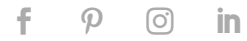




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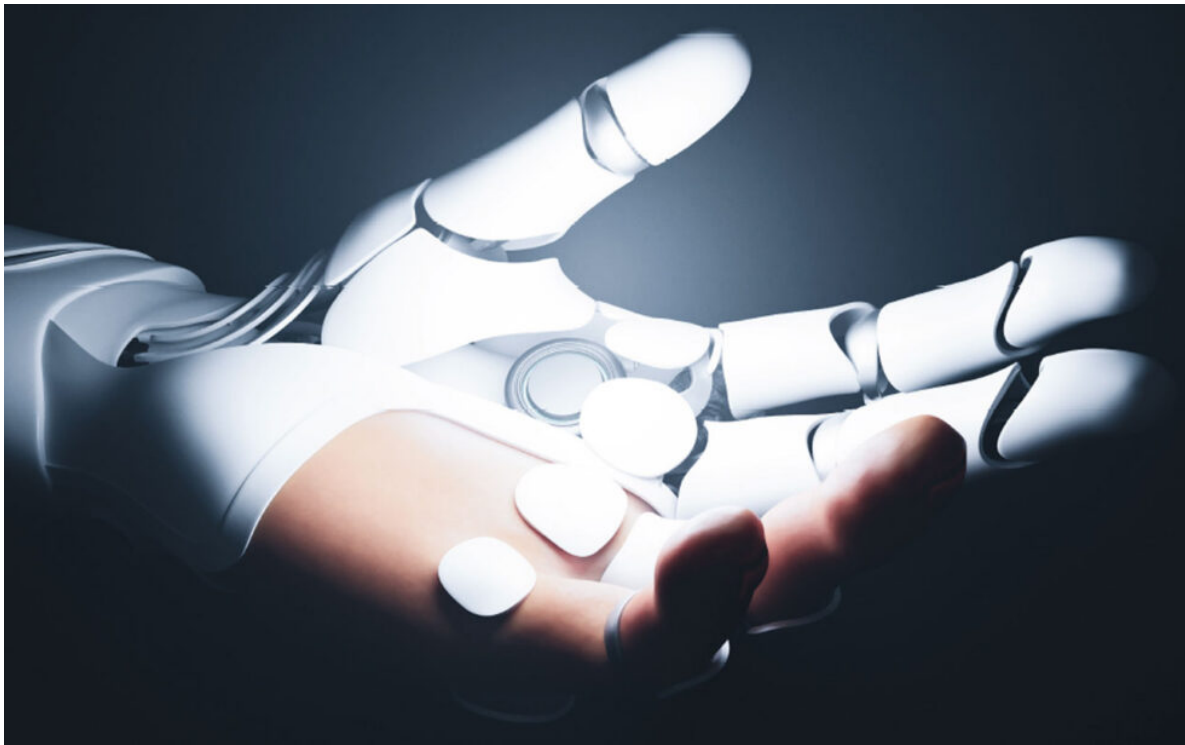
OR TODAY



Machine Learning in the OR

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By Don Sadler



Technology advancements in the 21st century have transformed practically every industry, including health care. These advancements include machine learning (ML) and artificial intelligence (AI).

“Operating rooms today are becoming a high-tech discipline and things like machine learning and artificial intelligence are no longer abstract ideas or hypothetical applications,” says David Taylor, MSN, RN, CNOR, president of Resolute Advisory Group LLC. “They are empowering tools that can give ORs across the country advantages that they never imagined.”

“Using machine learning and artificial intelligence can help OR managers go from a reactive to a proactive approach,” adds Beverly Kirchner, BSN, RN, CNOR, CNAMB.

Orthopedic and Interventional Procedures

Machine learning in the OR is currently being used in hard tissue procedures such as hips, knees and spine, while some augmented intelligence-based technologies are used in interventional procedures, says Anthony Fernando, president and CEO of Asensus Surgical.

Fernando distinguishes between artificial intelligence and augmented intelligence: “Artificial intelligence describes algorithms that are capable of making intelligent decisions, while augmented intelligence is designed to enhance, not replace, human intelligence.”

Lots of different variables come into play when it comes to using machine learning and AI in the operating room. “Every patient is different and surgeons and perioperative team members have different skill sets,” says Fernando. “Machine learning and AI bring consistency and reduce variability, which leads to better surgical outcomes.”

Modern operating rooms use digital and interconnected equipment and advanced imaging and robotic procedures. “Each of these produces data,” says Taylor, “resulting in a huge potential to improve patient therapies and surgical outcomes by means of machine learning and artificial intelligence.”

Taylor believes that machine learning empowers health care organizations to make sense of their data with purpose. “It can be leveraged to analyze large volumes, variety and velocity of data while supporting

evidence-based decision making in hopes of reducing medical errors and improving care coordination,” he says.

“When integrated properly, machine learning and artificial intelligence will accelerate the pace of innovation and improve efficiency in the perioperative environment,” Taylor adds.



Practical Uses in the OR

There are many practical ways that ML and AI are being used in operating rooms and ambulatory surgery centers (ASCs), starting with scheduling. “Machine learning and artificial intelligence use algorithms to staff the OR, which lowers perioperative costs,” says Kirchner.

“Artificial intelligence and machine learning can optimize OR slots based on the procedure performed and the time and length of the procedure,” says Francisco Rodríguez-Campos, MSc, Ph.D., MRSO (MRSC), principal project officer, device evaluation team at ECRI. “They can also predict patient outcomes and discharges based on optimization of surgical scheduling, which may improve OR utilization.”

Chad Ramos, the CEO of Privado Health, says that OR scheduler software uses AI to analyze upcoming cases and create the most optimal staff schedules.

“Using artificial intelligence to optimize OR utilization and block time management is one of the best use cases for AI in an ASC,” he says. “It’s a no brainer if a facility has enough cases to justify it.”

“Things can get quite complicated when you have more than three or four operating rooms, especially when the facility is busy,” adds Ramos. “Utilizing the OR scheduler can reduce valuable OR manager time that can be devoted to patient care, providing an immediate return on investment.”

“Instead of using complicated spreadsheets, we can pull and analyze data from electronic medical records such as block utilization, which will help control block schedules and eliminate large gaps in the surgery schedule,” says Kirchner. “The data can be used to predict staffing for all shifts so you are not understaffed or overstaffed.”

A study led by Rodney A. Gabriel, MD, MAS, aimed to develop machine learning models that predicted outpatient surgery end times and recovery room discharge times at a freestanding academic ASC. Or in other words, whether surgeries would be finished by the end of surgical block time and whether patients would be discharged by the end of the recovery room nursing shift.

The study demonstrated improvement in predicting the outcome at a range of start times when using various machine learning algorithms versus regression techniques. “Machine learning may be adapted by operating room management to allow for a better determination of whether an add-on case at an outpatient surgery center could be appropriately booked,” says Gabriel.

Gabriel believes that the utilization of machine learning to aid in OR management has much potential for ASC managers in an effort to improve efficiency and patient outcomes. “Various studies have

demonstrated improvement in case duration accuracy, cancellation prevention and recovery room management," he says.

Taylor agrees, noting that the post-anesthesia care unit (PACU) often becomes a bottleneck. "If the PACU reaches capacity, subsequent procedures are delayed or patients who are already in the OR must wait until PACU space becomes available," he says. "As a result, the OR is delayed, or even worse, there are possible cancellations for subsequent procedures.

"Machine learning algorithms result in the highest predictive capabilities, which enables them to improve scheduling by predicting case duration estimations," Taylor adds. "This improves OR efficiency while also reducing costs."

Machine Learning and Robotics

Kirchner lists a few more potential uses of ML and AI in operating rooms and ASCs. "Robots use a form of machine learning to assist in neuro and orthopedic surgery," she says. "The robot can be programmed to take specific actions, but it can also learn to do new tasks through machine learning and artificial intelligence. X-rays can also be read in real time using AI."

Ramos and his team at Privado Health are using AI to predict what materials need to be ordered and when to ensure that they have proper stock levels of implantable items and other materials on hand without spending too much on shipping or overloading precious storage space.

"We are using case scheduling, stock level, preference card and vendor data to calculate what, when and how much we should order," says Ramos.

ASCs and hospitals can also use AI to examine OR utilization rates and shift volume, reallocate resources and optimize OR block time with predictive analytics. "This is a huge area of benefit that most ASCs are not taking advantage of yet," says Ramos.

Scott Jackson, vice president of surgical solutions for Henry Schein, encourages ASC operators to investigate what ML and AI solutions are available on the market.

"Pay especially close attention to AI systems that can assist with block scheduling, OR optimization, staff utilization and supply ordering," says Jackson. "These are all very important areas for ASCs to manage and there are AI systems available that address each of these areas."

Benefits of Using ML and AI in the OR

Ramos points to cost savings as one of the biggest benefits of using ML and AI in the perioperative setting. "ASCs are running on razor thin margins so they need to be hyper aware of the money they spend on labor, supplies, patient communication and just about every area of the business," he says.

Using ML and AI also gives back precious time that nurses and other staff desperately need for patient care. "Burnout is real, so anything that can help reduce the workload is not only welcomed but should be prioritized," says Ramos.

"A key benefit in any health care application of AI is that for diagnosis and treatment planning, it removes bias and promotes standardization and consistency," says Bruce Lieberthal, vice president and chief innovation officer for Henry Schein.

Fernando concurs.

"It's all about standardization and consistency," he says. "For example, you know that a gall bladder surgery should take 20 minutes if you follow certain procedures. Surgeons and team members can plan their workflow better, which gives everyone greater peace of mind and reduces cognitive fatigue."

"In short, machine learning and artificial intelligence decrease costs and improve patient outcomes," says Kirchner. "They have also been shown in research to improve knowledge retention among perioperative staff and boost team engagement."

Reducing waste is another big benefit of using machine learning and artificial intelligence in the perioperative setting.

"At Privado Health, we use artificial intelligence and machine learning to identify opportunities to reduce wasted supplies and time by digging into surgeons' preference cards," says Ramos. "These preferences are often outdated and incorrect so things are being opened that should not be."

In addition, using ML and AI automates manual tasks that perioperative nurses no longer have to perform. "We are facing a massive nurse shortage in this country and a lot of the tasks nurses are asked to perform, like staff scheduling and material management, can and should be done by software and algorithms," says Ramos.

Fernando uses a driving analogy to illustrate what he believes is one of the biggest benefits of using ML and AI in the OR.

"For surgeons it's kind of like having lane assist or a backup camera in your car," he says. "Having a historical lookup for a case increases surgeons' confidence so they can worry less about making a mistake."

Success Tips for ML and AI Implementation

Ramos recommends that health care organizations start by taking a fresh look at all of the perioperative processes they are currently following. "If you're doing things the same way you have for the past couple of years, there's a good chance you aren't doing them as efficiently as you could be," he says.

These processes include case and staff scheduling, case costing, patient communication, material management and revenue cycle management.

"Each of these areas has legitimate AI uses that already exist," says Ramos. "Look at the options and how AI can be added to existing processes to make things run smoother and take the burden off staff. They will be thankful of this and ASCs will see it in their bottom line."

"To have a successful implementation, data needs to be standardized as well as the metrics that will be used to determine the success of the scheduling," says Rodríguez-Campos. "Such metrics might be interpreted differently across different institutions."

Kirchner has two words of advice when it comes to implementing ML and AI in the OR: "Educate and communicate," she says. "Always be transparent with your team."

Taylor stresses the importance of training perioperative staff in the use of machine learning and artificial intelligence. "OR staff are not machines and unless they are integrated, trained and managed as part of the process, both AI and ML could be compromised," he says.

"Perioperative staff needs to embrace the technology," adds Kirchner. "However, older staff may not embrace ML and AI as quickly as younger team member who have grown up with digital technology."

According to Taylor, perioperative nurses and nurse leaders are not being included in the development of machine learning algorithms. "As a result, technology that is being created to improve OR efficiency may not be useable for all members of the surgical team," he says. Therefore, Taylor recommends that perioperative nurses and nurse leaders be co-creators, as well as implementers, of machine learning and artificial intelligence technology.

Overcoming Surgeon Hesitation

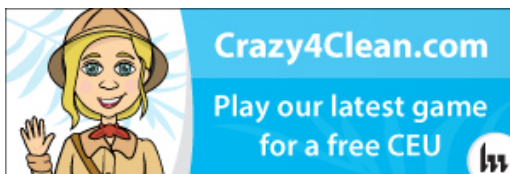
One of the biggest potential obstacles to widespread use of ML and AI in the perioperative setting is hesitation by some surgeons to try out the new technology.

"It's going to take a little while for surgeons to trust the technology," says Fernando. "The use of machine learning in the OR is relatively new so we need to give it a little time. Remember, we're talking about patients' lives."

Fernando encourages surgeons who are hesitant to give the technology a try. "They can always override or ignore suggestions so it really doesn't hurt anything to try it out," he says. "I recommend a crawl, walk, run approach."

There is currently tremendous untapped potential for the use of ML and AI in the perioperative setting. "Right now, surgery is one of the most underutilized areas for this kind of technology," says Fernando. "So, the sky is the limit going forward."

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