Automate Your Radiology Workflows for Deeper Insights Faster

Abstract:

Innovations in artificial intelligence (AI) and machine learning make it possible to automate time-consuming, manual processes, and are emerging as powerful assistants that enable unprecedented leaps in clinical productivity and diagnostic confidence for human specialists. In radiology workflows, which often involve repetitive tasks to set up and facilitate the reading, automation innovations present a major opportunity to help radiologists reach narrower and more definitive diagnoses faster. This paper explores current challenges in the radiology diagnostic workflow and details five areas in which GE Healthcare's Centricity™ Universal Viewer integrates automation to improve productivity and enhance patient care.

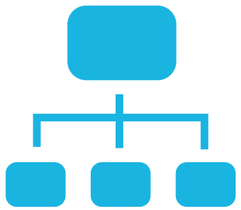
The power of Automation - Deeper Insights Faster

The move toward a value-based reimbursement (VBR) model is putting pressure on healthcare organizations to modernize IT systems so they can more effectively measure and improve the quality and productivity of their care. The long-term goal is clear: organizational integration of devices, applications, and data so clinicians and administrators can have the right information at the right time. This can help enable optimized patient care with the best possible outcomes at the lowest possible cost.

Because they involve repetitive processes, radiology workflows provide the opportunity to streamline productivity and enhance patient outcomes.
By automating key points in the workflow, intelligent solutions can reduce or eliminate manual and redundant tasks that slow down exam interpretation and reporting. Incorporating AI and data integration into the workflow also provide opportunities to potentially get deeper insights with less effort.

Five Steps to Increased Productivity

Automating radiology workflow to support faster and more narrower diagnosis.



Step 1:
Exam assignments

Routing the right study to the right radiologist, based on availability, sub-specialty, and credentials, can be a challenge, especially across multi-site, multi-PACS, and multi-vendor environments. Centricity Universal Viewer helps to solve this challenge with its Intelligent Worklist with Autoserve.

Autoserve provides smart exam allocation using rules to fit to diagnostics, business, and patient care priorities, with the ability to redirect exams when a radiologist is not available. Filtering and sorting with full-screen visuals and patient context for each exam allows easy and quick identification and work prioritization. Autoserve's rules-based automation algorithms drive efficient workload balancing that is sensitive to variables including modality, body part, location, procedure type, and service level agreements (SLAs). The bottom line? Autoserve helps ensure the right study goes to the right diagnostician - at the right time.

When used with the AutoNext feature, Intelligent Worklist also supports further productivity via a "head's down" mode. In this setting, radiologists are automatically presented with the next most important exam to read upon saving, dictating, or finalizing on the dictation system. Priority cases automatically jump to the top of the queue, eliminating and reducing the risk of missing an urgent exam.

By improving workflow and reading productivity, Intelligent Worklist lowers the risk of negative clinical consequences associated with delays in reading, interpreting, and reporting. It also empowers care teams to accelerate clinical decision making for an improved patient experience and outcome. In short? Exam assignments are keenly important. But it starts with the right tools in the right hands of the right people.

Autoserve supports the **smart allocation of work**, using rules to fit to diagnostician, business and patient care priorities, with the ability to redirect exams as needed.

Step 2:
Exam viewing

When analyzing images in a viewer, radiologists may often need to go through a time-consuming set-up process to adapt or adjust their viewing preferences (hanging protocols) based on modality or context, as well as the availability of prior studies.

Centricity Universal Viewer improves image setup efficiency with Smart Reading Protocols (SRP), a new way to create robust and adaptive hanging protocols. With SRP, the user does not need to manually create hanging protocol rules that anticipate a multitude of scenarios, exam types, or procedure information. Instead, SRP uses AI-based, machine-learning algorithms to make inferences and hanging recommendations based on preferences it learns from users. It also optimizes radiology workflow productivity by learning user or group reading preferences and automating image setup - including launching advanced visualization and other applications.

"The key benefits for us are time savings and enhanced collaboration. We're able to prepare images 50% faster than we could previously."

Wojciech Rogala
Head of Diagnostic Centre; Żory, Poland, Helimed Diagnostic Imaging[1]

Centricity Universal Viewer also saves valuable reading time by locating relevant priors with Smart Relevancy and quick-filters, which automatically search the patient history for images of similar body parts and modalities. Relevant images are then displayed using a registration view that synchs display features, such as zooming and scrolling, across images, allowing radiologists to scrutinize corresponding areas in two images simultaneously without the need for time-consuming manual display adjustments. Together, these automated viewing tools support a more thorough patient context and a more confident diagnosis.

Interrupted workflow design has been shown at one customer site to reduce time spent switching exam context by 85%[3]

"In our previous PACS viewer, it required 25 clicks. The radiologist often got interrupted in one patient and then went to locate a second patient in another vault before coming back to the first patient. With Centricity Universal Viewer Interrupted Workflow feature, it only now takes four clicks!"

Harold Barrett
Product Analyst Lead; University of Pittsburg Medical Center[2]

As radiologists are frequently interrupted while reading exams, workflow automation also makes it possible to manage these interruptions more efficiently. With Centricity Universal Viewer's Tabular Interrupted Workflow, radiologists can manage interruptions with one click to hold one or more exams in mid-review to immediately address urgent cases. Another click quickly reopens interrupted cases when ready to resume. The dictation system also automatically saves dictation and image annotation - and reopens at the left-off point. To make it easier to find recently read exams and review them against transcription, Centricity Universal Viewer's Recent Exam List displays opened cases, reports, and other items in reverse chronological order.

Step 3:
Analysis

Radiologists analyze diagnostic images and are called upon for a confident diagnosis. Integrating automated image feature detection and analysis into the workflow can save image prep time and provide deeper insights that support faster, more narrow diagnoses faster.

Technologies such as deep learning already are demonstrating their support to radiology productivity by automating, accelerating, and augmenting radiologist's analysis. While AI may be relatively new to healthcare, it is already contributing to faster, more effective care and decision making through systems like Computer Aided Diagnosis (CAD) - a second-generation AI technique based on continuous learning systems.

Centricity Universal Viewer interfaces with Advanced Visualization applications, providing an easy and seamless way to incorporate post-processing applications in diagnosis. These visualizations can be combined with existing hanging protocols to help reduce manual exam setup and support rapid reading in enhancing workflow efficiency. Preprocessed images are displayed on the monitor according to preset specifications such as vessel analysis, automated bone removal, automated registration, oncology quantification, lung and colon analysis, CT perfusion and more.

In addition, Centricity Universal Viewer supports DICOM Structured Report (CAD SR) which can be used to present CAD and other AI algorithm results with the image data, such as cancer detection digital breast tomosynthesis data. At GE Healthcare, our artificial intelligence partnerships have made significant progress over the past few years, and we have several artificial intelligence solutions in the market making a real impact for customers today.

"[Centricity Universal Viewer] Advanced Visualization has allowed us to improve the efficiency of our patient care, and our productivity."

Dr. Jean-Marc Treutenaere
Radiologist, SELARL du Nedon, Istres, France[4]

Intel® and GE Healthcare

GE Healthcare is an Affiliate member of the Intel® Internet of Things Solution Alliance, a global ecosystem of 400+ member companies that provide scalable, interoperable solutions that accelerate deployment of intelligent devices and end-to-end analytics. Together, Intel and GE Healthcare are bringing their respective long-term expertise in hardware, software, and healthcare to develop, test, and validate innovations across a wide spectrum of medical imaging hardware, software, cloud, and edge technology. The goal? Create solutions that will offer greater hospital efficiency through increased asset performance and expedited time to patient diagnosis and treatment.

To streamline operational and clinical workflows, support the detection and prioritization of critical cases, and ultimately improve patient outcomes, GE Healthcare is developing artificial intelligence (AI) solutions across multiple radiology modalities. This innovative work leverages Intel® Distribution of OpenVINO™ Toolkit to optimize AI inferencing of an X-ray image. Specifically, this enables radiologists to reprioritize workloads to ensure patients with a potentially life-threatening condition receive immediate treatment. Learn more at: https://www.intel.ai/white-papers/gehc/

AI Algorithms built into scanning devices can be used to prioritize exam work lists to make the most urgent findings that may exist on a study rise to the top of a STAT work list so they may be interpreted first.

Step 4:
Interpretation

After analyzing an image, radiologists must interpret the exam in context for the patient. The single imaging study, however, may not be enough: radiologists often need more background on patient medical history to make a narrower and more definitive diagnosis. Radiologists also often want to compare the current images against previously diagnosed and published cases, which may require a time-consuming search of textbooks, professional literature, and the internet.

Diagnostic workflow automation can support radiologists by serving them key clinical context automatically, eliminating the need to manually search patient records such as the EHR as well as normative comparison databases for more difficult or abnormal cases. By providing a more complete picture of the patients' condition and care within the reading workflow, these tools support a more rapid and confident diagnosis.

Imaging Related Clinical Context (IRCC), a feature of Centricity Universal Viewer, delivers this patient clinical content in context by linking to EMR data such as surgical notes, pathology reports, and clinical notes, while presenting these in the patient's exam jacket. It eliminates the need to open and search through multiple IT systems and supports the radiologist in forming a complete picture of the patient to quickly reach a more confident diagnosis. "Our ultimate goal is always to improve the health outcomes of every patient that walks through our door," states Matthew Barish, Vice-Chair, Operations, Management & Informatics, Division Co-Chief, Abdominal Imaging, Stony Brook Medicine. "I think IRCC helps us do that by improving the quality of our reports by narrowing our differential diagnosis and giving us information that we wouldn't otherwise have."

Integration of EHR notes in the reading workflow has been shown to reduce access time to critical patient data by 90%[5]

"There's always another film to be read, another patient to be seen, another phone call to be answered. So that extra time is filled doing what we really are meant to do, which is practice medicine, not navigate through an EMR."

Matthew A. Barish, MD, FACR
Vice-Chair, Operations, Management & Informatics, Division Co-Chief, Abdominal Imaging; Stony Brook Medicine, New York

Step 5:
Care Coordination

All of the previous steps converge at the point of diagnosis and decision making, which often happens collaboratively, with the radiologist acting as one member of a medical board or care team. Radiologists also often need to send results back to referring physicians, or ask colleagues to review exams and advise on their interpretation.

GE Healthcare's collaboration solutions such as Centricity 360 Suite support care coordination via seamless case sharing both in and out of hospital networks. For instance, Centricity Universal Viewer enables radiologists to easily prepare and share exams with multidisciplinary exam review teams as well as referring or collaborating clinicians by making it possible to send an exam directly to the cloud from the diagnostic viewer. It goes a step beyond by automating the sharing process to allow distributed care teams to collaborate on patient cases and distribute clinical data through a vendor-neutral collaboration tool. It also streamlines clinical collaboration with affiliated and unaffiliated clinicians and patients to help reduce duplicate imaging, avoid unnecessary patient transfers, and lower CD distribution.

Automation features in the collaboration tools allow for the easy and seamless sharing of data with specific individuals or defined user groups. This can be driven on specific criteria associated with both user profile as well as type of data being shared. This feature enables easier sharing and collaboration based on pre-determined criteria. The Physician Access application also automatically delivers patient images and reports to the referring physician's inbox, eliminating delays and lapses, while allowing doctors to respond and take action more quickly. The end result? Patients are diagnosed and treated more quickly.

The final piece is that Centricity Universal Viewer's User Defined Foldering features provide the ability to create folders and save exams for future reference such as teaching/academia and peer/quality review. Email integration makes it easy to share imaging studies with bookmarks to collaborate on clinical workflows, communicate results, and support seamless multi-disciplinary exam reviews.

Increase diagnostic confidence by up to 10% through care collaboration[6]

Conclusion:

AI brings radiology into a new era of the automation of time-consuming, manual processes. The repetitive nature of many radiology tasks makes the radiology workflow a prime target for optimization with AI-powered automation. That means that even before a radiologist opens a case, automation can operate behind the scenes to make the most of the radiologist's time, supporting the process of assigning, viewing, analyzing, and interpreting exams, not to mention helping care teams coordinate more effectively. At each of these five key stages of the workflow, GE Healthcare's Centricity Universal Viewer and Centricity 360 Suite include intelligent tools that support radiologists and result in increased productivity and narrower, more definitive differential diagnoses. Given the pressure on radiology departments and the move toward value-based reimbursement (VBR) models, enhancing these key points in the workflow with automation can help care teams deliver a faster and more definitive diagnoses.

What's next?

Today, AI is already showing promise and is poised to revolutionize radiology just as dramatically as digitization did decades ago. As soon as a physician orders a test, workflow AI may be able to optimize the test parameters, equipment, and scheduling. After a test is complete, next-generation AI may be capable of generating thousands of different algorithms that could potentially detect concerning features in images from multiple modalities. With every patient and every scan, these algorithms may learn and improve, becoming more agile and more capable. This new layer of intelligence is set to fundamentally change the radiologists' role in patient care, allowing radiologists to spend less time performing manual tasks and more time interacting with other members of the care team, as well as with patients.

As a medical imaging leader with more than one million machines installed across the world and more than 16,000 scans produced per minute[7], GE Healthcare's 100-year history in healthcare provides deep clinical and operational expertise as well as the trust of both doctors and hospitals worldwide. GE builds on this history, healthcare footprint, and trust to enable health delivery organizations like yours to provide faster, more effective care to your patients.

Partnerships leverage the software expertise of GE Healthcare Digital, the high-volume computing power of GE Health Cloud, and the clinical knowledge and expertise of leading academic institutions and health systems. At GE Healthcare, we are working together to target key disease states, inefficient processes and care areas to build enhanced productivity an diagnostic tools which will power subsequent releases of radiology solutions.[8]

To learn more about how GE Healthcare is leveraging the brightest minds in the healthcare industry to create and disseminate machine learning tools for radiology, please contact your GE Healthcare representative or call (866) 281-7545.

About GE Healthcare

GE Healthcare is the $19 billion healthcare business of GE (NYSE: GE). As a leading provider of medical imaging, monitoring, biomanufacturing, and cell and gene therapy technologies, GE Healthcare enables precision health in diagnostics, therapeutics and monitoring through intelligent devices, data analytics, applications and services. With over 100 years of experience in the healthcare industry and more than 50,000 employees globally, the company helps improve outcomes more efficiently for patients, healthcare providers, researchers and life sciences companies around the world.

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[1] *Case Study: HELIMED Diagnostic Imaging, 2014.*

[2, 3] *Self reported outcomes by the University of Pittsburg Medical Center, 2018. UPMC is a collaboration partner of GEHC and as a result, has a financial interest in the development and commercialization of certain GEHC next generation imaging products.*

[4] *Case Study: Benefits of 3D post-processing with AW VolumeShare7, 2016.*

[5] *Integration of EHR notes in the reading workflow has been shown to reduce access time to critical patient data by 90%. "Impact of PACS-EMR Integration on Radiologist Usage of the EMR," John Mongan and David Avrin, Journal of Digital Imaging, Society for Imaging Informatics in Medicine 2018.*

[6] *Multidisciplinary Team Redesigns Care Processes and Systems, Leading to Significantly Improved Performance on Core Measures in Four Clinical Areas, Phyllis Justus, RN, MSN, NE-BC Director of Nursing, professional Practice & Rose Brandau, RN, MSN Vice President/Chief Nurse Executive Carolinas Medical Center-University*

[7] *General Electric Company 2018 Annual Report*

[8] *Technology in development that represents ongoing research and development efforts. These technologies are not products and may never become products. Not for sale. Not cleared or approved by the U.S. FDA or any other global regulator for commercial availability.*

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