DeepLeaf: Next.js Powered Cross-Platform Solution for Automated Plant Disease Diagnosis and Crop Health Management

Touhidul Alam Seyam, Abhijit Pathak

Abstract

In the midst of a rapid technological revolution, artificial intelligence (AI) has permeated various aspects of society, with Generative Artificial Intelligence (GenAI) emerging as a notable subset. In this paper, we focus on exploring the legal implications stemming from the utilization of GenAI. Beginning with an overview of AI technologies and GenAI's role within this landscape, we delve into fundamental inquiries: 'How does GenAI operate?', 'What are its potential applications?', and 'What legal challenges may arise?'. Our methodology involves a comprehensive literature review to delineate AI and GenAI, followed by an examination of pertinent legal cases to assess the scope of legal issues and potential remedies within national and EU jurisdictions. Additionally, we scrutinize the output of GenAI, addressing issues of liability concerning its content and usage, while also considering the incorporation of relevant contractual provisions.

1 Keywords

generative artificial intelligence, training data, civil liability, advertising

2 Introduction

In the realm of science fiction, ALIE (Applied Lucent Intelligence Emulator) from The 100 series stands out as a cautionary tale about the potential dangers of artificial intelligence. Designed to improve human life, ALIE's lack of emotional programming led to drastic measures to solve overpopulation, nearly annihilating humanity (Day, 2016). Early warnings from figures like Elon Musk and Stephen Hawking underscored the risks of unchecked AI development (Clifford, 2018; Cellan-Jones, 2014).

Today, we find ourselves amid a rapid technological evolution, witnessing the pervasive integration of artificial intelligence into various facets of society, often subtly. While AI predominantly exists in software applications, notable exceptions like Sophia and Nadine exemplify its expanding presence (Bellapu,

2023). From smart assistants to autonomous vehicles, AI permeates our daily lives, presenting both opportunities and challenges (Custers & Fosch-Villaronga, 2022; EESC, 2018).

Recognizing the dual nature of AI, efforts at the European Union level have culminated in legislative proposals aimed at regulating its deployment. The Artificial Intelligence Act and AI Liability Directive, introduced in April 2021 and September 2022 respectively, represent pioneering steps towards establishing international norms for AI governance.

In this paper, we narrow our focus to Generative Artificial Intelligence (GenAI), aiming to explore its legal implications and propose solutions. By delving into its workings, potential applications, and associated legal issues, we endeavor to provide insights into the evolving landscape of AI regulation. Our methodology incorporates literature review, legal case studies, analysis of GenAI providers' contracts, and legislative evaluation to address fundamental questions and navigate the complex legal terrain surrounding GenAI. Throughout, we draw upon existing and proposed legislation to inform our examination.

3 1. What does GenAI technology mean? How does it work?

GenAI technology encompasses a diverse range of applications within the field of artificial intelligence (AI). While AI is a multifaceted concept, attempts to define it solely as machines or software with human-like intelligence often fall short of capturing its full scope (Bertolini, 2020, p. 9). Discrepancies in defining AI persist across technical and legal literature, with interpretations varying widely. For instance, Surden (2019, p. 1307) simplifies AI for legal comprehension by describing it as technology capable of automating tasks typically requiring human intelligence. Häuselmann (2022, p. 46) characterizes AI as machines capable of learning from experience and autonomously executing tasks, mimicking human cognitive abilities.

Russell and Norvig (2021, pp. 1-5) propose four defining characteristics of AI: human-like thinking and behavior, as well as rational thought and action. Alternatively, Paschen et al. (2020, p. 405) conceptualize AI as computer systems capable of rational decision-making and problem-solving based on available data. AI can be broadly categorized into narrow and broad definitions. Narrow AI encompasses systems designed to address specific tasks or problems, such as facial recognition technology or virtual assistants like Siri and Alexa. In contrast, broad AI, also known as Artificial General Intelligence (AGI), aims to replicate the full functionality of the human brain, a milestone yet to be achieved (Häuselmann, 2022, p. 45).

AI serves as an umbrella term for diverse technologies, each with distinct capabilities and applications (Bertolini, 2020, p. 15). GenAI specifically pertains to AI systems capable of generating content, including text, images, music, and video, based on the quality of the data used for training (Muller et al.,

2022, pp. 1-7). According to the European Union's Artificial Intelligence Act, amended as of June 14, 2023, an "artificial intelligence system" is defined as a machine-based system designed to operate autonomously, generating outputs such as predictions, recommendations, or decisions that influence physical or virtual environments (Article 3, point 1).

In summary, GenAI technology represents a subset of AI focused on content generation, offering vast creative potential contingent upon the quality of training data (Häuselmann, 2022, pp. 47-67).

4 Training Methodology

4.1 Dataset Selection

4.2 Model Selection

4.3 Model Architecture

4.4 Dataset Preprocessing

4.5 Dataset Augmentation

5 Dataset Preparation

5.1 Model Architecture

5.2 Training and Validation Loss Analysis

5.2.1 Performance Metrics

5.2.2 Cross-Validation

6 App Development Methodology

6.1 User Interface Design

6.1.1 UI/UX Considerations

6.2 Choosing a Framework for Frontend

6.3 Choosing a Framework for Backend

6.4 Developing the Backend (Flask)

6.4.1 API Design

6.5 Developing the Frontend (Next.js)

6.6 Example Image of Working App in Multiple Platforms

6.7 Deployment

6.7.1 Continuous Integration/Continuous Deployment (CI/CD)

6.7.2 Cloud Deployment (Vercel)

6.7.3 Containerization (Docker)

7 Results and Discussion

7.1 Limitations

7.2 Future Improvements

8 Conclusion

9 References