

New Computer Vision Platform Helps Clinicians Train AI to Recognize a Rare Disease

Medical specialists at Royal Brompton Hospital use the Intel® Geti™ platform to translate their expertise into a machine learning inference algorithm that transforms their research.

Royal Brompton and Harefield hospitals



The mission: Simplify a time-consuming, experts-only process

Primary ciliary dyskinesia (PCD) is a rare, inherited condition that causes defects in human cilia, the tiny hairlike structures that line the respiratory tract and help protect against infection. It can cause respiratory distress early in life, leading to a lifetime of congestion, coughing, and chronic infections. Detection traditionally requires manual acquisition of cilia cross-sectional images for analysis using electron microscopy—an exhaustive, expensive process that contributes to longer wait times for patients in need of care.

“PCD is one of the more complex conditions to diagnose,” says Claire Hogg, professor of pediatric respiratory medicine at the Royal Brompton Hospital. “The process requires specific skills across cell biologists, cell physiologists, and clinicians to interpret the results of several complex tests. We’re looking for a way to automate key aspects of the diagnostic process with AI.”

The solution: An AI training platform that anyone can use

According to Professor Hogg, PCD testing is well suited for deep learning inference in a real-life deployment. Because human cilia have remained structurally unchanged for millennia, anomaly recognition is an easy task for machine learning algorithms. Medical diagnostic services have collected patient samples over decades, providing a virtually limitless number of images available for algorithm training. But to effectively automate the PCD cilia diagnostic procedure, the team would also need to teach an AI algorithm to identify diseased cilia—a sophisticated determination that requires years of training and expertise for humans to do accurately.

“Achieving our goal requires us to transfer the expertise of our specialists to machine learning algorithms,” says Professor Hogg, “even when those specialists aren’t machine learning or AI experts.”

To make it easy for medical professionals to apply their knowledge, the Royal Brompton team selected the Intel® Geti™ computer vision platform—an innovative, powerful platform that anyone can use to develop AI models and put them to work. The Royal Brompton team was funded by the National Institute for Health and Care Research (NIHR) Invention for Innovation program.

“What I do,” says Andreia Pinto, thoracic research associate at the Royal Brompton Hospital, “is teach the system my own knowledge. It’s an easy point-and-click process.”

“The Intel Geti platform is very intuitive to use,” says Dr. Tom Burgoyne, senior scientist at Royal Brompton Hospital. “Teaching the system to recognize diseased cilia is very easy and straightforward. As I train the model, I use a touchscreen pen to draw around the cilia that I want the system to recognize.”

“I was optimistic from the beginning, but my expectations were surpassed. I have been very positively surprised by the simplicity of the Intel Geti platform.”

- Andreia Pinto, research associate, electron microscopy and cilia specialist, Royal Brompton and Harefield hospitals, London

The Intel Geti platform uses active learning to speed up the entire model training process. As the clinicians tell the platform what to look for, it begins making predictions and suggesting images for annotation. Researchers then simply accept or correct the predictions, reducing annotation time and effort.

“You can go image by image to determine whether the AI is identifying things appropriately and easily correct it. As you do that, the learning improves quickly,” says Dr. Burgoyne.

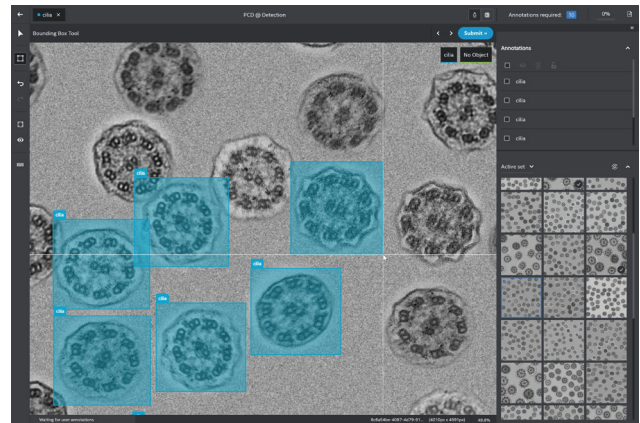
Keeping a human expert in the loop during training is particularly important for clinical applications. Because it deals with organic, living structures, medical diagnostics is an inexact science. Cases are never black and white, and expert human judgment is essential.

Clinicians train for years to recognize subtle clues and make the associative connections that lead to an accurate diagnosis. No machine can learn to judge like a human expert. However, because the Intel Geti platform works in a continuous feedback loop with human experts, it can learn to deduce what they are looking for. “From my experience with AI and machine learning,” says Professor Hogg, “what’s unique about the Intel Geti platform is that it feels like an additional member of our team.”

Training Intel Geti platform began with approximately 4,000 images—patient images with known PCD diagnoses plus images of normal cilia. The Intel Geti platform’s combination of active learning and real-time, expert feedback allowed the team to train an initial deep learning model.

From there, clinicians have continued teaching and improving the model. “We’re constantly bulking up the system as we encounter unique cases and abnormalities,” says Pinto. “It’s easy for me to train the system on new cases.”

Since the initial 4,000-image training period, Pinto and the team have added 16,000 more images. As their project moves forward, they continue to add images regularly. Because the Intel Geti platform retrains on the fly, each additional image contributes to the model—a huge benefit with large, continuously growing data sets. This ongoing training continues to set the stage for potential medical applications of the PCD diagnosis algorithm. Additional studies are necessary to confirm the model’s accuracy and efficacy before medical use.



Using a simple point-and-click interface, the Intel Geti platform makes it easy for medical experts at Royal Brompton Hospital to teach their AI algorithm.

What’s next

As their model continues to develop, the team is excited to explore how it could potentially be used in a patient-care context to streamline PCD diagnosis. Further development and testing are required before the Royal Brompton Hospital algorithm can be used in medical applications.

The Royal Brompton Hospital team also hopes to explore how the Intel Geti platform could help build models for

assistance in diagnosing other diseases, including cystic fibrosis and bronchiectasis.

“The Intel Geti platform has unlocked new AI possibilities for our hospital,” says Professor Hogg. “As we continue training our model, we’re ecstatic to further explore potential use cases and the impact AI technologies can have on medical patients around the world.”

The model development process

The Intel Geti platform helps the Royal Brompton team use AI to detect the signs of a rare disease through an intuitive process:

1 Upload diagnostic images

2 Show the Intel® Geti™ platform what to look for through an easy-to-use interface

3 Save time in the training process, as the Intel® Geti™ platform selects the best, most challenging images for further training

4 Retrain the model as the platform predicts what you’re interested in

5 Work together to rapidly improve the model’s accuracy

6 Export an optimized model for use and application

7 Upload additional images to teach the model new expert insights

8 Retrain easily and export a new model

Learn more

Find out how Intel® Geti™ platform can help your organization easily develop AI algorithms—and learn how additional Intel® technologies can help you build and deploy AI applications at scale.

Intel® Geti™ platform: geti.intel.com ›

Intel® Distribution of OpenVINO™ toolkit: openvino.ai ›

Intel® AI: intel.com/ai ›



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