Streamlining cancer detection with decentralized AI

Using a collaborative machine learning approach, a group of 12 European institutions accelerates cancer diagnosis

Project ODELIA is set to revolutionize cancer diagnosis by streamlining disease detection and making it more precise, especially for breast cancer. Through a decentralized approach to AI development, it is gearing up to build more accurate AI models with reduced bias while safeguarding data privacy, enabling early cancer detection, and facilitating timely, life-saving care.

Enabling timely cancer diagnoses

Cancer detection is a race against time. As cases rise, shortages of essential medical professionals such as pathologists and radiologists in many parts of the world can overwhelm the medical community and compromise timely life-saving care for patients.

“Given the increasing demand for cancer diagnosis, pathologists and radiologists are often overburdened,” says Oliver Lester Saldanha, a full-time researcher at the Technical University of Dresden’s Carl Gustav Carus Hospital in Germany. “It’s really important to develop AI tools that can assist them and lessen their workload.”

Beyond alleviating the strain on medical professionals, AI models can significantly enhance the diagnostic process, improving predictions for earlier detection and more accurate diagnoses and treatment. They do this by analyzing medical images and identifying subtle details that can be challenging for humans to detect.

However, building robust AI systems for healthcare requires substantial and diverse data, particularly in cancer screening. Traditional models typically involve sharing sensitive patient information and centralized control, often raising ethical, data privacy, and legal concerns.

“Data-sharing agreements can also be slow and time-consuming. On top of that, transferring large volumes of data between institutions creates problems like duplication and loss,” says Saldanha, who researches the use of AI and machine learning in healthcare.
However, an innovative AI model training approach promises to streamline cancer detection while using large volumes of data without compromising privacy and integrity. This method could ultimately lead to faster and more accurate cancer diagnoses, assisting medical professionals and improving patient outcomes.

**Transforming breast cancer detection**

To tackle the challenge of collecting data for AI model training, a consortium of 12 European institutions, including the Carl Gustav Carus Hospital, has adopted the HPE Swarm Learning solution. This project, known as the Open Consortium for Decentralized Medical Artificial Intelligence (ODELIA) and funded by the research program Horizon Europe with €8.6 million, is creating a pan-European open-source network for collaborative AI algorithm training without the need to share sensitive patient information.

ODELIA initially aims to develop a groundbreaking algorithm for breast cancer detection in medical resonance imaging (MRI) scans — a vital goal given the prevalence of this disease and the potential for early diagnosis and treatment.

“The project will also demonstrate the benefits of swarm learning, like faster development, improved performance, and broader applicability,” notes Saldanha. “We want to highlight that AI models can be trained effectively while preserving data privacy and without the need to share patient data.”

**Ensuring data privacy**

Swarm learning involves training AI models in a decentralized network by sharing learning parameters instead of raw data. This approach helps ensure data privacy and security, which are crucial in healthcare. Multiple parties can collaborate and train models while keeping their data local.

“Though training a model on-site with all the data is usually more efficient, swarm learning streamlines the process by eliminating data-sharing agreements and the need to move large volumes of data,” explains Saldanha. “This helps prevent data loss, missing information, and duplication problems, which is particularly helpful when dealing with multiple data sources.”

**Building more accurate models**

With each of the 12 partners across Europe contributing data and insights, ODELIA expects to develop more comprehensive and accurate AI tools.

“Our goal is to have a model that’s unbiased, understands information effectively, and makes accurate predictions,” shares Saldanha. “That sets us apart from other projects that heavily rely on biased data.”

He points out that many medical AI models suffer from bias due to the limited and skewed datasets they’re trained on. “Consider the medical equipment used, like slide scanners and radiology devices, for collecting data. Even within the same country, hospitals may use different equipment, which leads to variations in data collection methods.”

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Patients from different regions or countries also have diverse characteristics influenced by factors such as race, diet, and lifestyle. "Data bias is a major issue in medical AI because it can lead to misdiagnosis or leave out patients who really need treatment," adds Saldanha.

To mitigate such imbalances, it’s crucial to provide the model with a wide range of patient data and different data collection methods. This exposure helps the model understand and address variations and uncertainties.

"While this approach might temporarily affect performance, having a sufficient amount of diverse data can eventually improve the AI tool’s ability to predict outcomes," says Saldanha.

**Facilitating prompt care and treatment**

Enhancing a model’s performance and reducing bias will facilitate more precise detection and diagnosis of diseases, particularly cancer.

"Detecting a disease early is crucial for better prognosis and treatment, especially in the case of breast cancer, where early prediction increases cure rates," says Saldanha. "With projects like ODELIA, delays in diagnosis can be minimized to make sure patients receive timely care."

AI tools can also streamline patient evaluations and lower screening costs by reducing the need for diagnostic tests. "Ultimately, it can cut the time to diagnosis."

**Building a global swarm learning network**

Laying the groundwork for its ambitious mission, ODELIA is setting up dedicated infrastructures at partner sites with support from HPE Swarm Learning.

“The systems are separate from the partners’ networks to physically isolate the data and prevent potential security vulnerabilities from affecting the hospitals’ infrastructures,” explains Saldanha. “Data is then configured for the model, and we train the model and assess its performance on distinct cohorts."

ODELIA envisions expanding its consortium and AI training approach to cover other types of cancer and diverse medical applications. It also diversifies its objectives, including the prediction of treatment responses.

Longer term, the project aims to connect various consortiums to create a worldwide network of partners, leveraging swarm learning to transform healthcare globally.

“I believe healthcare models and AI tools shouldn’t be held back by data limitations or privacy concerns,” says Saldanha. “Imagine a universal model trained on healthcare data from institutions worldwide, enabling a wide range of screenings and predictions. The future of healthcare can be bright with this universal approach.”

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