

## **ARI3129: Advanced Computer Vision for Artificial Intelligence**

### **Generative AI Journal**

#### **1. Introduction**

Generative AI has become an indispensable tool across various fields, including research and engineering education, thanks to its ability to streamline workflows, enhance creativity, and automate repetitive tasks. For this project, CHatGPT (GPT-4o), developed by OpenAI, was selected to be the generative AI model to assist in the analysis and documentation of this computer vision assignment. The decision to use ChatGPT was influenced by its versatility in handling diverse tasks, ranging from generating some snippets of code and providing some debugging to explaining complex concepts in clear and concise language. Its ability to adapt to iterative feedback and refine outputs further reinforced its suitability for this project.

One of the key strengths of ChatGPT lies in its natural language understanding and generation capabilities. This allowed for seamless integration into various stages of the project, such as writing the background section, refining technical explanations and assisting with Python scripts for dataset analysis. Tasks such as counting counting classes, generating visualisations (e.g. Pie Charts) and analysing multiclass distributions were significantly accelerated by the AI's ability to generate high-quality, functional code. Furthermore, ChatGPT provided valuable assistance in drafting documentation by creating structured and coherent narratives, which were later refined to meet the project's specific requirements.

The rationale for choosing ChatGPT over other generative AI models, such as Claude or Gemini, was primarily driven by its accessibility, extensive community support, and robust integration with tools like Jupyter Notebook and VS Code. ChatGPT's capacity to handle iterative prompts and deliver detailed responses tailored to specific needs was instrumental in overcoming technical challenges. For example, during the dataset analysis phase, ChatGPT helped troubleshoot issues related to class imbalances and missing labels, providing both solutions and context for the encountered problems.

Moreover, ChatGPT proved to be an invaluable brainstorming partner, helping to generate ideas and approaches for tasks such as organising dataset preparation workflows and structuring the project's technical paper. Its real-time collaboration capabilities streamlined the process of integrating technical and analytical elements into a coherent project narrative.

The use of generative AI was not without its considerations. While ChatGPT excelled in many areas, the decision to rely on it also required a critical understanding of its limitations, particularly in the areas of originality and context-specific precision. Nonetheless, its integration into the project enabled substantial improvements in both efficiency and quality, making it an indispensable tool for this research. In the subsequent sections, this journal explores the ethical considerations, methodologies, and specific contributions of generative AI to the project, along with reflections on its overall impact.

#### **2. Ethical Considerations**

Integrating generative AI, specifically ChatGPT, into this project raised some ethical considerations, particularly in data bias, originality and fairness. While ChatGPT proved to be an invaluable tool in generating code, analysing data, and drafting documentation, its application required ongoing critical evaluation to ensure ethical standards were upheld. These considerations underscore the importance of responsible AI usage in academic and technical work.

##### **Data Bias**

Generative AI models like ChatGPT are trained on vast datasets sourced from the internet, which may carry inherent biases from their underlying data. These biases can manifest in various ways, from reflecting regional or cultural disparities to prioritising certain methodologies over others. During this project, these biases became apparent in specific tasks where ChatGPT was used, for

sections, such as dataset analysis, code debugging, and drafting some bullet points for documentation.

For instance, when analysing class distributions in the dataset, ChatGPT provided generic solutions that often assumed uniform data structures or consistent labelling practices. While functional, these solutions lacked the nuance required to handle specific challenges in the project, such as missing labels or class imbalances. Additionally, some outputs prioritised efficiency over accuracy, these needed manual adjustments to align the AI's suggestions with the actual structure of the dataset. This highlighted how biases in the model's training data were optimised for general use cases and could overlook context-specific subtleties.

Moreover, the AI's responses to ambiguous prompts sometimes exhibited a preference for widely recognised approaches, such as recommending pre-trained YOLO models, without fully considering alternative object detection frameworks. This bias towards mainstream solutions, likely stemming from the prevalence of such topics in its training data, reinforced the importance of framing prompts clearly and reviewing the AI's responses critically.

To mitigate these biases, we employed several strategies. First, prompts were iteratively refined to provide clearer instructions and avoid overly generic outputs. For example, when generating Python snippets for class counting and pie chart visualisations, we included specific details about the dataset structure to ensure accurate and relevant code. Second, all outputs were critically evaluated, with adjustments to address oversights or inconsistencies. Lastly, I supplemented the AI-generated content with additional research and domain knowledge to balance potential biases in its responses.

These experiences underscored the importance of human intervention when using generative AI in tasks requiring contextual sensitivity. While ChatGPT offered significant efficiency gains, its reliance on generalised training data required careful oversight to ensure outputs aligned with the project's unique requirements.

#### Originality and Intellectual Property

Generative AI models like ChatGPT offer powerful tools for generating content, but they also introduce challenges related to originality and intellectual property. These concerns are particularly relevant in academic and technical projects where unique contributions and proper attribution are critical. During this project, originality and intellectual property considerations became significant in tasks such as drafting plans for sections, generating Python snippets, and structuring methodological explanations.

For instance, when drafting the background section on object detection techniques, ChatGPT provided coherent and well-structured content. However, some parts of the generated bullet points and text chunks mirrored commonly available descriptions from its training data, requiring careful revisions to ensure the final output was original and reflected the project's unique focus. Additionally, while the AI suggested relevant references, a few of these citations were fabricated or incomplete, necessitating manual cross-checking and verification to maintain academic integrity.

Similarly, in the generation of Python snippets for dataset analysis, the AI's responses often included default solutions that were functional but lacked innovation or specificity for the project's requirements. For example, while the code provided by ChatGPT for counting class instances and visualising distributions was technically accurate, it needed customisation to handle specific challenges, such as missing labels and multi-class analysis. These instances highlighted the importance of treating AI outputs as starting points rather than final solutions.

To address originality and intellectual property concerns, several strategies were employed. First, AI-generated content was treated as a draft that required significant human intervention to refine and adapt to the project's context. For example, sections written by ChatGPT were revised to incorporate original insights and address gaps in the AI's understanding. Second, all references suggested by the AI were verified and replaced with credible academic sources where necessary, ensuring that the final work adhered to proper citation standards. Lastly, the AI's contributions

were transparently documented to distinguish between human and AI-generated elements, reinforcing accountability.

These measures ensured that the project's outputs were both original and ethically sound, despite the reliance on generative AI for efficiency and idea generation. While ChatGPT offered immense value in accelerating workflows, its limitations in originality and citation accuracy required continuous oversight to maintain the integrity and intellectual property standards of the work.

### Academic Integrity

The use of generative AI models like ChatGPT in this project raised important considerations regarding academic integrity, particularly in ensuring that all work reflected personal understanding, originality, and adherence to ethical standards. While ChatGPT served as a valuable tool for generating ideas, drafting some text, and producing Python snippets, its outputs required careful oversight to ensure they did not compromise the integrity of the work.

A key challenge involved maintaining originality in the project deliverables. ChatGPT often provided well-structured drafts for technical sections, such as methodology. However, these drafts occasionally contained phrasing or ideas that closely mirrored publicly available content from its training data. To address this, all AI-generated content was thoroughly reviewed and revised to ensure that it reflected original insights and unique contributions to the project. For example, the background section, initially generated by ChatGPT, was expanded with additional context and refined to align with the specific focus of the project.

Another challenge was ensuring that all references and citations included in the project adhered to academic standards. ChatGPT occasionally provided fabricated or incomplete references, which required manual verification and replacement with credible sources. This iterative process ensured that all cited materials were accurate and appropriately attributed, preserving the academic rigor of the project.

Transparency was also a critical component of maintaining academic integrity. All contributions from ChatGPT were documented, including the prompts used and the modifications made to its outputs. For example, when generating Python snippets, the AI's suggestions were treated as starting points and were subsequently debugged, refined, and adapted to address project-specific requirements. This ensured that the final implementations were not solely reliant on AI but demonstrated significant human effort and understanding.

By taking these measures, the project upheld the principles of academic integrity while leveraging the strengths of generative AI. ChatGPT was used as a supplementary tool, with its outputs critically evaluated and integrated into the project in a way that preserved originality and ethical standards. This approach ensured that the work remained a genuine reflection of personal knowledge and effort, despite the use of AI assistance.

### Conclusion

The integration of ChatGPT into this project demonstrated its immense potential as a tool for improving efficiency, creativity, and problem-solving. From generating Python code to drafting documentation, ChatGPT significantly streamlined complex tasks. However, its use also highlighted the need to address ethical considerations, particularly in maintaining originality, privacy, and academic integrity.

ChatGPT served as a collaborative tool, with its outputs treated as starting points and refined through critical evaluation to ensure alignment with project objectives. While it offered numerous benefits, challenges such as biases, generic outputs, and fabricated references reinforced the importance of human oversight. These practices ensured that the final deliverables reflected personal expertise and adhered to ethical standards.

In conclusion, ChatGPT proved to be a valuable assistant, enhancing the project's outcomes while highlighting the importance of responsible and transparent AI usage. This experience lays a solid foundation for leveraging AI in future academic work, with an emphasis on maintaining accountability and originality.

### 3. Methodology

The integration of ChatGPT into this project followed a systematic approach to ensure its effective use across various stages, including some Python code generation, technical documentation drafting, and brainstorming solutions to project challenges. ChatGPT (GPT-4o) was accessed through the OpenAI web interface, while Jupyter Notebook and Visual Studio Code (VS Code) and Google Colab for their advanced GPU to run the testing were used as the primary development environments. These platforms facilitated the seamless incorporation of AI-generated outputs into the coding and documentation workflows, enabling efficient project execution.

The methodology began with careful crafting of prompts to clearly define tasks and provide sufficient context. For example, when generating code for dataset analysis, prompts included specific details about the dataset structure, such as the need for class counts and pie chart visualisations. This ensured that the AI's responses were tailored to the project's requirements. Responses from ChatGPT were then reviewed for accuracy, relevance, and alignment with the project's objectives. In instances where outputs were incomplete or overly generic, iterative refinement was employed, with follow-up prompts providing further clarification or requesting improvements. This iterative process ensured that the final outputs were not only functional but also met the project's unique needs.

AI-generated Python scripts were manually checked and rigorously tested using real data in the development environment. For instance, ChatGPT's initial code for class counting required debugging and adaptation to handle edge cases, such as missing labels and multi-class distributions. These modifications highlighted the collaborative nature of using generative AI, where human oversight and expertise were essential to refine the AI's outputs into reliable solutions. Similarly, ChatGPT was used to draft bullet points and plans of the technical documentation, such as the background and methodology. While these drafts provided a solid foundation, they were expanded and revised to incorporate original insights and align with academic standards. This approach ensured that the final documentation reflected both personal understanding and project-specific contributions.

Transparency and accountability were prioritised throughout the process. All AI-generated content was meticulously documented, including the prompts used and the modifications made to its outputs. This ensured that the role of ChatGPT in the project was acknowledged and that its use adhered to ethical and academic standards. By following this structured methodology, ChatGPT was effectively integrated into the project as a collaborative tool, enabling more efficient workflows and higher-quality outputs while maintaining originality, ethical standards, and academic integrity.

### 4. Prompts and Responses

Throughout the project, ChatGPT was used to assist in generating Python scripts, analysing datasets, and drafting technical documentation. Each interaction involved crafting specific prompts to obtain accurate and relevant responses. Below are notable examples of prompts used, the AI's responses, and their contributions to the project.

#### Example 1: Dataset Analysis

Prompt: "Write some Python code to count the class instances from label files in test, train and valid folders. Then I must make Piecharts showing the distribution"

Response: ChatGPT provided a Python script using `os`, `collections.Counter`, and `matplotlib`. The script included a partial functional code able to read label files, count class instances, and generate pie charts.

(However, the AI assumed that all label files had uniform structures, which required debugging and refinement. Additional modifications were made to handle missing labels and ensure compatibility with the project's dataset structure.)

Contribution: This response served as a starting point for implementing dataset analysis. By adapting the code to address specific challenges, such as edge cases and dataset irregularities, the final solution was tailored to the project's needs, significantly reducing development time.

#### Example 2: Technical documentation

Prompt: "Draft some bullet points for my background section on object detection techniques, focusing on YOLO and its applications without delving into architectural details."

Response:

The AI-generated many well-structured bullet points explaining the evolution of YOLO models, their real-time detection capabilities, and their relevance to object detection tasks. The draft included key concepts, such as the single-pass detection approach and practical applications, but lacked sufficient depth in contextualising the models within the scope of the project.

Contribution: This draft provided a solid foundation for the background section. It was expanded and refined to include project-specific insights and additional academic references, ensuring that the final version aligned with the project's objectives and academic standards.

#### Example 3: Debugging Assistance

Prompt: "I'm encountering an issue with missing labels in the dataset when running the class distribution analysis code. How can I modify the script to handle this?"

Response: ChatGPT suggested adding a conditional check to skip files without corresponding label data and provided code snippets to implement the solution. The response included examples of handling missing files using Python's os module and exception handling.

Contribution: The solution provided by ChatGPT helped resolve the issue efficiently, allowing the analysis script to run smoothly across all datasets. This saved significant debugging time and ensured accurate dataset analysis results.

#### Example 4: Multiclass Distribution Analysis

Prompt: "Write a sample code to count images with single, two, or three/more classes."

Response: The AI provided a Python script using collections.Counter to categorise images based on the number of unique classes present. While functional, the script required adjustments to integrate with the existing dataset structure and ensure compatibility with real-world scenarios.

Contribution: This response formed the basis for analysing multiclass distributions in the dataset. By refining the script to address project-specific requirements, the final output provided valuable insights into the dataset's structure, enhancing the overall analysis.

Each response was treated as a draft or starting point, with substantial modifications made to align with project-specific requirements. This iterative approach ensured that the AI's contributions complemented human expertise while upholding academic integrity.

### 5. Improvements, Errors and Contributions

The use of ChatGPT in this project significantly enhanced the efficiency and quality of the work, but it also introduced challenges that required careful management. This section highlights the key areas where ChatGPT contributed to improvements, the errors encountered, and how these issues were addressed to ensure the success of the project.

#### Improvements

One of the most notable improvements achieved through ChatGPT was the reduction in development time. Tasks that would have taken hours to complete manually, such as generating Python snippets for dataset analysis and creating visualisations, were completed in a fraction of the time. For example, ChatGPT provided functional code snippets for counting class distributions and generating pie charts, which served as excellent starting points. Its ability to generate structured text also streamlined the drafting of technical sections, such as the background and methodology, where it produced coherent and organised content that was later refined to include project-specific insights.

Another key improvement was the ability to quickly brainstorm and iterate on ideas. During the dataset analysis phase, ChatGPT suggested strategies for handling multiclass distributions and

visualising the results, enabling a more comprehensive analysis of the dataset structure. Additionally, its capability to debug and optimise code snippets ensured that solutions were both functional and efficient, reducing the potential for errors in the implementation.

#### Errors

Despite its strengths, ChatGPT occasionally produced outputs that required careful oversight. One common issue was the generation of overly generic solutions. For instance, the initial Python scripts provided by the AI assumed a uniform dataset structure, which led to errors when applied to real-world data with missing labels or inconsistent formatting. These issues were resolved by manually debugging the scripts and adapting them to address the specific challenges of the project.

Another notable error was the occasional generation of fabricated references or incomplete citations. While ChatGPT often suggested relevant academic concepts, its inability to reliably produce accurate references required all citations to be cross-verified with credible sources. This process, though time-consuming, ensured the academic integrity of the project.

ChatGPT also tended to freeze or refuse to output after being prompted and, at times, the output would not match what we would have asked for.

#### Contributions

ChatGPT's contributions were most evident in areas where creativity, speed, and structure were essential. The AI played a significant role in simplifying complex tasks. These contributions allowed more time to be allocated to refining the project's outputs and addressing higher-level challenges.

In addition to technical tasks, ChatGPT provided substantial support in drafting and organising technical documentation. This collaborative approach ensured that the final deliverables were both efficient and tailored to the project's requirements.

### 6. Individual Reflection

#### Nick:

In my personal experience, ChatGPT played an invaluable role throughout the project, providing valuable insights and support in nearly every aspect. From debugging and data analysis to documentation and structuring ideas, generative AI proved to be a powerful tool that enhanced our efficiency and productivity.

One of the key lessons learned during this process was the importance of crafting effective prompts to obtain accurate and useful responses. With experience, it became easier to refine queries to better align with project needs, ultimately improving the quality of outputs received. While there were moments of frustration when responses did not meet expectations, persistence and iterative refinement of prompts often led to useful insights and solutions.

Generative AI significantly reduced the time spent on complex tasks such as analyzing model outputs and troubleshooting code, making the overall workflow smoother and more efficient. Although challenges arose, such as occasional irrelevant responses and the need for manual adjustments, the long-term benefits of using ChatGPT outweighed these drawbacks.

Overall, my experience with generative AI in this project was highly positive. It served as a reliable assistant, particularly in areas such as data analysis and debugging, where it provided clarity and direction that contributed to the successful completion of the project.

#### Saul:

Using generative AI in my project was helpful, especially for interpreting results and writing down findings. It made analysing complicated data easier by breaking it down and pointing out key insights I might have missed. It also helped me write about my findings in a clear and organised way, which saved me time and made the process smoother. I was surprised by how well it turned complex ideas into simple explanations, making my work easier to understand. This experience

changed how I see AI in academic projects. I now think it's a great tool for saving time and improving accuracy, especially with data and documentation.

Luca:

Using ChatGPT for this project has reinforced my confidence in the power of generative AI. The more I use it, the more I see how transformative it can be in simplifying complex tasks and enhancing productivity. ChatGPT played a crucial role in this project by accelerating tasks such as generating Python scripts, visualising dataset distributions and drafting documentation. Its ability to brainstorm and provide structured outputs significantly improved the workflow and allowed me to focus on higher-level challenges.

One of the most valuable aspects of this experience was learning how to refine and adapt AI outputs. While ChatGPT provided excellent starting points, such as functional code snippets and well-written drafts, its outputs required critical evaluation and refinement to align with the project's specific needs. For example, debugging and tailoring its Python scripts for dataset analysis deepened my understanding of the technical processes involved.

What stands out most is how seamlessly generative AI integrates into academic workflows when used responsibly. By treating AI as a collaborative partner, I was able to maintain originality and ensure that the final deliverables reflected my knowledge and expertise. This project demonstrated that generative AI is not just a tool for efficiency but a catalyst for creativity and problem-solving.

Taking everything into account, my experience with ChatGPT has been highly positive. It has not only enhanced the quality of this project but also shown me how generative AI can redefine the way academic and technical work is approached. I am excited to continue using it in future projects and to explore its full potential.

## 7. References and List of Resources Used

OpenAI, "ChatGPT: Optimizing Language Models for Dialogue," OpenAI Documentation, 2023. [Online]. Available: <https://openai.com/chatgpt>.