

IIT Indore's AI Breakthrough Boosts Early Detection of Breast and Cervical Cancer

According to the World Health Organization (WHO), breast cancer and cervical cancer are the top two leading causes of deaths in India. Early detection of these cancers through medical imaging is very important to save lives. However, there is a serious shortage of trained radiologists who can accurately identify cancer in such images and reduce the need for unnecessary biopsies. This problem is even more severe in rural and underserved areas where expert medical staff are not easily available.

Addressing this major healthcare challenge, researchers at IIT Indore have developed advanced Artificial Intelligence (AI) algorithms that can automatically detect and locate breast and cervical cancers in medical images with very high accuracy. These algorithms have outperformed the best existing methods reported in scientific literature by a large margin. The research has been led by **Prof. Kapil Ahuja** and his team at the Math of Data Science and Simulation (MODSS) Lab in the Department of Computer Science and Engineering (CSE) at IIT Indore. The team includes current Ph.D. student **Mr. Saurabh Saini**, former postdoctoral candidate **Dr. Deepti Tamrakar**, and former Ph.D. student **Dr. Aditya A. Shastri**.

For breast cancer detection, doctors mainly use mammogram images. These images contain many fine texture patterns. When cancer develops, these patterns become irregular. The IIT Indore team carefully analyzed these texture patterns and their directions using their proposed Histogram of Oriented Texture (HOT) descriptor algorithm. This method makes it possible to clearly distinguish between healthy and cancer-affected tissues, even in difficult cases where the breast tissue is very dense.

In the case of cervical cancer, doctors primarily use colposcopy images. Here, cancer cannot be identified by texture alone. Doctors must examine both detailed features, such as color and edges, and abstract features, such as shapes and objects, at the same time. To address this, the researchers developed a deep learning algorithm called Block-Fused Attention-Driven Adaptively-Pooled ResNet (BF-AD-APResNet) descriptor. This algorithm is capable of capturing both detailed and abstract features very effectively.

Prof. Suhas Joshi, Director of IIT Indore said, "This research reflects the institute's commitment to developing technology-driven solutions for critical national healthcare challenges."

The team also ensured that these AI systems clearly explain how they arrive at their decisions. This transparency has helped doctors understand and trust the results. The researchers tested their methods on four different datasets collected from across the world.

The systems consistently achieved accuracy levels in the mid-to-late nineties, significantly outperforming existing techniques used in this area.

Prof. Kapil Ahuja said, “We are planning to extend this approach to several other major cancers, including thyroid, lung, oral, colorectal, and esophageal cancers, which are among the top ten cause of cancer deaths in India.”

