NVIDIA CLARA

SOLUTIONS FOR MEDICAL IMAGING

NVIDIA

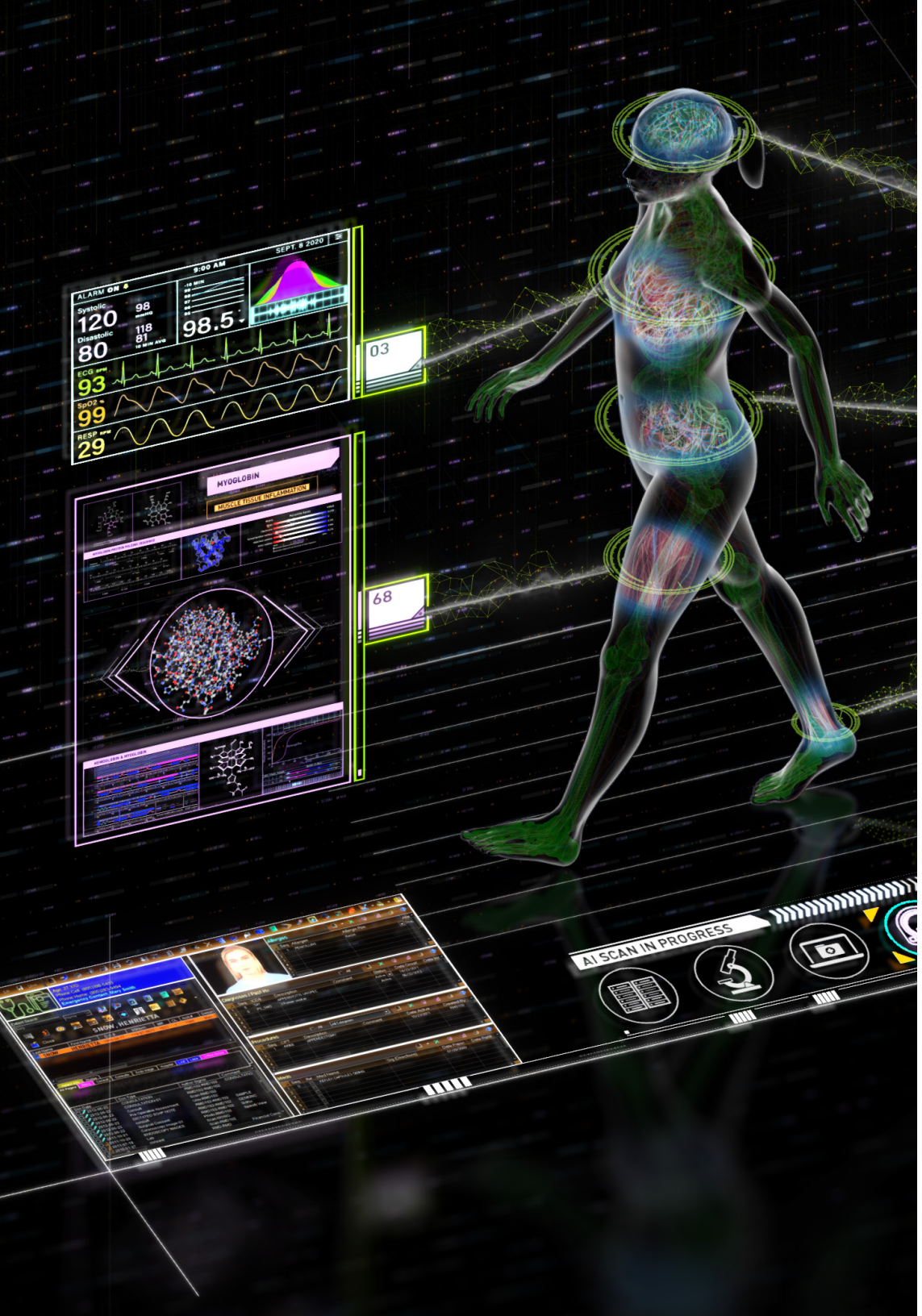
INTRODUCTION

In today's hospitals, radiologists and medical imaging technicians are grappling with an onslaught of data stemming from the growing use of CT scans, MRI scans, and other imaging instruments used for patient diagnostic care.

The sheer volume of imaging scans makes acquiring and reading medical imaging studies a time-consuming task. The field of radiology can benefit from smart tools to assist with the process of analyzing complex images, identifying abnormalities, and uncovering indicators of diseases.

NVIDIA Clara™ enables developers to build, deploy, and manage AI enhanced medical imaging applications in hybrid computing environments to streamline the acquisition, processing, analysis, and reporting steps in a radiology workflow.

Powered by NVIDIA GPUs, NVIDIA Clara can generate views of the body that were previously unattainable, such as clearer and less grainy 3D cinematic renderings of medical images. MRI scans can potentially be performed in a quarter of the time, and with less contrast, without sacrificing the quality of the images.



NVIDIA CLARA

A Healthcare Application Framework for AI-Powered Medical Imaging

NVIDIA Clara Train

Makes medical imaging data AI-ready by providing APIs and a toolkit to bring AI-assisted annotation capabilities to any medical viewer.

Includes privacy-preserving federated learning, a collaborative learning paradigm that enables research hospitals and institutions to collaborate and develop more robust AI algorithms without sharing private data. Additionally, Clara Train provides users with pre-trained models for quicker training. AI researchers can also take advantage of tools like the AI Assisted Annotation toolkit, mix precision model training capabilities, smart cache, and a deterministic training option.

NVIDIA Clara Deploy

Provides a container-based deployment framework for AI-accelerated medical imaging workflows. It has features that facilitate efficient memory handling between containers for a given pipeline, easy-to-use APIs, monitoring tools, and the ability to integrate with your own services.

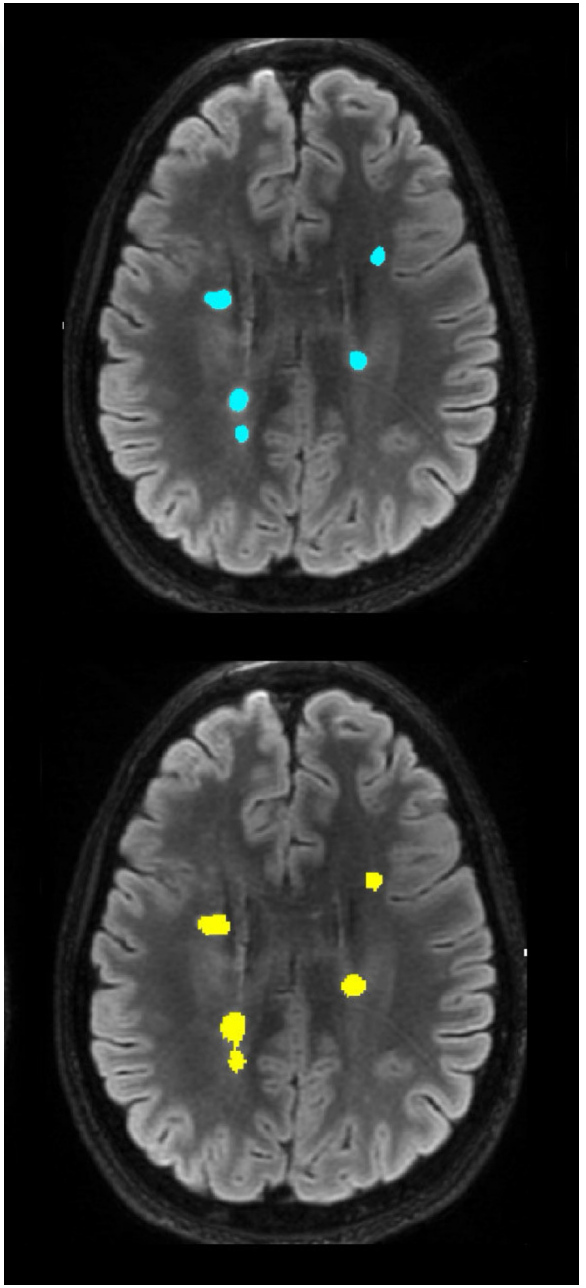
From automating workflows to improving processing speed and image quality, medical imaging developers are discovering numerous ways to use AI to assist doctors in detecting and diagnosing disease. With the Clara platform, they are effectively harnessing AI to transform healthcare workloads.

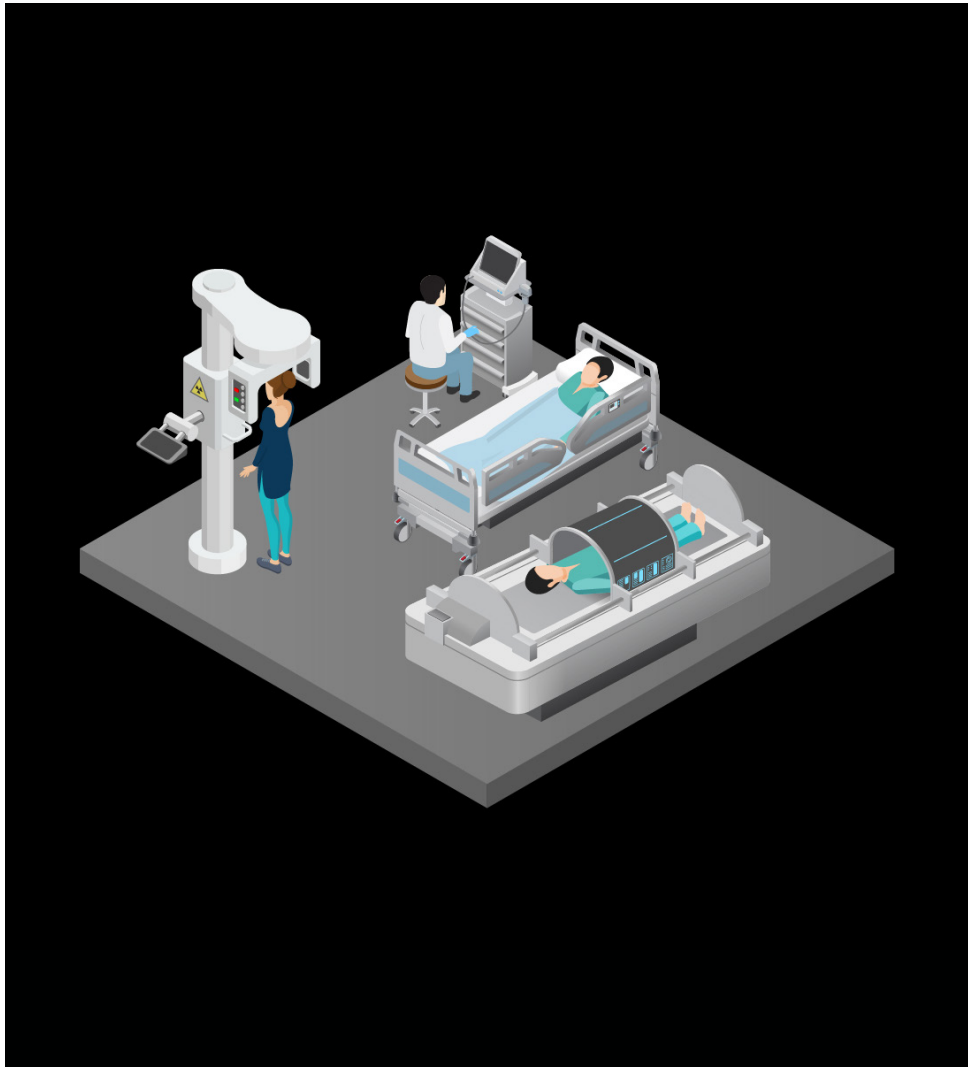
Today, GPUs are found in almost all imaging modalities, including CT, MRI, x-ray, and ultrasound—bringing AI and compute capabilities to transform the instrument, the images, and the workflows. From medical institutions to research centers, we explore stories about how developers, researchers, and radiologists are using the Clara platform to improve diagnostic and interventional imaging capabilities.

TRANSFORMING RADIOLOGY WITH AI

Radiologists worldwide are exploring the use of AI tools to help manage heavy reporting workloads and a growing demand for precision medicine. The Sydney Neuroimaging Analysis Centre (SNAC) is building a comprehensive neuroimaging AI platform with a series of solutions, embedded in radiology workflows, to improve reporting efficiency and accuracy and to facilitate rapid, accurate quantification of the progression of brain diseases by automating labor-intensive analysis tasks with AI.

Using NVIDIA Clara Train, NVIDIA DGX Station™, and NVIDIA DGX-1™, SNAC has reduced the time to train a new model from days to hours. NVIDIA Clara Deploy has provided SNAC with a well-structured design path to deploy their AI algorithms into clinical workflows. Early test results show that the AI platform speeds up neuroimaging analysis workflow processes, such as classification, segmentation, and image enhancement by 10X to 300X with greatly improved accuracy. This is facilitating integration of the platform into real world clinical radiology practice and SNAC's clinical trial central reading services.





BUILDING AI TOOLS FOR CLINICAL RADIOLOGY

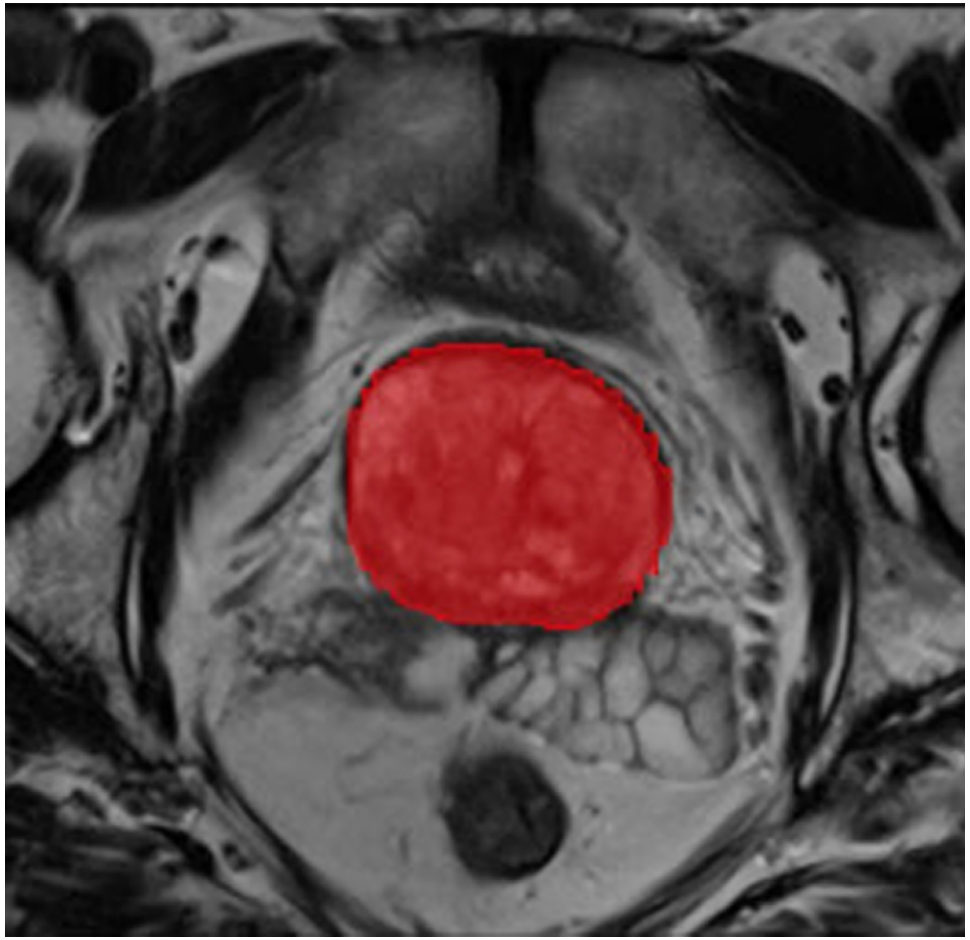
The Center for Intelligent Imaging (ci2), in the Department of Radiology and Biomedical Imaging at UCSF, is on a mission to bring AI to every stage of the radiology workflow. Since October 2019, the team has been busy developing proofs of concept (POCs) focused on hip fracture classification from x-rays, liver transplant donor CT exams, and a brain tumor segmentation model.

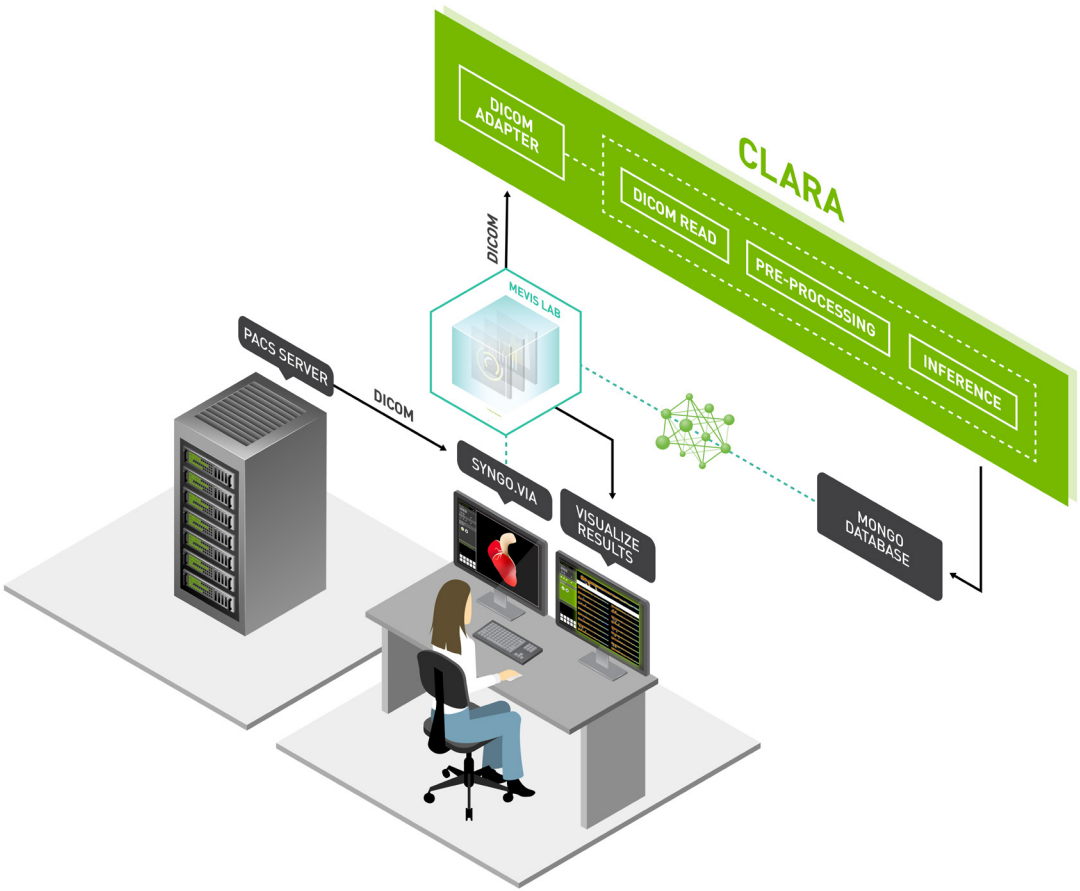
Ci2 is leveraging the NVIDIA DGX-2 AI system and NVIDIA Clara Imaging. The high-performance of DGX-2 is helping researchers speed up model training on over a petabyte of imaging datasets that UCSF has amassed over the years. NVIDIA Clara Train is being used to train deep learning models that reconstruct and analyze radiological images, such as CT and MRI scans, while Clara Deploy optimizes integration with the center's clinical infrastructure.

SPEEDING DIAGNOSIS AND TREATMENT

The SUNY Upstate Medical University Department of Urology is developing AI-powered imaging tools for use in the clinic to speed up cancer diagnosis and time to treatment.

3D volumetric segmentation algorithms are typically challenging to implement—requiring a great deal of customization and fine-tuning. However, SUNY is using the NVIDIA Clara platform to help streamline the process. NVIDIA Clara Train is accelerating deep learning training with techniques like transfer learning for localization of the prostate in pelvic imaging. Using Clara Train, SUNY has achieved impressive model performance from the onset—even prior to fine-tuning the model on their local data. The trained AI model was subsequently deployed with NVIDIA Clara Deploy. SUNY is now applying their prostate segmentation learnings to build new models for kidney stone identification and to improve cancer detection.





SCALABLE DEEP LEARNING FOR CLINICAL DEPLOYMENT

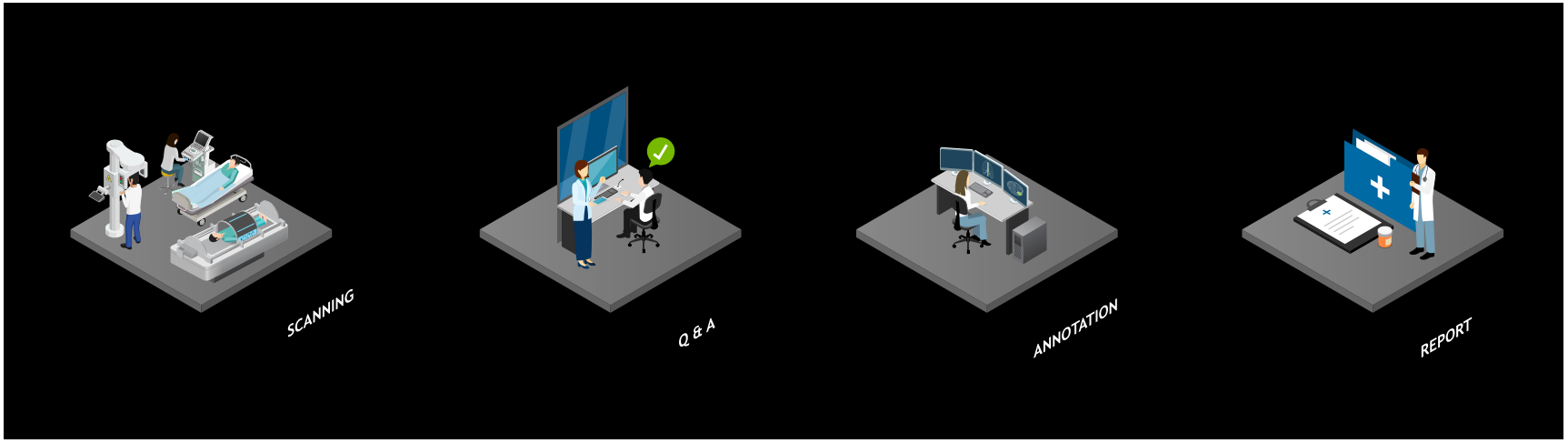
Access to well-curated data in the medical field, with emphasis on collecting these datasets efficiently and with minimal interruption to daily clinical workflows, is critical. The Ohio State University (OSU) Laboratory for Augmented Intelligence in Imaging focuses on implementing deep learning (DL) algorithms in a scalable fashion for clinical deployment.

OSU uses NVIDIA Clara, NVIDIA DGX systems, and prelabeled clinical data pulled from their institutional data warehouse to train and deploy DL models, such as the Brain Metastasis and Coronary Stenosis Detection model.

LEADING INSTITUTIONS USE FEDERATED LEARNING TO BUILD BETTER PERFORMING MODELS

Early detection through mammography is critical when it comes to reducing breast cancer deaths, but breast density can make it harder to detect the disease. The American College of Radiology (ACR), Diagnosticos da America (DASA), Ohio State University (OSU), Partners HealthCare (PHS), and Stanford University collaborated to improve a breast density classification AI model using NVIDIA Clara Federated Learning.

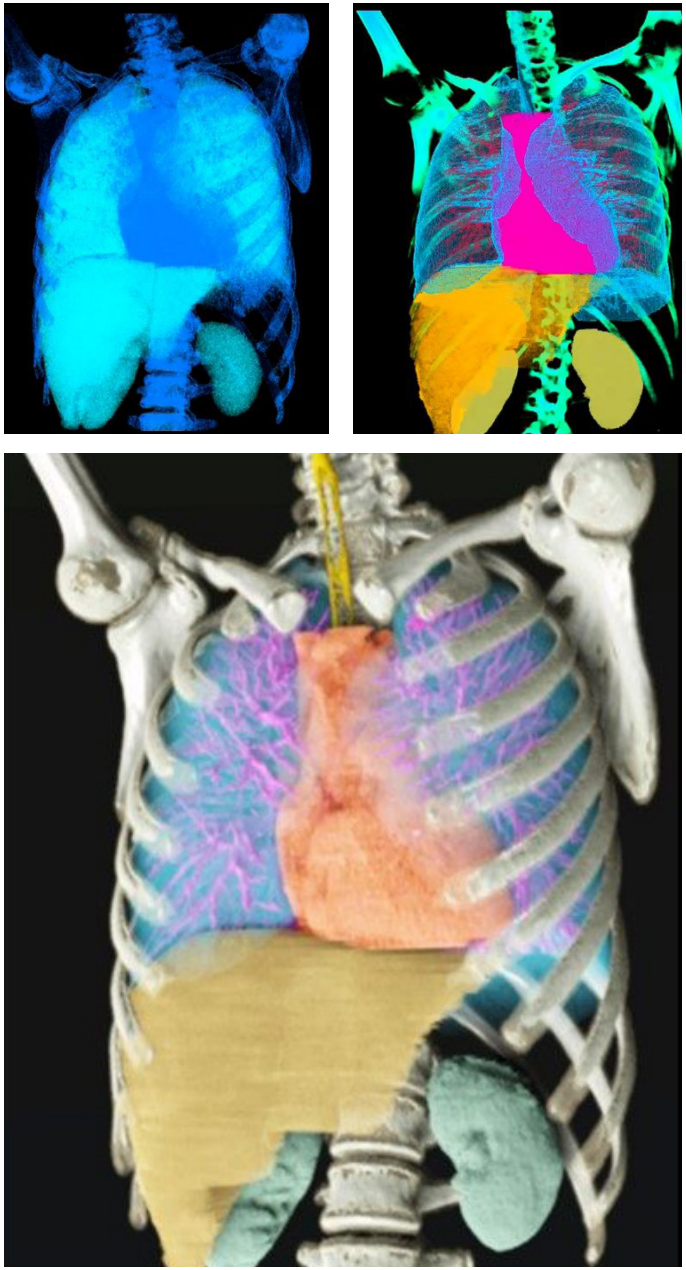
The team used a 2D mammography classification model provided by PHS, which was trained using NVIDIA Clara Train on NVIDIA GPUs. The model was then retrained using Clara Federated Learning at PHS, as well as the collaborating sites, without any data being transferred. The result: each institution obtained a better performing model that had overall superior predictive power on their own local dataset. In doing so, federated learning enabled improved breast density classification from mammograms, which could lead to better breast cancer risk assessment.



ADVANCING THE ADOPTION OF AI IN CLINICAL PRACTICE

To accelerate the development and adoption of AI in clinical practice, radiologists must be part of the lifecycle to create AI tools at their institutions. The American College of Radiology Data Science Institute (ACR) AI-LAB is helping radiologists learn the basics of AI and participate directly in the creation, validation, and use of medical imaging AI.

A key area of focus for the ACR AI-LAB is to work with medical imaging models throughout the development lifecycle, specifically, model creation, evaluation, and sharing. This allows AI-LAB to promote education, research, and preparation for regulatory review. The AI-LAB accomplishes these goals by embedding NVIDIA Clara and providing users the ability to work with models in a repeatable, scalable fashion—on-premises—at member hospitals across the United States. NVIDIA Clara Train is integrated into the AI-LAB solution stack as part of the deployment package. By providing this easy-to-use interface, radiologists and their teams can train their own models as they develop unique AI workflows to meet their patients' needs.



IMPROVING MODEL DEPLOYMENT TO BRING AN INFERENCE PLATFORM INTO THE CLINICAL WORKFLOW

The MGH and BWH Center for Clinical Data Science is on a mission to implement an inference platform that is resilient, scalable, and simple to manage.

The team is using NVIDIA Clara Deploy to standardize output so its visualization partners can easily consume the output from AI models. In this stage of AI inference deployment, standards have not been widely adopted and thus models are not portable or easily integrated. Clara Deploy addresses this issue by simplifying and scaling integration processes. Prior to Clara, the deployment processes were one-offs. Now, MGH can deploy models within minutes of receiving a properly configured Docker image.

Ultimately, the deployment of validated models into clinical workflows will speed up diagnoses, improve diagnostic accuracy, and make quality diagnostic results widely available to remote populations that currently do not have readily accessible clinical experts.

NVIDIA CLARA ADOPTERS

GET STARTED

NVIDIA Clara Train and NVIDIA Clara Deploy application frameworks make developing and deploying AI for medical imaging seamless. With full-stack GPU-accelerated libraries and reference applications, they create real-time, secure, and scalable solutions for developers, data scientists, and researchers.

Download NVIDIA Clara Train and the NVIDIA Clara Deploy at: **NVIDIA Clara Medical Imaging**