How AI can help detect cancer

As India sees an ever-rising tide of cancer cases, Mumbai's Tata Memorial Hospital is turning to artificial intelligence for help. Here is how.

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Mumbai | Updated: January 6, 2024 21:14 IST

Use of AI has already allowed doctors at the TMH to reduce radiation exposure for children by up to 40 per cent. (Wikimedia Commons/Representational)

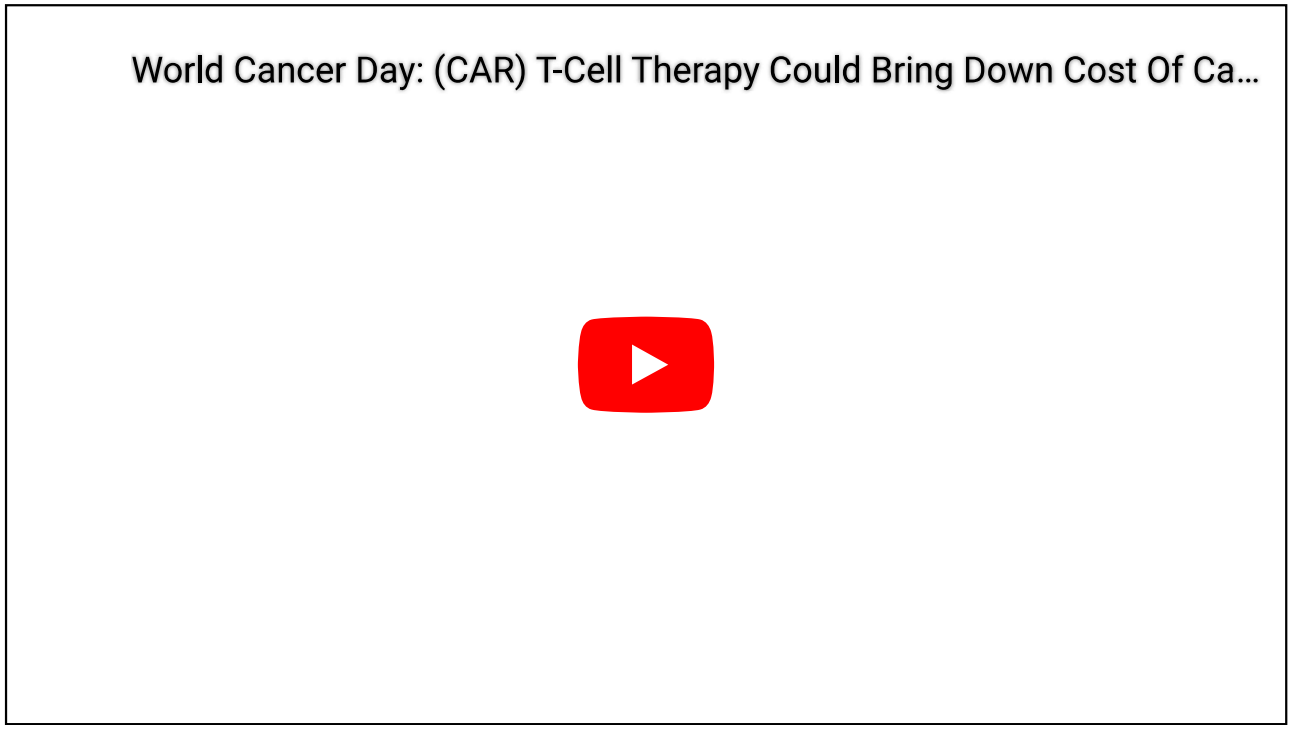
Given the escalating cases of cancer, the shortage of specialists poses a significant challenge in curbing fatalities. To address this gap, Mumbai's Tata Memorial Hospital (TMH), the biggest cancer hospital in India, is **turning to artificial intelligence (AI)**.

By established a 'Bio-Imaging Bank' for cancer, the hospital is utilising deep learning to craft a cancer-specific tailored algorithm that aids in early-stage cancer detection. It incorporated data from 60,000 patients into the biobank in the last year.

Here is all you need to know about the project.

What is a 'Bio-Imaging Bank', and how does AI come into the picture?

The project's overarching goal is to create a robust repository encompassing radiology and pathology images, intricately linked with clinical information, outcome data, treatment specifics, and additional metadata. This comprehensive resource is strategically designed for the training, validation, and rigorous testing of AI algorithms.



Initially focusing on head neck cancers and lung cancers, with a minimum of 1000 patients for each cancer type, the project aims to surpass the committed patient data for both cancer types by its completion date. Alongside database creation, the project involves training and testing multiple AI algorithms using the gathered data,

addressing medically relevant tasks such as screening for lymph node metastases, nucleus segmentation and classification, biomarker prediction (for instance HPV in oropharyngeal and EGFR in lung cancer), and therapy response prediction.

The multi-institutional project is funded by the Department of Biotechnology, in collaboration with IIT-Bombay, RGCIRC-New Delhi, AIIMS-New Delhi, and PGIMER-Chandigarh.

How does AI help in early cancer detection?

AI contributes significantly to cancer detection by emulating the human brain's information processing. In cancer diagnosis, AI analyses radiological and pathological images, learning from extensive datasets to recognise unique features associated with various cancers. This technology facilitates early detection by identifying tissue changes and potential malignancies.

Dr Suyash Kulkarni, Head of Radiodiagnosis at TMC, explained how the team employs AI in radiology. Comprehensive imaging generates longitudinal patient data, aiding in understanding behaviour, treatment response, disease recurrence, and overall survival. AI and machine learning protocols utilise this data to develop predictive models for tumour survival and guide treatment aggressiveness.

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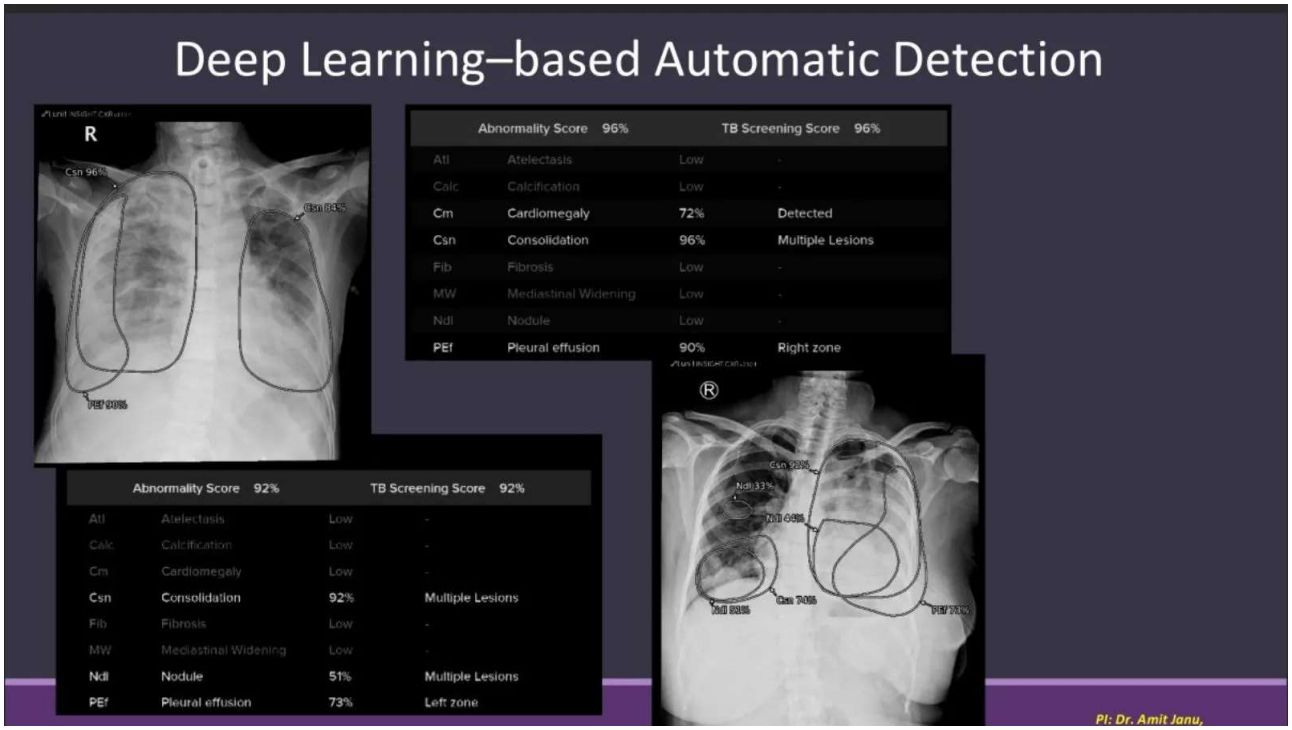
The creation of a tumour image bank involves segmenting and annotating images, outlining tumours, identifying different features, and annotating them as malignant, inflammatory, or edematous. Biopsy results, histopathology, immunohistochemistry reports, and genomic sequences are correlated with images and clinical data to develop diverse algorithms.

This approach allows TMH to develop algorithms for different tumours, assess treatment responses directly from images, and avoid unnecessary chemotherapy

for predicted non-responders, offering clinical utility. Leveraging the biobank, predictive and diagnostic models are developed using thousands of breast cancer images, undergoing AI and ML analysis with technical support from partner IIT-Bombay.

Is this technology currently in use?

Yes. TMH has already added the data of 60,000 patients into the biobank over the previous year, started using AI to reduce radiation exposure for paediatric patients undergoing CT scans.



Screengrab from a presentation on how AI autimatically detects cancer. (Credits: Tata Memorial Hospital)

"Through an innovative project, we've achieved a 40% reduction in radiation by enhancing images with artificial intelligence algorithms. This ensures a significant decrease in radiation exposure to children, maintaining diagnostic quality without compromise — an example of the impactful algorithms we aim to develop," Dr Kulkarni said.

Also, on a pilot basis, the department is using a specific algorithm in the ICU for thoracic radiology, which focuses on imaging and diagnosing conditions related to

the thoracic region of the body, specifically the chest area. The AI immediately provides a diagnosis, proven to be 98 percent correct after doctors cross-check.

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"We are currently validating diverse artificial intelligence algorithms, such as the thoracic suit. This specialised tool interprets digital chest X-rays, identifying pathologies like nodules and pneumothorax. For instance, when an MRI is conducted in the ICU, the AI algorithm automatically provides a diagnosis, validated with our radiologists," he said. "It aids in early diagnosis, saving time," he added.

So, can AI help reduce cancer fatalities in the future?

In the future, AI is poised to play a transformative role in cancer treatment, particularly in mitigating fatalities in rural India. AI's potential lies in tailoring treatment approaches based on diverse patient profiles, and thus optimising therapy outcomes.

Dr Sudeep Gupta, director of TMC envisions a future where AI, with a simple click, swiftly detects cancer, eliminating the need for extensive tests and enabling even general practitioners to diagnose complex cancers. This technology is poised to significantly enhance precision in cancer solutions. "Through continuous learning, AI enhances accuracy, ensuring timely cancer diagnoses, improving patient outcomes, and aiding healthcare professionals in decision-making processes,"he said.

However, the use of AI tools raises debates about potential replacement of human radiologists, facing regulatory scrutiny and resistance from some doctors and health institutions.

First uploaded on: 06-01-2024 at 16:49 IST