Multimodal Learning for Medical Image Analysis

This project aims to create advanced artificial intelligence (AI) systems that combine different types of medical data, such as X-rays, lab results, patient records, and doctors' notes, to improve the accuracy and reliability of medical diagnoses and treatments. By developing new AI models that process and understand these diverse data sources together, we seek to make healthcare tools that are more effective, trustworthy, and easier for doctors to use, ultimately helping patients receive better care.

Healthcare generates vast amounts of information, including medical images (like CT scans), numerical data (like blood test results), and written reports (like radiology notes). Currently, most AI systems focus on just one type of data, such as images, which limits their ability to fully support doctors who rely on multiple data sources to make decisions. Our research will develop new AI methods that integrate these different data types into a single, unified system. We will build specialized AI components to handle each data type, create ways to combine them effectively, and adapt cutting-edge AI technologies, like vision-language models, to work with medical data. We will also use innovative techniques to make these systems efficient, capable of handling large and complex datasets, and able to provide clear explanations of their decisions. Our work will involve testing these AI models on real-world medical datasets to ensure they are accurate, robust, and fair across diverse patient groups.

Healthcare systems worldwide are under pressure due to an aging population and a shortage of medical professionals, making it critical to develop tools that help doctors work more efficiently. The growing availability of diverse medical data offers a unique opportunity to improve diagnoses and treatments, but current AI tools often fail to fully utilize this information because they focus on single data types. By combining multiple data sources, our project addresses this gap, aiming to create AI systems that better mimic how doctors think, are more resilient to incomplete or noisy data, and can explain their reasoning in ways that doctors can trust. This research is essential to support strained healthcare systems and improve patient outcomes.

We expect to develop new AI models that significantly outperform existing tools by integrating multiple types of medical data, leading to more accurate diagnoses and personalized treatment plans. These models will be more efficient, allowing them to process complex medical data quickly, even on standard hospital computers. We anticipate that our systems will be more robust, handling situations where some data is missing or unclear, and more transparent, providing doctors with clear insights into how decisions are made. These advancements will pave the way for smarter, more reliable AI tools in healthcare, improving patient care and supporting medical professionals. Our findings and tools will be shared publicly to benefit researchers and healthcare providers worldwide.