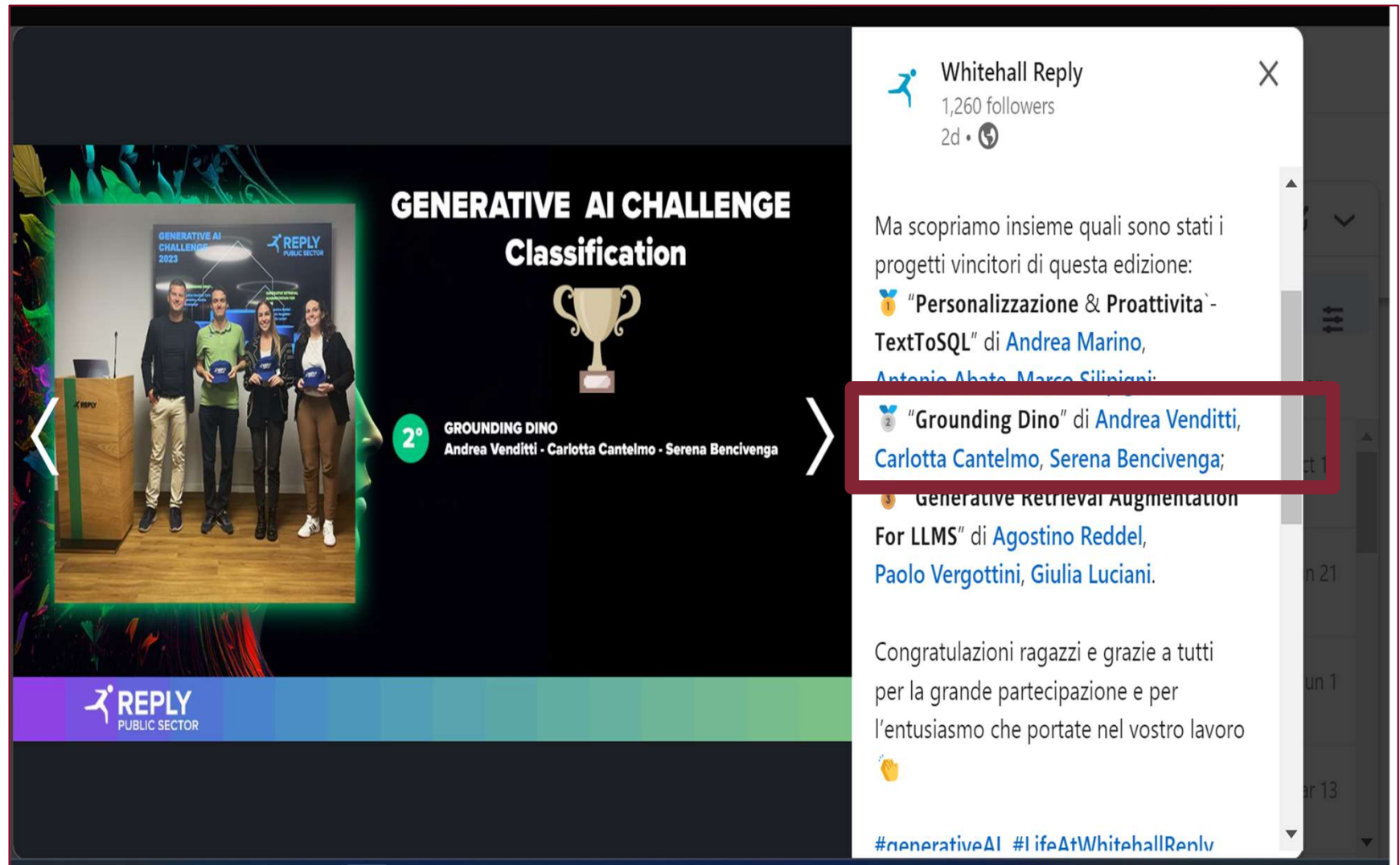


Teacher teaches Student in replicating its decision-making processes

- Easily digestible documentation
- Knowledge sharing



# Implementation



The image is a screenshot of a social media post from 'Whitehall Reply'. The post features a large graphic titled 'GENERATIVE AI CHALLENGE Classification'. On the left of the graphic is a photo of four people (three men and one woman) standing on a stage, holding blue award plaques. To their right is a large gold trophy icon. Below the trophy, the text reads '2° GROUNDING DINO' followed by the names 'Andrea Venditti - Carlotta Cantelmo - Serena Bencivenga'. The background of the graphic is dark with green and blue abstract patterns. At the bottom left of the graphic is the 'REPLY PUBLIC SECTOR' logo. The social media post itself is from 'Whitehall Reply', which has 1,260 followers and posted 2 days ago. The text of the post says: 'Ma scopriamo insieme quali sono stati i progetti vincitori di questa edizione: 1° "Personalizzazione & Proattività - TextToSQL" di Andrea Marino, Antonio Abate, Marco Silipigni; 2° "Grounding Dino" di Andrea Venditti, Carlotta Cantelmo, Serena Bencivenga; 3° "Generative Retrieval Augmentation For LLMS" di Agostino Reddel, Paolo Vergottini, Giulia Luciani. Congratulazioni ragazzi e grazie a tutti per la grande partecipazione e per l'entusiasmo che portate nel vostro lavoro'. The post ends with the hashtags '#generativeAI' and '#lifeAtWhitehallReply'.

**Whitehall Reply**  
1,260 followers  
2d • 🌐

Ma scopriamo insieme quali sono stati i progetti vincitori di questa edizione:

1° "Personalizzazione & Proattività - TextToSQL" di [Andrea Marino](#), [Antonio Abate](#), [Marco Silipigni](#);

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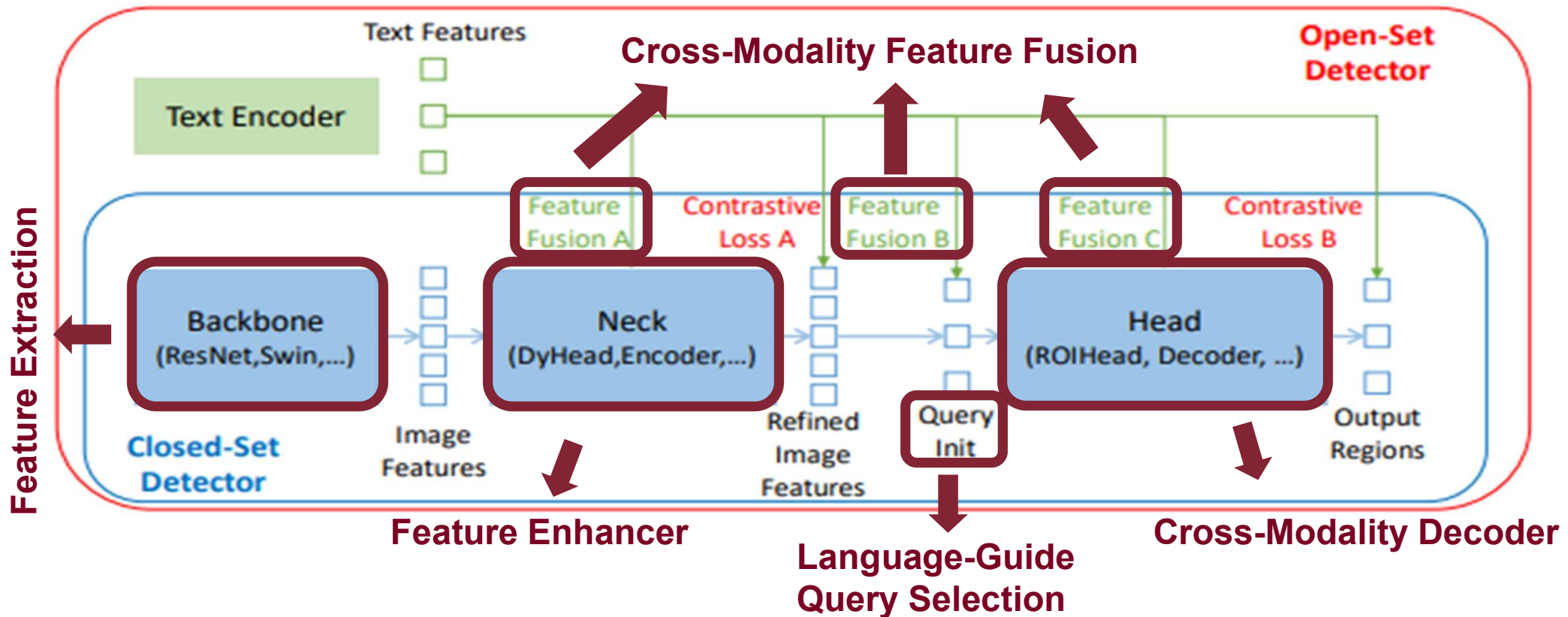
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#generativeAI #lifeAtWhitehallReply

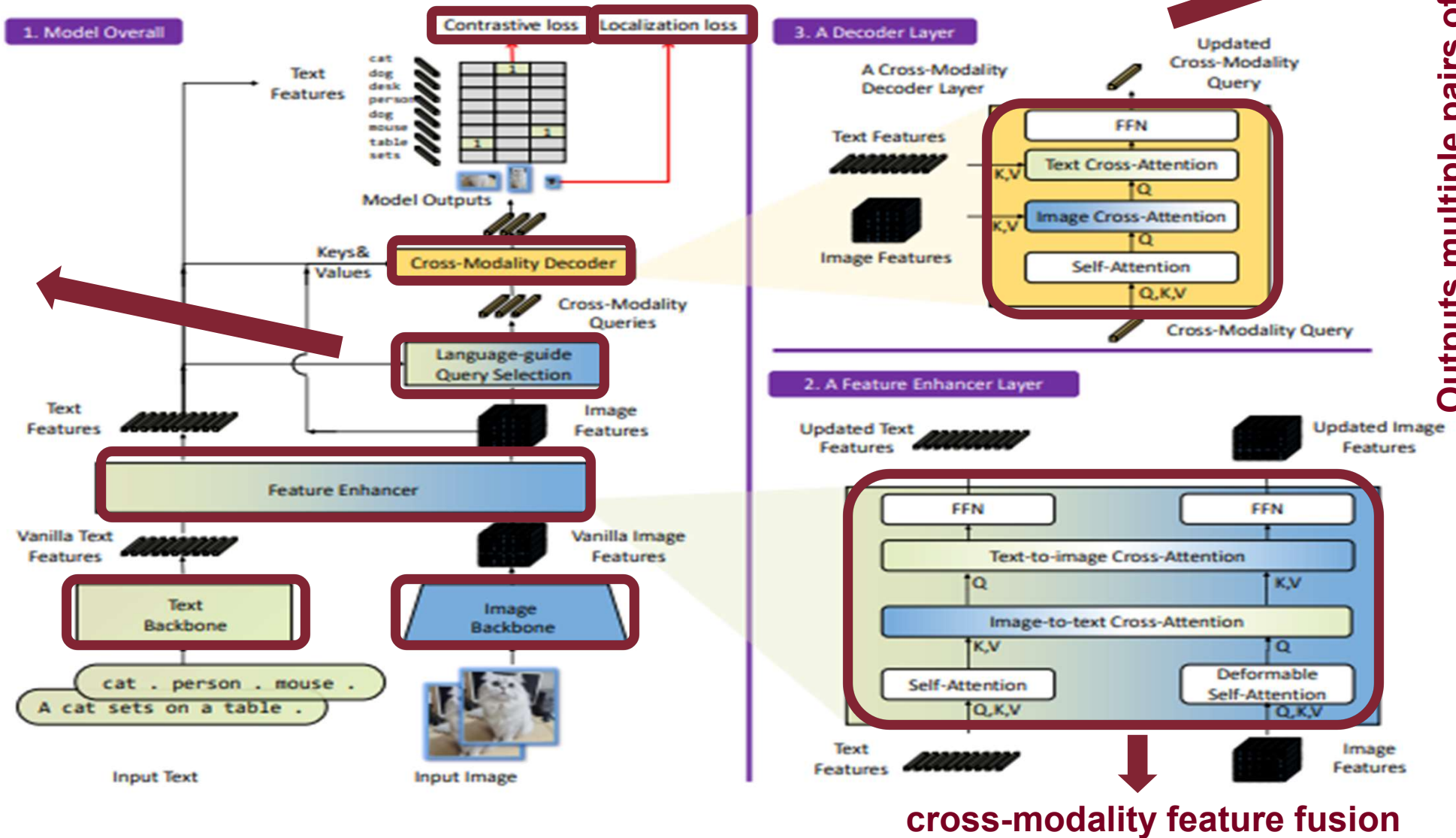
# Grounding Dino

- Open-set object detector
- Referring expression comprehension (REC)
  - Describing objects with attributes (noun phrases)
- Zero-Shot Transfer for Model Generalization
- Dual-encoder-single-decoder architecture
  - Next page



# Grounding Dino Architecture

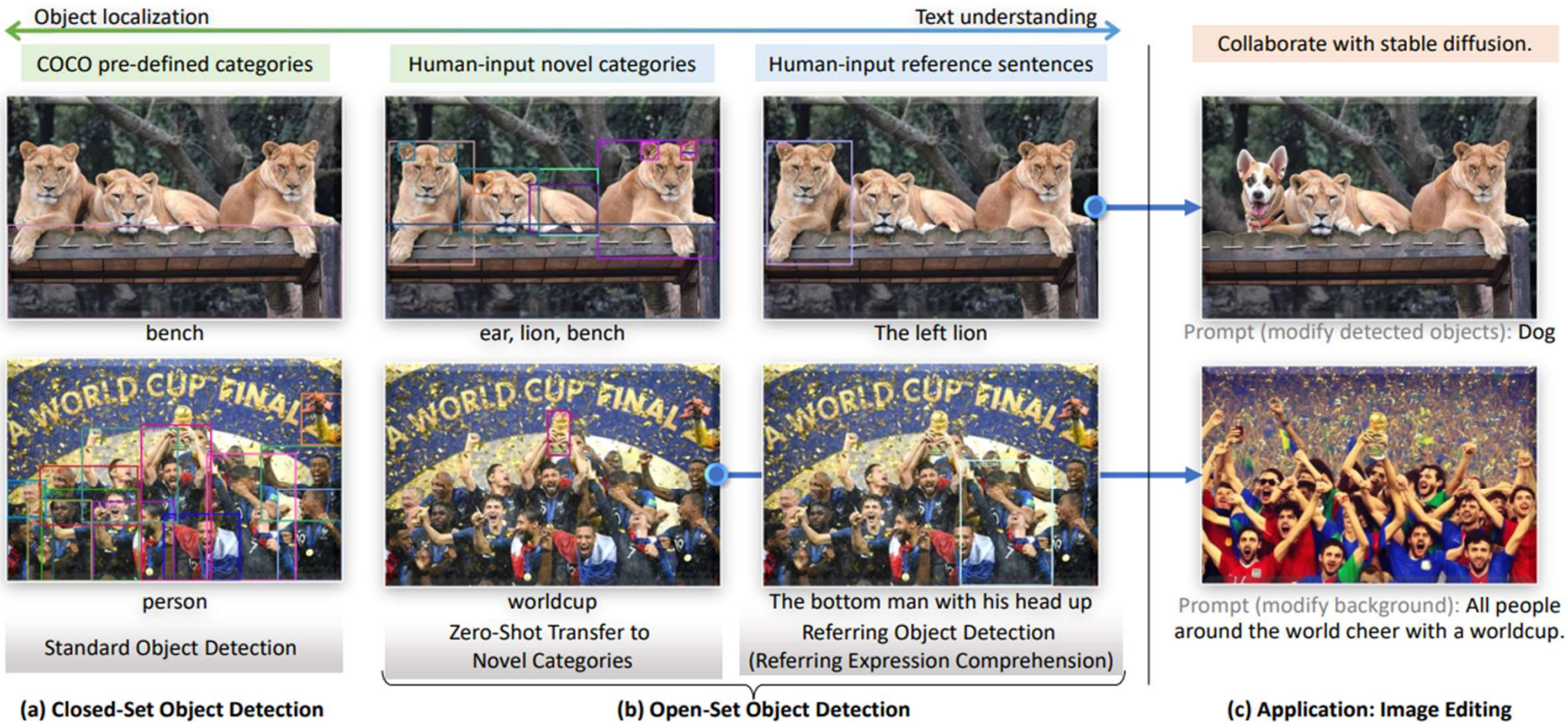
select cross-modality queries from image features



Outputs multiple pairs of object boxes and noun phrases

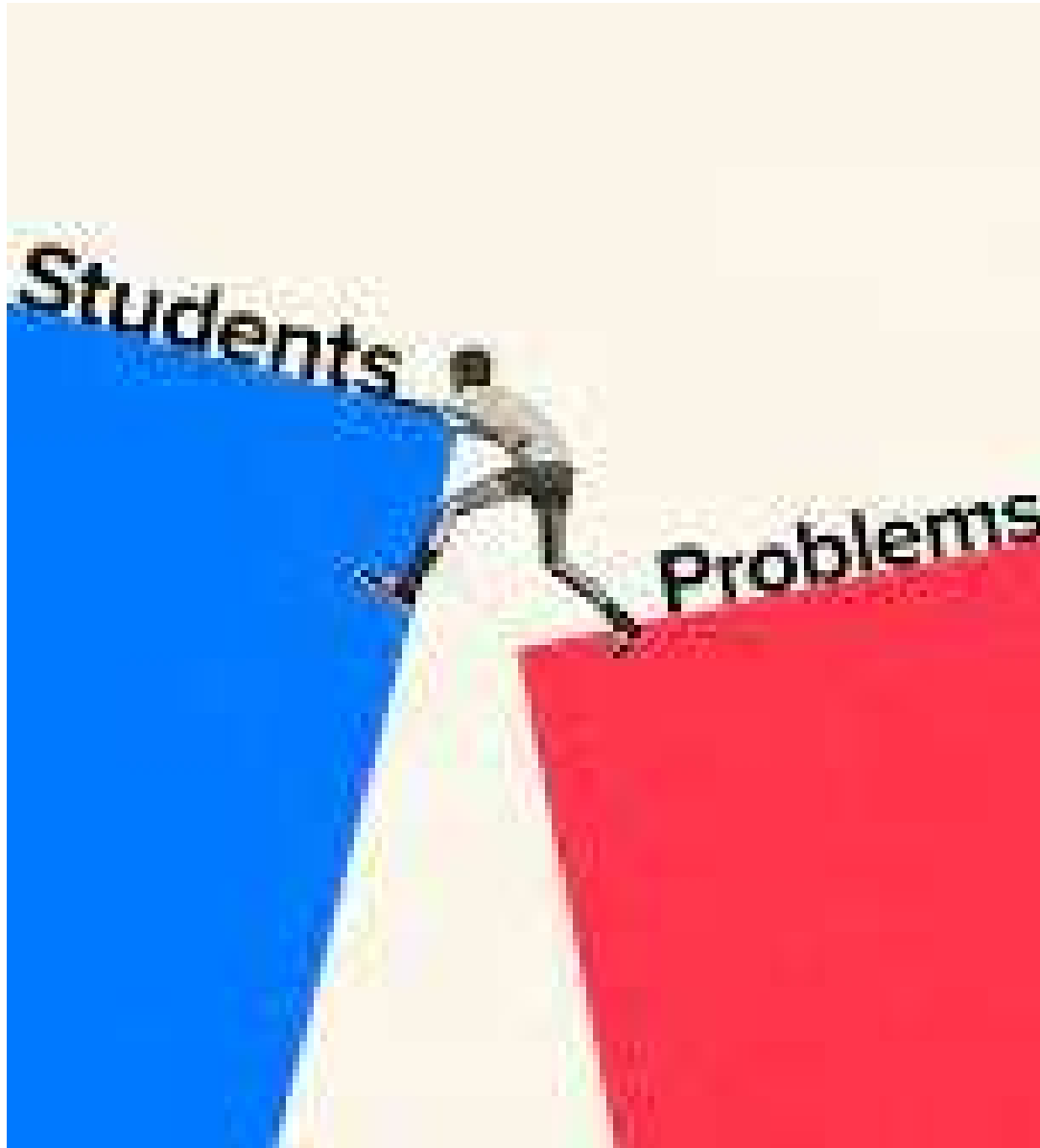


# Grounding Dino Example



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# Problems Faced

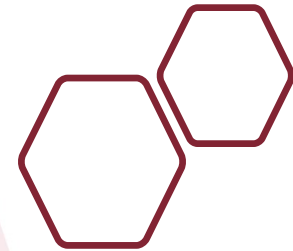




# Problems Faced

- Language Barrier
  - Requirement documents, project prototypes → difficulties in comprehending nuances
  - Understanding technical jargon and intricate project details → hurdle (in the beginning)
- Learning On-The-Job
  - New courses and training modules emerged regularly
  - Technical certifications → English
  - Non-technical aspects → Italian (**Not Primary Language**)
    - Workplace safety, labor laws, workers' rights
- Understanding Complex Codebases (migrating)
  - Many dozens -- or even hundreds -- of files
  - Intricate codebases → require in-depth comprehension
  - Understanding others' logic and design choices → Challenging





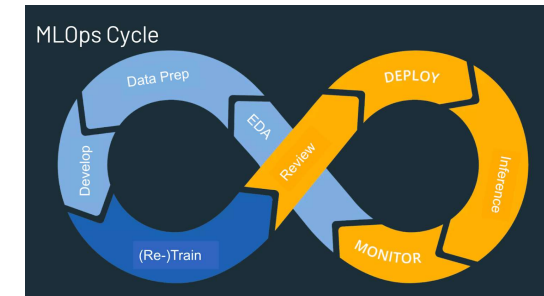
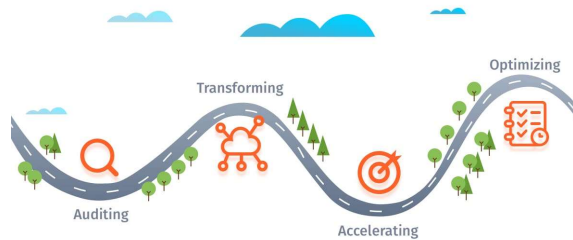
# Solutions

- Collaborative Learning and Language Proficiency Enhancement
  - Seek clarification from internship tutor and colleagues → nuances solved
  - Deep-dive into the Italian language → B2
- Multifaceted Learning Approach for On-The-Job Learning
  - Learning many things at the same time
  - From language improvement
  - To understanding non-technical topics
    - Labor laws and workplace safety → **Solved**
- Leveraging AI Tools for Understanding Complex Code
  - AI-powered tools → code explanation and clarification



# Conclusion

- The internship has been a **transformative journey**
- Ranging from very large **Software development** projects (in public admin)
- To cutting-edge **AI & ML**
- To **Data Base Management**
- To **Unit & Integration Testing**



# Future Prospects

- MLOps
  - Design, Development, Deployment to general public
- Improve existing algorithms and techniques
  - AI alignment, Explainability
- Novel ideas and methods → breakthroughs in science and technology
- Research and Publication → Contribute to open science and open source

