Collaboration between TECHNOLOGIST and TECHNOLOGY is the Future of Sleep Scoring

How AI Sleep Scoring Solutions Are Aiding Frontline Clinicians

By Andrea Ramberg, RPSGT, CCSH, Clinical Informaticist with EnsoData
Artificial intelligence is impacting the future of virtually every industry and every human being. From freight/logistics to banking, financial services and insurance (BFSI), to cybersecurity and even marketing, many industries will be impacted by AI, with healthcare at the forefront. Per HealthTech Magazine, "There are numerous applications of AI on the market today...that can improve patient care and potentially save lives." One such solution in the healthcare space is in the world of sleep study analysis.

Today, an AI scoring solution can perform the arduous task of scoring polysomnography (PSG) studies. Scoring a PSG takes a certified professional nearly an hour, and there can be a lot of variance between scorers, especially those trained at different locations. The goal is for an AI solution to score that same study, but in a fraction of the time, with the same levels of clinician agreement. AI is poised to completely change how sleep centers around the world operate, allowing clinicians to reinvest time back into improving the patient experience and increasing patient access and compliance.

What is AI?

Oftentimes, when one thinks of "AI," futuristic movies like Terminator, The Matrix, I Robot, Her, Ex Machina, Wall-E, and others come to mind, where an AI "Robot" either takes over the world, changes the lives of the people around them, or simply creates a connection with a human being. In popular culture, AI is portrayed in the best possible light (Chappie, Wall-E) and as the biggest villain (I Robot, Terminator). In the current reality, AI is typically more of a behind-the-scenes player, rather than the star of the show.

In most cases, artificial intelligence allows for the analysis of "big data." At its most basic concept, AI involves the development of computer algorithms, programs, and software systems that can perform tasks normally completed by a human. Machine Learning (ML) is a type of AI that learns and adapts to improve its performance over time. As more data is fed through the algorithm, ML systems gain additional experience. Unlike the old auto scoring solutions, which rely on inputs from the programmer, ML systems evolve and iterate on their own. New data is the key, as a computer processes differently than humans, storing and iterating on each decision forever. Fresh batches of data - from varying sources especially - help the algorithm poke holes in its own logic, expanding its decision-making tree one execution at a time.

In the world of sleep scoring, there are a variety of mathematical solutions to the arduous process. Some rely on simple "if this, then that" decision-making trees, which often led to inconsistencies and repeated errors during the scoring process. As technology advances, and as new AI methods are validated and published, however, modern ML solutions powered by algorithms can soon outperform their human counterparts when it comes to scoring speed and consistency.

What Counts as AI?

AI can be as simple as a digital opponent in a game, like Deep Blue, the first AI to beat a human in Chess, or AlphaGo, which accomplished the same feat in Go. In the case of the AlphaGo AI, developers used a Monte Carlo tree search algorithm in combination with deep neural network technology. This required the team to program in the moves from previous winning events, then train the algorithm against both human and computer opponents. Over time, AlphaGo became the top "player" in the world, all because it was able to iterate and store memories and movesets beyond the capabilities of the grand masters, largely because the quantity of movesets is massive in Go compared to Chess.

When you look at the applications AI might have in healthcare, the possibilities are endless, but not without challenges. In healthcare, a strong AI solution must combine clinical, environmental, and laboratory-based objective measures to allow a deeper understanding of medical disorders, all while helping to reduce the cost of care delivery and improve patient access.

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AI is Assisting with Sleep Scoring Today

There are currently AI solutions in the sleep world, addressing the time-consuming task of scoring sleep studies. Chris Fernandez, Co-Founder of EnsoData, shared this thought on the potential for AI usage in sleep medicine.

"The polysomnography test, or PSG, is by far one of the most comprehensive, data-rich tests performed in healthcare," said Fernandez. "With over 120 million
physiologic data points in each patient study simultaneously from the brain, heart, respiratory system, and much more, there are tremendous opportunities for machine learning and AI systems to learn and improve on the way we not only analyze different sleep stages, for example, but also how we can use AI to create new ways to study the PSG that can show promise for uncovering even deeper insights into the critical importance of sleep and its significant influence on health, wellness, and disease.”

Currently, PSG scoring is labor-intensive and time-consuming. Certified sleep technologists pore over 800+ pages of data, and even the most well-trained technologists have inter-scorer reliability (ISR) issues. Because the gold standard leaves too much gray space for interpretation, we posit that ISR issues are a function of the rules, rather than a deficiency in technologist scoring.

Put another way, certain common exceptions to the parameters established by the AASM result in ambiguous pathological patterns that may not clearly fit within the rules. This results in technologists sometimes getting hung-up on matching agreement, poring over a single set of epochs trying to get it right - when in fact, there may be no “right” answer based on the current scoring paradigm.

“Discrepancies in sleep stage and event scoring have been found in 18% of all polysomnography epochs and overall interscorer agreement of 82.6% has been described by the AASM based on their inter-scorer reliability program,” states Richard S. Rosenberg, PhD in Rosenberg et al 2013. In layman’s terms, consistency could be improved, as roughly 1 in 5 sleep events is “miscategorized.”

The reality is sleep scoring is a time drain in a clinical setting when the epochs under review may not even change the final result of the study. The treatment recommendation typically is identical whether that one epoch changes or not. Time is lost. Sanity is lost. There’s a better way.

AI can use historical data to better predict sleep stages, providing clinicians with probabilities for each stage or event and helping them to quickly make those difficult decisions between stages with more confidence.

AI scoring solutions simplify the process. Because they iterate and improve with each successive version, AI scoring solutions are empowering sleep professionals to focus on what computers can’t: patient care.

Helping Technologists Reconnect with Patients

Providing the empathy and compassion needed when working with patients is still something that only a clinician can do. Unlike AI, a clinician is able to read the facial and body clues of a patient and meet them where they are in their clinical pathway. When clinicians have more time, they can better educate their patients on what to expect, what their diagnosis means to them, and what treatment options are available.

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Building relationships with patients not only helps to cultivate better comprehension of their diagnosis, but also fosters a collaborative environment that helps treatment adherence, communication, and wellness.

Clinicians can also use the time saved by AI scoring to start a sleep navigator program. This program allows the clinician to utilize their breadth of knowledge to facilitate a valuable service to the co-morbid population found in the hospital, creating a continuum of care that ensures patients get diagnosed and treated in a timely fashion.

Navigating the hospital floors not only provides much-needed care for these patients, but also provides a platform for educating other medical disciplines that aren’t as versed in sleep health. Ultimately, sleep navigator programs provide a concrete, valuable way for the sleep health clinician to help both their patients and the broader organization.
Embracing AI Scoring is a Matter of If, Not When

At the SLEEP 2020 conference this August, Dr. Nathaniel Watson, MD, MSc, touched on the gravity of our current situation, and how the future of sleep scoring is dependent on AI scoring advances.

“Presently, 70 million Americans suffer from sleep difficulty, 60% of which have a sleep disorder. The unfortunate reality is there’s one board-certified sleep doctor for every 45,000 citizens and 80-85% of sleep-disordered breathing is going undiagnosed and untreated. So, I suggest we embrace what artificial intelligence has to offer the field of sleep medicine to facilitate the diagnosis and treatment of the massive unmet sleep disease burden in the United States,” said Dr. Watson.

At the end of the day, AI can’t treat sleep disorders on its own. While it can certainly help with scoring and diagnosis, patient care and satisfaction are still in your hands. However, when you add an AI scoring solution to your team, you can offload the heavy lifting of scoring and refocus on your patients. If you’d like to speak with me about your practice and how an AI sleep scoring solution can simplify the process at your sleep center, set up a consultation at your convenience.

ANDREA RAMBERG is dual credentialed with her RPSGT and CCSH and has spent over a decade in the sleep field. She holds her Bachelor’s in Psychology while pursuing a Master’s in Industrial and Organizational Psychology. Andrea currently works with EnsoData as a Clinical Informaticist.