

Multi-Modal AI System for Early Cancer Detection

Abstract

This document presents a novel artificial intelligence system designed to detect early-stage cancers by jointly analyzing multi-modal medical imaging data, including CT, MRI, and PET scans. The system leverages deep learning with a proprietary feature fusion architecture to correlate subtle cross-modal patterns that may be overlooked in single-modality analysis.

System Overview

The proposed system ingests synchronized CT, MRI, and PET imaging data and processes them through modality-specific encoders. A cross-modal attention layer aligns semantic features across modalities, allowing the model to learn interdependencies between anatomical structure, metabolic activity, and tissue contrast.

Key Innovations

- Cross-modal attention mechanism enabling dynamic feature alignment across CT, MRI, and PET modalities.
- Uncertainty quantification layer that outputs confidence estimates for each diagnostic prediction.
- Explainable AI visualization module that highlights contributing regions in each imaging modality for clinical interpretation.

Clinical Impact

By integrating complementary imaging modalities and providing interpretable outputs with confidence measures, the system aims to support radiologists in identifying early-stage malignancies with improved sensitivity and reduced false positives. This approach positions the system as a decision-support tool rather than a standalone diagnostic authority.

Disclaimer

This document is provided for research and testing purposes only. The described system does not constitute medical advice or a clinically validated diagnostic tool.