Innovative Approaches in Generative AI for Enhancing Computer Vision Tasks through Advanced Foundational

Research Project for the PhD Course in ·Complex Systems Engineering· · 39° Cycle

1. Introduction

The field of computer vision has witnessed significant advancements with the integration of generative AI and fou

Generative models like Generative Adversarial Networks (GANs), Variational Autoencoders (VAEs), and transfor

Remote sensing is the process of gathering data from a scene or an object without having any physical contact w

2. State of the Art

Recent advancements in generative AI and foundational models have introduced several state-of-the-art techniq

- Generative Adversarial Networks (GANs): GANs are capable of generating realistic images by learning the und

- Variational Autoencoders (VAEs): VAEs learn a probabilistic representation of the data, enabling the generation

- Transformers in Computer Vision: Models like Vision Transformers (ViT) and CLIP (Contrastive Language-Imag

- Multimodal Models: Combining vision and language models has led to the development of powerful tools for tas

The spectral resolution of hyperspectral imaging (HSI) is higher than that of traditional remote sensing images. T

3. Research Project

This research project aims to explore innovative approaches in generative AI and foundational models to enhanc

- Development of Efficient Generative Models: Investigate techniques to improve the efficiency and scalability of

- Domain Adaptation and Fine-Tuning: Explore methods for fine-tuning generative models on domain-specific da

- Ethical and Responsible AI: Develop frameworks for bias detection and mitigation in generative models, ensurin

The didactic-scientific path of the proposal is divided into the following training modules:

- First Year:
  - Module 1: Acquisition of in-depth knowledge on generative AI technologies and their applications in computer
  - Module 2: Acquisition of skills in deep learning and foundational models, focusing on their implementation and

- Second Year:
  - Module 3: Application of acquired skills to develop efficient generative models for specific computer vision tasl

- Third Year:
  - Module 4: Experimentation and enhancement of research results through collaborations with research centers
  - Module 5: Writing the Ph.D. thesis and publications, documenting the research findings and contributions to th

Conclusion

This research project aims to advance the field of computer vision by developing efficient, scalable, and ethically