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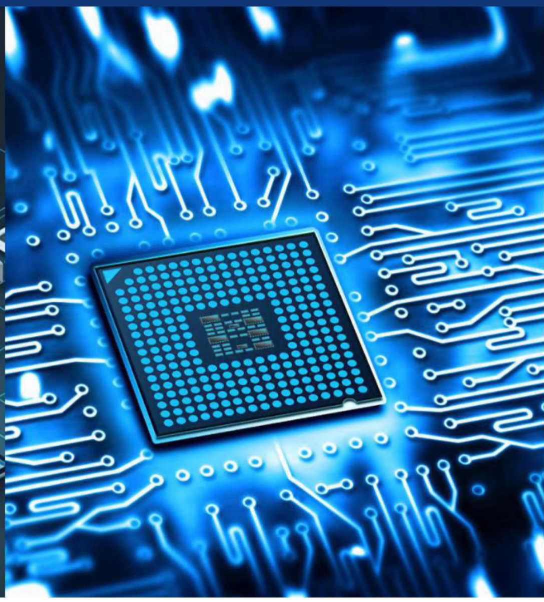

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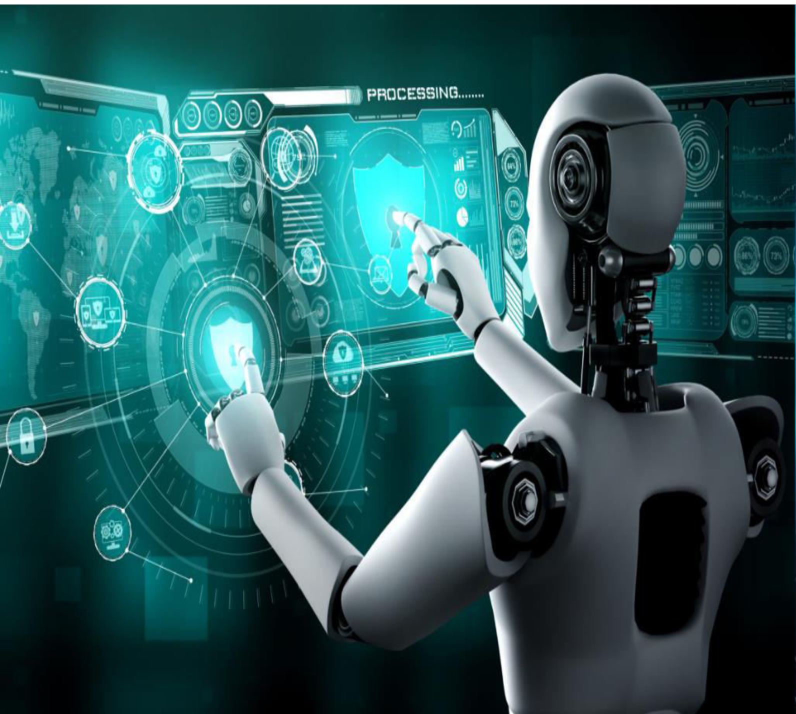

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Visual Transformer Technique for Human Organ Identification

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ABSTRACT: This paper presents a transformer-based system for automatic detection and classification of human organs from medical images. Leveraging Vision Transformer (ViT) architecture, the proposed model captures both local and global anatomical structures from high-resolution input images. The approach is trained on publicly available datasets using transfer learning and shows significant improvements in accuracy and processing time. The system has potential applications in diagnostics, surgical planning, and medical education, offering real-time assistance and reducing human error..

KEYWORDS: Vision Transformer, Medical Imaging, Organ Detection, Deep Learning, Transfer Learning, AI Diagnostics.

I. INTRODUCTION

With advancements in artificial intelligence, medical imaging is undergoing a transformation toward automation and real-time diagnostic assistance. Traditional organ identification methods require extensive manual effort, making them time-consuming and susceptible to errors. Deep learning approaches, particularly convolutional neural networks (CNNs), have improved performance, but their limited receptive field hinders global contextual understanding, which is crucial in organ localization. Vision Transformers (ViT), introduced by Dosovitskiy et al., leverage the power of self-attention to model long-range dependencies and are proving to be effective in image recognition tasks. This project aims to implement a ViT-based system for accurate human organ identification from medical images, enhancing precision and efficiency in clinical settings. [1].

II. RELATED WORK

The Vision Transformer (ViT) introduced by Dosovitskiy et al. has become a foundational architecture in vision-based deep learning, showing that transformer models can outperform CNNs in classification tasks when trained on large-scale datasets. Carion et al. introduced DETR, which applied transformers to object detection tasks, enabling end-to-end learning without handcrafted components. Deformable DETR and Anchor DETR further improved efficiency and detection of small, irregularly shaped structures. Naeem et al. conducted a comprehensive review in 2024, highlighting how ViT-based architectures outperform CNNs in medical image analysis tasks, particularly for detection and segmentation. Attention-based models also offer improved explainability, which is essential for clinical trust, as emphasized by Tjoa and Guan in their work on explainable AI in healthcare.

III. PROPOSED SYSTEM

The proposed system involves a real-time organ detection pipeline powered by a Vision Transformer architecture. Medical images, such as X-rays, CT scans, and MRI slices, are captured and pre-processed by resizing, normalization, and patching into 16×16 pixel segments. These patches are then fed into a ViT model pretrained on large image datasets and fine-tuned on annotated medical datasets such as DeepLesion and LUNA16. The attention mechanism

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within the transformer layers identifies spatial relationships between organ structures and highlights relevant regions. The model outputs predicted organ classes along with attention-based localization, enhancing interpretability. The system is designed to operate efficiently on high-resolution images while maintaining precision and generalizability across organ types and imaging modalities. Transfer learning is employed to adapt the model to different datasets and conditions, ensuring better robustness and minimal dependency on large annotated data.

IV. PSEUDO CODE

Step 1: Load a medical image (X-ray, CT, or MRI).
Step 2: Apply preprocessing techniques including normalization, resizing, and patch division.
Step 3: Feed image patches into the pretrained Vision Transformer model.
Step 4: Use self-attention layers to extract spatial and contextual features.
Step 5: Predict and classify detected organs based on attention-weighted features.
Step 6: Display the organ classification results with bounding boxes or segmentation overlays.
Step 7: Output attention maps for explainability in clinical decision-making.
Step 8: End.

V. SIMULATION RESULTS

The proposed model was evaluated using standard medical datasets, including DeepLesion and LUNA16. Results show that the ViT-based approach achieved an accuracy of 90.3% on organ classification tasks and demonstrated strong performance in detecting small and occluded structures, particularly in low-resolution scenarios. Visual attention maps highlighted the specific regions contributing to the model's decision, offering interpretability. Compared to baseline CNN architectures, the ViT model reduced inference time per image and improved localization accuracy. Simulations also indicated that the model can generalize well to unseen organ types and different imaging modalities, making it suitable for real-world clinical applications.

VI. CONCLUSION AND FUTURE WORK

This study proposes a novel organ identification system based on Vision Transformer techniques, addressing the limitations of traditional manual and CNN-based methods in medical imaging. The system provides high precision, adaptability, and interpretability, making it suitable for real-time diagnostic assistance and surgical planning. In the future, the model can be extended to support 3D organ reconstruction and integrate with wearable medical devices for continuous monitoring. Further improvements can include multilingual model support, low-resource deployment via mobile applications, and real-time integration with augmented reality tools for intraoperative guidance.

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