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OUR MISSION: The ACR Bulletin supports the American College of Radiology’s Core Purpose by covering topics relevant to the practice of radiology and by connecting the College with members, the wider specialty, and others. By empowering members to advance the practice, science, and professions of radiological care, the Bulletin aims to support high-quality patient-centered health care.
FROM THE CHAIR OF THE BOARD OF CHANCELLORS

What has the ACR been doing to obtain new CPT codes for contrast-enhanced ultrasound?

The College is working strategically to ensure fair reimbursement.

A s chair of the ACR Economics Committee on Coding and Nomenclature, I hear from members almost daily since the FDA-approved IV contrast use in love ultrasound last year. This innovation can benefit our patients in many ways, and we know the ultrasound community is anxious to bring the latest technology to the bedside. Chair of the ACR Board of Chancellors James A. Brink, MD, FACR, has kindly allowed me to take over his regular column to update our members on the progress toward obtaining current procedural terminology (CPT) codes.

You can be sure that a lot of work has been going on regarding contrast-enhanced ultrasound since FDA approval. We have a workgroup of CPT advisors from the ACR, American Roentgen Ray Society (ARRS), RSNA, Association of University Radiologists (AUR), and American Institute of Ultrasound in Medicine (AIUM) working on this effort with input from the Society of Radiologists in Ultrasound (SRU), Society of Pediatric Radiologists (SPR), and International Contrast Ultrasound Society (ICUS).

We all understand that this situation is a bit of a Catch-22. Utilization doesn’t typically increase without a CPT code, yet the CPT Editorial Panel won’t approve new codes until clinical utilization increases. The problem is that once we submit a proposal for a code, it is out of our hands. The CPT Editorial Panel will determine if it meets the Category I criteria. If the panel determines it doesn’t, the proposal will be rejected altogether or assigned a Category III CPT code. Category III CPT codes are reserved for new or emerging technologies and are used to track utilization until services are performed with sufficient frequency (as defined in the literature, and which is not an issue here) to warrant Category I CPT codes. Because Category III codes are not valued by the Relative Value Scale Update Committee (which advises CMS on the relative value of services under the Medicare physician fee schedule), payment for the service is at the discretion of the individual payers. The rub here is that most Medicare contractors and private payers don’t pay for Category III codes, so we work hard for Category I code status whenever possible.

The ACR, ARRS, RSNA, and AUR CPT advisors have been actively working with the ACR Commission on Ultrasound since FDA approval. In the fall and winter, we brought in the AIUM, SRU, ICUS, and SPR. (SPR is employing ultrasound contrast for some really exciting non-vascular uses, such as ultrasound cytocontrastograms.) Our workgroup spent many hours working on a survey that we recently sent to as wide an audience as possible so that we can gauge the number of cases currently performed in clinical practice across the country. Furthermore, the survey includes questions pertinent to the current procedures in which ultrasound contrast is used and the clinical workflow around these cases. Hopefully you took the time to fill out the survey if you have it and have not completed it, please do so as soon as possible. We hope to get a very robust response. Obviously, solid data showing that indeed these exams are widely performed across the country will be very persuasive when we argue to the CPT Editorial Panel that these exams deserve Category I codes.

In 2017, CPT Editorial Panel meetings take place in February, June, and September. Any codes accepted at any one of these meetings will go into effect in 2019 (based upon normal cycle time for code implementation). From our perspective, the September meeting gives us the best chance of success because we suspect that utilization of these procedures is rising quickly. The longer we can wait to submit for the 2019 cycle, the greater chance of sufficient utilization for Category I success. The deadline to submit for the September meeting is in June, so we need the data from our survey in May so that we have enough time to craft the code proposal. We believe the results of the survey will demonstrate sufficient utilization of these procedures across the country so that we can move forward in a successful manner for our members.

When you or your partners ask, “What has the ACR done for me lately?” consider the following: A process like this has already taken hundreds of staff and volunteer hours, and it will consume many more before we reach the finish line. While this is truly a multi-society effort, the ACR has coordinated all of the calls, emails, and work to date based on our scope and unique experience with the CPT process. The College also has a team of dedicated staff to assist. Further, once codes are approved by the

Ensuring fair reimbursement for the high-value services that radiologists perform for our patients is the value proposition of the ACR.

CPT Editorial Panel, the next step is to present those new codes at the RBRVS Relative Value Update Committee so that relative value units can be assigned. Again, this is a forum in which ACR has unique strengths and experience, including expert physician volunteers (led by Kurt A. Schoppe, MD), to ensure that the value assigned to these codes is appropriate for the effort and intensity associated with performing them. Ensuring fair reimbursement for the high-value services that radiologists perform for our patients is the value proposition of the ACR. It’s yet another reason every radiologist in the country should belong to this organization. If you have a colleague who has not chosen to be a member, please share this column.

By Mark D. Alson, MD, FACR, RCC, Chair of the ACR Economics Committee on Coding and Nomenclature and ACR CPT advisor
At weekly multidisciplinary meetings, radiologist Frederico F. de Souza, MD, collaborates with colleagues to establish treatment plans for complicated hepatobiliary cases.

Imaging 3.0®: Teaming Up

Radiologists at the University of Mississippi Medical Center (UMMC) are improving patient care by bringing together a multidisciplinary team to review complex cases at the outset of the treatment plan. UMMC receives referrals for patients who have complicated liver, biliary, and pancreatic ailments; each week, the group, which can include surgeons, interventional radiologists, residents, nurse practitioners, pathologists, and radiation oncologists, review the upcoming most complex cases. “The radiologist reviews all imaging studies related to the patient, describes the findings, answers any questions related to the findings, and gives the most likely diagnosis or a short list of differential diagnoses during the multidisciplinary conferences,” explained Frederico F. de Souza, MD, director of both the body imaging division and body imaging fellowship at UMMC. This approach provides more accurate diagnoses and effective treatment plans and reduces costs for both the institution and patient.

Take a closer look at this radiologist-led collaborative care effort at bit.ly/Rad_Team.

Discover ACR’s 2017 CPI Chest Module

Discover the most current chest imaging cases from the ACR Continuous Professional Improvement (CPI) program. For more than two decades, CPI has offered high-quality self-assessment publications across ABR-required study areas, as well as special edition topics such as body MRI and perinatal imaging. The newly released CPI Chest Radiology Module 2017 offers up to 8 CME and 8 SA-CME. Imaging 3.0®: Teaming Up

Congratulations to Radiology-Teaches and R-SCAN® for being among the winners and finalists of the Creating Value Challenge. Radiology-Teaches was honored for improving medical education curricula around delivering high-value care. R-SCAN was honored for implementing high-value care as a critical element of patient care.

Congratulations to Radiology-Teaches and R-SCAN Honored for High-Quality Care

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Neiman Institute® Provides Radiologist Patient-Facing Data Tool

A new free resource allows radiologists to determine whether they would have been designated as patient-facing by CMS from 2012 through 2014. Developed by the Harvey L. Neiman Health Policy Institute, the Radiologist Patient-Facing Dataset will help radiologists determine if they are likely to be exempt under the Merit-Based Incentive System (MIPS) group reporting option. “Radiologists can also use this dataset to look up their total CMS fee-for-service procedures, total CMS patient-facing procedures, and percent of procedures classified as patient-facing for each year between 2012 through 2014,” says Danny R. Hughes, PhD, Neiman Institute senior director for health policy research and senior research fellow. “Using this and other Neiman Institute online data tools, radiologists can prepare and succeed in CMS’ evolving payment models.”

Access the tool at neimanhpi.org/patient-facing.

DISPATCHES

YouTube Meets Patient Education

YouTube and similar social media platforms offer a powerful opportunity to educate patients not only about imaging examinations, but the central role radiologists play. With nearly 90 percent of patients using online resources for health education, a growing number of radiologists are using YouTube to reach their patients. A recent AJR study led by Andrew B. Rosenkrantz, MD, MPA, analyzed 63 YouTube videos found via the search terms “CT scan,” “MRT,” “ultrasound patient,” “PET scan,” and “inamrogram.” All videos depicted a patient undergoing examination, 84.1 percent showed a technologist, 20.6 included a radiologist, and 41.3 percent mentioned potential radiation. The group suggests that existing videos could be improved to add important content such as safety protocols and the role of radiologists in providing and interpreting examinations and ensuring quality. The authors note that addressing information gaps could enhance the value of patient-facing videos. “Online video sharing, rather than traditional static web pages, can be particularly helpful by depicting the examination process in real-time, including interactions with the radiologist and office staff.”

Read the article at bit.ly/Patient_YT.

Contrast-Enhanced Ultrasound Safe for Pediatric Patients

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Find the study at bit.ly/Ped_CEUS.

When a medical educator takes the time to counsel a learner about the nuances of medicine... that educator can affect the way hundreds of patients are treated thereafter by that learner. — Melanie Sulistio, MD, on the importance of feedback to trainees (Read more at bit.ly/MED_Facilitating.)

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DISPATCHES

Here’s What You Missed

The Bulletin website is home to a wealth of content not featured in print. Check our blog posts, extra articles, and multimedia content at acrbulletin.org.

Interruption or Opportunity?

Interruptions are an unavoidable component in every workplace. Read how to reframe these intermissions as opportunities to provide value-added care at bit.ly/Interruption_Opportunity.

Crossing Over

Insight into workplace and lifestyle attitudes and values among different generations can improve the work-life balance for all radiologists in your practice. Discussion about successful integration is available at bit.ly/Cross_Over.

Shattering Radiology’s Glass Ceiling

Amy Paik, MD, reflects on her experience as chief resident of an otherwise all-male radiology program at bit.ly/Glass_Rad.

While health care professionals and researchers can, and will, continue to advance scientific knowledge to make medicine better, we also must understand the synergies between innovation, data, basic science, and social science. — Amy Compton-Phillips, MD, on health care redesign (Read more at bit.ly/Change_Design.)

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Physicians should provide public context on important health care issues. And radiologists must reinforce that we are physicians with vital expertise that can help ensure health care reform actually makes care better. — Nicole B. Saphier, MD, Voice of Radiology blog (Read more at bit.ly/VofR.)

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The Economics of Machine Learning

How will emerging technology affect radiology in the near future?

“DeepRadiology Announces the World’s First Fully Autonomous Radiology Interpretation System.” This news story, released during RSNA 2016, was followed by two statements:

1. “The system is able to produce final interpretations and reporting on medical imaging studies and reporting on medical images without the need for a radiologist,” and

2. “The device is ... currently being evaluated by the U.S. Food and Drug Administration.”

I do not know if the system described is real, if this is just hyperbole, or if it is somewhere in between. I do know that this announcement illustrates the need for radiology to respect this emerging technology. As Keith J. Dreyer, DO, PhD, FACR, recently articulated during a presentation to the ACR Board of Chancellors, radiology should take ownership of this technology — before it takes ownership of us. Ownership includes directing the economic actions related to the evolving technology. In this column, I will discuss several short-term (as in, the next three to five years) economic considerations and activities.

One possibility is that the diffusion of this technology will be incremental, such as an algorithm to detect and flag a focal condition (for example, cerebral hemorrhage) for further review. Under this scenario, it is doubtful any specific action will be necessary in regard to the radiology CPT code set. But imagine a scenario in which an FDA-approved vendor will pursue a Current Procedural Terminology (CPT) code to report the service. The code or codes created at the CPT Editorial Panel will largely depend on how the technology affects the work of providing a radiological interpretation. An early question may be, is there physician work involved at all? For example, will the deep learning interpretation involve radiologists (or other physicians) or replace them altogether? If there is no work, then there is no CPT code. But what if radiologists use the input from the deep-learning system to complement their interpretation, resulting in more work? Under this scenario, the CPT code may be an “add-on,” such as was the case when mammography computer-assisted detection emerged. If the technology inherently alters the work of the typical interpretation of a specific service, a revision of that service’s CPT code may be in order. For example, if bone age studies someday are “typically” interpreted alongside a deep-learning application, the CPT code for bone age study interpretation may require a completely new code and descriptor.

If new codes are created, the next step would involve valuation. The base question remains the same: How is a radiologist’s work changed using deep learning? And how does this change in work translate into the customary used in the Medicare Physician Fee Schedule relative value units (RVUs)? And what effects will the technology have on the valuation of the imaging services to which it is applied. For instance, if deep learning provides an interpretation of a head CT, does that somehow lessen the value of the head CT code itself or negate its value altogether? Or is there an increase in the value of the head CT code to capture the increased work of merging the radiologist’s and the deep learning interpretation? Are there related activities involving radiology (for example, providing testing and validation or developing validation protocol)? And what about the cost of the technology for the facilities or physicians’ offices, generally referred to as the technical component (TC)? How will those entities be paid for the hardware and software necessary to provide this technology, and how will this fit into the broader CMS practice expense methodology? What impact could machine-learning have on TC-related activities (such as protocols or image acquisition) and will that affect these payments? These are all important questions for us to ponder.

The emergence of deep learning will affect many industries that rely on large data sets to make predictions and interpretations. Radiology is not alone. Therefore, the Commission on Economics is already scenario-planning, as it is the rest of the ACR. I have described several short-term economic decision points potentially on the horizon. As the leaders in imaging technology, it is incumbent on the ACR to take ownership of deep learning; make sure the technology is safe and contributes to high-quality patient care.

ENDNOTE

How does R-SCAN work?

A simple process brings imaging Choosing Wisely® topics into practice. The R-SCAN website has everything you need to complete the program. The steps include the following:

1. Referring clinicians and radiologists form a team to improve imaging utilization.
2. Baseline data are collected to evaluate the imaging exam ordering patterns of the referring practice.
3. Radiologists and referring clinicians engage in an educational collaboration to improve imaging exam ordering.
4. Data are collected to evaluate improvements in imaging exam ordering.

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Take the next step to increase collaboration with your referring colleagues and boost patient care. Get started today at rscan.org.
ML 101: THE RADIOLOGIST’S BASIC GUIDE

From IBM’s Watson to CAD, most radiologists have heard of machine learning. But do you know how this technique is already used in the field? Plus, what does the future hold? The ACR Bulletin brings you FAQs so you can be sure to have the basics down pat.

What Is Machine Learning?
A researcher named Arthur Samuel coined the term “machine learning” (ML) in 1959. Samuel defined ML as the “field of study that gives computers the ability to learn without being explicitly programmed.”1 In other words, ML is the notion that machines can, over time, learn to do what we as humans do. How? Computers can capture datasets, aggregate the information in those data, and then create predictions, explains Keith J. Dreyer, DO, PhD, vice chair of radiology at Massachusetts General Hospital in Boston and assistant professor of radiology at Harvard Medical School in Cambridge, Mass.

How Does It Work?
The idea that a machine can understand how to perform a new process without specific instruction once seemed impossible. What inner workings have made ML a reality? The answer is a series of algorithms, according to J. Raymond Geis, MD, FACR, assistant professor of radiology at University of Colorado School of Medicine in Aurora, Colo., and vice chair of the ACR’s Commission on Informatics. “Instead of being programmed to do a specific task, machines rely on these algorithms to incorporate statistical methods and learn to perform the task without being specifically shown how,” Geis explains. “While these algorithms have been known for decades, the huge increase in computer-accessible data and faster computing power now make them affordable to use in daily life.”

How Is It Being Applied?
One of the most famous examples of ML is IBM’s Watson, whom you may remember from the TV game show Jeopardy! Watson won a first place prize of $1 million against human competitors. More recently, you may have also seen a commercial about Watson sorting through hundreds of medical images to make a diagnosis.2 But ML is already used in medicine and radiology: the most common use being computer-aided detection, or CAD. CAD uses datasets to process an image and detect conspicuous sections where disease might be present. However, even with CAD, radiologists still typically interpret images and review and contextualize the information from CAD: “It needs to be an interactive process between human and machine,” says Dreyer.

What Does It Mean for Radiology?
There’s a large initiative by academic and commercial groups to develop more valuable ML products, so “you will see the use cases boom in the future,” says Geis. He adds that ML provides an opportunity to find new and useful patterns in datasets, such as electronic health records, radiologic images, or even genomic information. Within ML, radiology seems to have become a hot topic because of the vast quantities of already labeled images, such as those on social media platforms like Facebook, which allow us to test applicability. Even though Facebook images may be of friends or scenery, rather than radiologic images, they can serve as use cases to experiment with ML recognition — for instance, the way that Facebook can now “suggest” who to tag in an image.

Dreyer explains that ML can be used for two different tasks: detection and diagnosis. Detection simply refers to identifying the presence of a finding in a radiologic image. Diagnosis could take this a step further, analysing possible clinical classifications to identify the object, similar to how a radiologist would read an image to determine what’s going on with a patient.

What’s the Difference Between Machine Learning vs. Artificial Intelligence vs. Deep Learning?
Machine learning refers to a computer’s ability to train itself without being programmed. Artificial intelligence is what results when machine learning is put into practice and is a more mainstream, popularized term. Another common term that’s been confused with ML is deep learning, which is actually a subset of ML. Deep learning involves multiple, complex levels of computation, explains Geis. “In a simple network, you have one input layer, a single ‘hidden’ or computational layer, and one output layer. In a deep network, you have multiple hidden layers.”
What Challenges Exist?
A recent article in the *New England Journal of Medicine* warned that ML could “displace much of the work of radiologists and anatomical pathologists” while improving diagnostic accuracy. Despite the use of CAD and the development of even better algorithms, many remain concerned about the use of ML in image interpretation. Dreyer explains, “There’s a lot of context and information that needs to be conveyed beyond a simple interpretation based on one finding in a complex imaging exam. Even if an algorithm finds tuberculosis on a chest CT, that doesn’t mean other diseases aren’t present. There still needs to be a comprehensive interpretation.” Geis also adds that while many are optimistic about the benefits of ML, many roadblocks exist, including the need for more research and datasets. Additionally, ML brings up many issues that need to be thought through, such as legal risk, ethical issues, and an undefined regulatory framework.

What Does the Future Hold?
Could ML actually replace radiologists? “Not anytime soon,” according to Geis. “Machine learning will, however, arrive in the next few years in the form of advanced CAD, personalized exam protocols, and tools to help with specific clinical questions.” So what’s the key for radiologists to avoid being left behind? “To see the potential of ML in radiology, we need to watch the consumer markets to see how technologies are being applied,” says Dreyer. “Companies like Google, Facebook, and IBM are driving a lot of innovation, and it will be translated into the clinical domain.”

By Alyssa Martino, freelance writer for the ACR Bulletin

ENDNOTES

Lesson #1. When the cost of something falls, more people demand it.
Machine-learning algorithms take available information and use it to fill in — or predict — missing information or something that is unknown (such as the presence of a disease). In this way, machine learning is a prediction technology, explains Avi Goldfarb, PhD, the Ellison Professor of Marketing at the Rotman School of Management at the University of Toronto. “As artificial intelligence improves, it will lower the cost of machine predictions,” he says. “And as the cost of prediction drops, we’ll begin using machine learning for many more tasks — including those that were never before framed as prediction problems, like medical diagnosis.”

Lesson #2. When the cost of something falls, the value of substitutes drops along with it. The substitute for machine prediction is human prediction. As the cost of machine learning falls and it starts getting used more often, the value of human prediction will also fall. So, if diagnostic radiology were considered only as a prediction problem, the value of radiologists would fall.

Lesson #3. When the cost of something falls, the value of complements rises. “When coffee becomes cheaper, people buy more sugar and milk, and their value rises,” says Goldfarb. “In the machine-learning economy, we believe human judgment is going to become increasingly valuable as a complement to diagnostic prediction.”

Implications for Radiology
These days, everybody is talking about IBM’s Watson, but machine learning isn’t new. In fact, Arthur Samuel, a pioneer in artificial intelligence at IBM, built a checkers-playing program as far back as 1959. What is new is the ability to apply machine learning to radiology, says Adam C. Powell, PhD, president of Payer-Provider Synergist, a management advisory and operational consulting firm focused on the managed care and health care delivery industries.

“For machine learning to work, you need digital inputs and outputs,” says Powell. “In radiology, we are now capturing images and information digitally and thus have a digital input. Thanks to electronic medical records, we now have a digital output from the diagnostic process. We can develop algorithms to map inputs to outputs, using archives of digital images and recorded diagnoses as training data.”

So can a computer learn to do a better job of diagnosing medical problems than the radiologists who programmed it? And will the laws of economics put radiologists out of their jobs?

— Keith L. Dreyer, DO, PhD

Evaluating the impending impacts of the machine-learning economy

Karl Benz is credited with inventing the automobile in Germany, but Henry Ford introduced the concept of mass-produced vehicles that were economical for the everyday consumer. Many consider machine learning as revolutionary to medicine as the automobile was to transportation, but what will it take to enter the mainstream? What are the economic shifts we can expect? And can radiologists prepare for a machine-learning future?

For answers, let’s consider some basic lessons from Economics 101.

**Lesson #1.** When the cost of something falls, more people demand it.
Machine-learning algorithms take available information and use it to fill in — or predict — missing information or something that is unknown (such as the presence of a disease). In this way, machine learning is a prediction technology, explains Avi Goldfarb, PhD, the Ellison Professor of Marketing at the Rotman School of Management at the University of Toronto. “As artificial intelligence improves, it will lower the cost of machine predictions,” he says. “And as the cost of prediction drops, we’ll begin using machine learning for many more tasks — including those that were never before framed as prediction problems, like medical diagnosis.”

**Lesson #2.** When the cost of something falls, the value of substitutes drops along with it. The substitute for machine prediction is human prediction. As the cost of machine learning falls and it starts getting used more often, the value of human prediction will also fall. So, if diagnostic radiology were considered only as a prediction problem, the value of radiologists would fall.

**Lesson #3.** When the cost of something falls, the value of complements rises. “When coffee becomes cheaper, people buy more sugar and milk, and their value rises,” says Goldfarb. “In the machine-learning economy, we believe human judgment is going to become increasingly valuable as a complement to diagnostic prediction.”

**Implications for Radiology**
These days, everybody is talking about IBM’s Watson, but machine learning isn’t new. In fact, Arthur Samuel, a pioneer in artificial intelligence at IBM, built a checkers-playing program as far back as 1959. What is new is the ability to apply machine learning to radiology, says Adam C. Powell, PhD, president of Payer-Provider Synergist, a management advisory and operational consulting firm focused on the managed care and health care delivery industries.

“For machine learning to work, you need digital inputs and outputs,” says Powell. “In radiology, we are now capturing images and information digitally and thus have a digital input. Thanks to electronic medical records, we now have a digital output from the diagnostic process. We can develop algorithms to map inputs to outputs, using archives of digital images and recorded diagnoses as training data.”

So can a computer learn to do a better job of diagnosing medical problems than the radiologists who programmed it? And will the laws of economics put radiologists out of their jobs?

— Avi Goldfarb, PhD

The need for patient interaction and shared decision-making may also expand. “The patient will still need someone to explain the implications of the findings,” says Powell. “How can they visualize the issue? How can they make intelligent decisions about the care pathway they wish to follow based upon the probabilities that are presented by the data? Machine learning may drive the need for more clinical radiologists who take a holistic approach.”

**Mainstream Acceptance**
What will it take for machine learning to become mainstream in medicine? The answer, says Goldfarb, is surprisingly simple: “It just has to be better than a person.” Are we there yet in radiology? Not quite. But as more data accumulates, as the research progresses, there will be an increasing number of situations in which machines are able to automatically make diagnostic predictions with a greater degree of accuracy than a person would.

Powell agrees. “It’s not going to be all or nothing, and there are many differences and opportunities that machine learning is only starting to address. It may be easier for a machine to perform better than a person at evaluating some very constrained, frequently seen clinical situations. It will probably be much harder for a machine to be better at irregular, complex, or rare problems.”
SIZING UP TECHNOLOGY SYMBIOSIS

Specialists who embrace these new developments have a bigger toolbox than ever.

Machine learning (ML) is on the rise in just about every field of medicine, signaling changes that have some specialists speculating on how the ever-improving technology may change their position in the health care landscape. Radiologists may feel particularly uncertain as computer-aided detection (CAD) and diagnostic algorithms produce impressive results that test the mettle of human counterparts. A good example in radiology is mammography CAD, which is now used in approximately 90 percent of mammography practices, according to Elliott L. Siegel, MD, FACR, professor of radiology at the University of Maryland School of Medicine. By analyzing images for suspicious tumors, most experts and the ACR agree, CAD can be an invaluable screening tool. A CAD algorithm has been able to detect and characterize various types of mammograms with great accuracy. According to the authors of a recent study, the automated CAD system could help physicians more easily diagnose and treat patients with the most common kinds of musculoskeletal malignant growths. In medical oncology and cardiology, algorithms and machine-learning risk decision trees are used to guide treatment decisions and provide recommendations related to eating habits and exercise.

“Radiology is far ahead of other specialties in its research on machine learning,” Siegel says. “We have been conducting research in this area for more than 30 years.”

ML in Other Specialties

For radiology, the inherent value in machine-learning algorithms that can consume huge sets of data to process millions of images and medical observations is clear. Other specialties are also considering new technologies in search of better patient outcomes, rather than treating ML technology as something to be feared. For example, cardiologists are exploring the use of ML algorithms to detect and characterize various types of cardiac images. These algorithms can be used to identify patients at risk of developing heart disease, leading to earlier intervention and improved outcomes. In addition, ML algorithms can be used to analyze data from wearable devices and mobile applications to monitor patients remotely and detect changes in health status.

Future Benefits

“Machine learning is a tool to improve efficiency, diagnostic accuracy, and safety,” Siegel says. “With the advent of these tools over the next many years, we should view them as exciting and wonderful enhancements to our practice.”

With machine learning becoming more mainstream and affordable—and boasting high rates of accuracy and probability of a correct diagnosis—it is evolving to create smaller practices coping with rising costs and staffing shortages. As radiological services are enhanced, there will still be a need for personalized, human recommendations in imaging as they relate to further testing and treatment.

Pairing ML algorithms with automated cancer-screening tools, for example, allows computers to look for uncommon disease while a radiologist focuses on her diagnostic target. CAD uses a dataset to process an image and signal areas where disease might be present. However, even with CAD, there’s typically a parallel track where a radiologist also interprets images and then decides what’s true or false.

“It is fairly well recognized that in medical applications there are tasks that are better suited to computational approaches and other tasks that are better suited to human approaches,” says Cordon-Car旭. “Humans are much more capable at detecting model failures and outliers, as well as recognizing conflicting information, whereas computers are much better at keeping track of relationships and building models off of these relationships. Success in this field will therefore always be measured in terms of the ability to efficiently combine and integrate the strengths of both.”

For the first hundred years of radiology, the medical charts always accompanied the patient, and the radiologist never saw it. As a result, radiologists reading images often had no knowledge of the patient’s medical history. Does the patient have diabetes or cancer or some other condition that might affect the findings? In more ways than one, radiologists were practicing in the dark.

With the advent of electronic medical records (EMRs), it became possible to practice more accurate diagnosis of pathology. Integrative patient-focused machine-learning models developed in the Precise Medical Diagnostics program at the Icahn School of Medicine at Mount Sinai have been trained to analyze patient data from the department of pathology at Mount Sinai to create disease-specific diagnostic and predictive pathology to be at the forefront of effective treatment strategies. “Such standardized approaches will position specialists to offer the best patient care,” says Robert M. Eisenberg, MD, PhD, co-founder of the Precise Medical Diagnostics program at the Icahn School of Medicine at Mount Sinai’s Center for Computational and Systems Pathology.

“Machine-learning algorithms could assist in the discrimination between pathological hypertrophic cardiomyopathy (HCM) and other conditions that might present similarly,” says Christy Blay, MD, assistant professor of hematology and medicine and director of the Integrative patient-focused machine-learning models developed in the Precise Medical Diagnostics program at the Icahn School of Medicine at Mount Sinai. “Creating objective and standardized methods for assessing comparison with clinical variables and tumor pathology was the basis for some of the early prostate cancer models that have helped to guide treatment decisions for men newly diagnosed with prostate cancer.”

Accessing Guidelines and Mitigating Errors

Many think of CDSS for imaging as strictly applying to decision support for order entry by referring providers. However, decision support tools can aid diagnostic radiologists as well. Beyond putting meaningful information about the patient’s medical history at radiologists’ fingertips, CDSS for radiologists also ensure the use of current guidelines and best practices for interpreting images to help make clinical decisions.

“For the purpose of the radiologist is not just to say what’s there; it’s to help the referring doctors know what to do about it,” says Hirschorn. “Say I find a pulmonary nodule on a chest scan. Very often it’s benign, but sometimes it’s cancer. An algorithm developed by a team of experts will tell you the best thing to do next depending on the patient’s age, the size and location of the nodule, and other factors like smoking history. In the past, radiologists would try to dig up that algorithm from a book or a sticky note or an online search. Now, they can use CDSS to instantly provide a report with the appropriate recommendation.”

RIDING THE TECHNOLOGY WAVE

Decision support for radiologists rises to the point of care.

Having clinical decision support at the point of care means not only enhanced efficiency for radiologists, but also fewer mistakes. “A big stumbling block in a radiologist’s work is the inability to quickly access the information they need to know along with the pressure placed on them for report turnaround time, which is a metric used by virtually every institution,” says Arun Krishnaraj, MD, MPH, chief of the division of body imaging at the University of Virginia Health System. “When the focus is on getting the report out quickly, sometimes errors can creep into the report is incomplete because the information is just too hard to get.”

Using clinical decision support can help reduce these errors and improve the overall quality and reliability of radiology reports. By integrating CDSS into the EHR, radiologists can have access to relevant information about a patient’s medical history, current medications, and other pertinent data directly at the point of care. This not only helps radiologists make more informed decisions, but also improves patient outcomes.

Delivering Benefits for Radiologists, Referrers, and Patients

Cree M. Gaskin, MD, professor of radiology and medical imaging and vice chair of informatics at the University of Virginia Health System, has begun integrating radiology-centric dashboards into the EHR to help radiologists find relevant information and produce more accurate reports. “Diagnostic radiologists commonly interpret hundreds of studies per day while creating reports that integrate the imaging findings with patient clinical context and current medical knowledge,” says Gaskin. “We may interpret a study quickly—often in seconds—but it might take several minutes to read a chart, and over time, the chart can become so complex that we may miss something.”

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“Machine-learning algorithms could assist in the discrimination between pathological hypertrophic cardiomyopathy (HCM) and other conditions that might present similarly,” says Hirschorn. “For example, if I’m reading a CT of a patient with pancreatitis, please just tell me the amylase and lipase lab values right away. Don’t make me dig for them. All about having the right information in the right place at the right time. That’s what clinical decision support (CDS) for radiologists is all about.”

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For example, you might receive a call at the end of the day saying the chart is incomplete because the information is just too hard to get.”

According to Gaskin, the benefit of having meaningful clinical information at your fingertips is twofold: a more useful report for clinicians based on patient clinical context and a potentially better outcome for the patient. “For example, you might be looking at the foot, but if you knew that the issue was at the great toe, you might give that an extra look,” he says. “By knowing exactly what’s going on with the patient, you’re less likely to miss a subtle finding.”
Driving Adoption of CDS for Radiologists

Like every new technology, CDS for radiologists will take some getting used to before users begin seeing its value. But radiologists should persevere, Gaskin emphasizes. "Radiologists should insist upon having access to integrated decision support technology now," he says. "But for it to be widely adopted, CDS technology must fit seamlessly into the radiologist's workflow, or it will be ignored."

Most important, says Krishnani, is for radiologists to ensure they have easy access to relevant patient data. To make this happen, radiologists need to specify to practice leaders, health system administrators, and technology vendors exactly what information they need. "At a minimum, we should design structured reporting templates," says Krishnani. "Sit down with your referring providers to ensure the reports include the key elements they feel are necessary, and build those prompts into your template. Finally, bring in your EHR vendor to find out how to populate that information automatically in your report."

Hinchorn says populating report templates with relevant information using standardized language is exactly where the ACR Assist™ decision support tool comes into play for radiologists. (See sidebar for more information.) "ACR Assist currently has valuable content for pulmonary and adrenal nodules," says Hinchorn. "And more is being developed every day. Radiologists who have created standardized protocols or decision support algorithms should contact the ACR to get their content populated in ACR Assist. Contributing to that community effort is important. As radiologists, we need to ride this technology wave, not get left behind."}

ACR Assist™

ACR Assist™ is a clinical decision support framework that provides structured clinical guidance to radiologists as part of the radiology workflow. Structured content is delivered via reporting vendors at the time of image interpretation to augment the radiologist's findings narrative. With ACR Assist, radiologists no longer need to search through numerous reference guides, PDFs, and notes, or call a colleague to find the exact classification for a radiology report. ACR Assist uses natural language processing to determine when to provide radiologists with necessary content objects at the optimum time in the workflow. ACR Assist enhances reporting systems with point-of-interpretation Access to Taxonomies, care pathways and algorithms, and classification and communication guidance. The framework brings evidence-based guidelines for recommendations and actionable reporting into clinical practice, in a structured, vendor-neutral manner, providing guidance during interpretation at the time this information is most useful to radiologists.

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with CMS’s push to base Medicare reimbursements on value-based quality metrics, radiologists across the country are now striving to change their fundamental assumptions about how quality patient care is delivered. In this quality reporting environment, raw output will play an ever-diminishing role in favor of demonstrable outcomes. But how can radiologists prove that they have a positive impact on patient care?

"We’re moving in the direction of quality measures and pay-for-performance," says Jason A. Kreitner, MHA, RT (R), (T). former administrative director of diagnostic imaging and now vice president of NRDR at Hackensack University Medical Center in Hackensack, N.J. "Radiologists now have access to benchmark data and are able to adjust their practice and workflows to achieve best practices, which ultimately leads to better patient care and outcomes. Registries are an important way to achieve this," he says. "It’s crucial that hospital partners with their physicians to provide resources to track and aggregate data through the hospital’s electronic medical record (EMR) for these registries. I believe that forging a strong partnership between both groups is imperative to success in the era of value-based health care."

The partnership between Hackensack University Medical Center and its affiliated private practice radiology group has been a catalyst for ongoing registry participation and quality improvement. "Our hospital-based quality team is extremely impressed with our department’s efforts on measuring value," says Gregory N. Nicola, MD, vice president of the Hackensack Radiology Group in Hackensack, N.J. "Passionating hospital departmental quality meetings with data is more powerful than having the hospital quality committee take your word for it or put us as taking quality seriously. This is especially appreciated by the hospital given that we are a private practice."

The department began its participation in registries with two of the NRDR databases: the Dose Index Registry® (DIR) — because dose management and patient safety are chief concerns for radiologists and hospital administrators alike — and the General Radiology Improvement Database (GRID), due to its direct relevance to specific radiology tasks and the potential for immediate action in areas such as turnaround times, patient wait times, patient satisfaction, and other process and outcome measures.

After seeing the benefit of DIR and GRID in quality improvement, Hackensack began participating in other registries. Then they heard about the ACR Diagnostic Imaging Center of Excellence (DICOE) program. Hackensack was one of the first recipients of DICOE status in 2013, and the facility received its first renewal of the designation in 2016.

The Real-Time Benefits of Registries

Using registries to prove radiology’s positive impact on patient care

Registries and Quality Reporting

The strong commitment to quality also positions the radiology group and the hospital for future success with the Quality Payment Program (QPP), the care delivery mechanism of the Medicare Access and CHIP Reauthorization Act of 2015 (MACRA). Using the registries, the team will be able to demonstrate quality activities and workflow transformation translate to increased reimbursement under QPP. Kreitner says, “These registries are pivotal in providing quantitative data that help drive a quality culture mindset of improvement, which is not only the right thing for patient care, but is so important in a public reporting program such as the CMS Five-Star Quality Rating System.”

Participants in the Merit-based Incentive Payment System (MIPS) track of the QPP will have the opportunity to submit data for each of the four MIPS categories through an EMR or a qualified clinical data registry (QCDR) like the NRDR registries, among other reporting mechanisms. The QPP’s first performance period begins on January 1, 2017, and ends on December 31, 2017. Under QPP, radiologists must now report various measures to CMS to avoid a penalty of up to 4 percent on their annual reimbursement. While the penalty (which could also be a bonus if your score is above average) begins at 4 percent, it will increase each year until it reaches 9 percent.

“Congress felt data registries were going to be the best way to start tracking diseases, patients, and outcomes, as well as to foster quality improvement,” Nicola notes. As a result, those groups who are already participating in ACR registries have a leg up: NRDR gives you access to 30 to 40 reporting measures, whereas radiologists who only report claims-based data may have just five to six measures to choose from for CMS.

More Art Than Science

This is where it gets complicated: Nicola says there’s an art to choosing which measures to report to CMS as part of the QPP. “You want to pick categories where you out-perform others, but also those that are of high value,” he says. In fact, measures where physicians have historically performed well may be considered “topped-out” in future performance years for the QPP, meaning they may lead to reduced scoring opportunities. “You want to have a bigger pool of measures to choose from, and NRDR provides that,” Nicola says. “There’s a huge amount of power in having a lot more data than you necessarily need to submit.”

Continued on page 21
ACR Fellowship Round-Up

Take a look at the opportunities the ACR has to offer.

Bruce J. Hillman Fellowship in Scholarly Publishing

The Hillman Fellowship is designed to provide a concentrated, two-week experience in medical journalism and publishing for a qualified staff radiologist. The goal is to sufficiently engage talented junior and mid-career radiologists to encourage them to pursue some aspect of medical journalism as a part of their careers.

For more information, visit bit.ly/HillmanFellow.

Applications due August 31.

James M. Moorefield, MD, Fellowship in Economics & Health Policy

James M. Moorefield, MD, Economics Fellowship, sponsored by the ACR’s Economics & Health Policy Department, provides radiology residents direct exposure to the ACR’s economics activities.

For more information, visit bit.ly/MoorefieldFellow.

Applications due June 1.

Valerie P. Jackson Education Fellowship

The Valerie P. Jackson Education Fellowship provides the opportunity for a radiology or radiation oncology resident, fellow, community or academic radiologist, radiation oncologist, or medical physician. Applicants may also include educators with a specific interest in the field of radiology, radiation oncology, or medical physics with the goal of gaining direct exposure to the operations of the Education Department at the ACR.

For more information, visit bit.ly/JacksonFellow.

Applications due fall 2017.

Rutherford-Lavanty Fellowship in Government Relations

The Rutherford-Lavanty Fellowship, founded in 1993, provides radiology residents direct exposure to ACR government relations activities.

For more information, visit bit.ly/RutherfordFellow.

Applications due June 16.

W
ant to know more about the College and build your resume at the same time? Apply for a fellowship. Ranging from a government relations to scholarly publishing, ACR fellowships provide members with opportunities to experience critical areas of the College. Check out what you can apply for below.

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Applications due June 16.
When did you know you wanted to be a radiologist?

Well, I would love to say there was a great thunderclap moment — an instant when even disinterested passersby would have to admit my unmistakable radiologist identity burst forth for the first time. But my path, it turns out, was a bit more gradual than that.

As a third-year medical student, I was impressed (read: shocked) by how often patient diagnosis relied on imaging to confirm the initial findings of clinical examination and laboratory testing. By the time I was a fourth-year medical student finishing my elective rotation in radiology, I knew I had found the field where I belonged. But what was it about radiology that drew me in?

I was absolutely astonished that radiologists could impact the lives of so many individuals.

I found that solving problems, which is the nature of the work in the field, is incredibly intellectually rewarding. The opportunity to diagnose and the need for attention to detail provided new and exciting challenges each day.

The atmosphere of teaching and collaborative learning that permeates the field. Even today, I have yet to meet a radiologist who can resist the overwhelming love for the work in the field.

I loved the atmosphere of teaching and collaborative learning that permeates the field. Even today, I have yet to meet a radiologist who can resist the overwhelming love for the work in the field.

Matthew M. Miller, MD, argues that radiologists can change the lives and trajectory of care for 50+ people in a single day.

Matthew M. Miller, MD, breast imaging fellow at Duke University Medical Center.
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