Using Machine Learning to Increase Agility in HIM

By Kapila Monga

As early as 1959 people have been defining what machine learning—a subfield of computer science—means. In that year Arthur Samuel, one of the pioneers of machine learning, said that machine learning is a science that gives "computers the ability to learn without being explicitly programmed."[1]

Machine learning professionals create algorithms and programs that learn from data and make predictions regarding an outcome. A point worth clarifying is that predictions don't just have a temporal aspect—it is not just about predicting what will happen in future. In the field of machine learning "prediction" means identifying any missing value, whether in the past, present, or future.

Machine learning algorithms include using techniques like anomaly detection, clustering, multi-class classification, regression, random forest, and others.[2] Payers are increasingly using machine learning to solve problems relating to member satisfaction, population health management, risk management, operations, and compliance. Machine learning is also seeing increased adoption in clinical areas such as disease onset predictions, disease progression analytics, and treatment pathway analysis to name a few. There have been several instances where machine learning has been successful for the aforementioned objectives, which has put to rest doubts about whether machine learning, mathematics, and computer science-driven algorithms can have an impact on healthcare delivery.[3]

This article explores how use of machine learning can increase the efficiency, effectiveness, and agility of health information management (HIM) departments and functions. It will also address some challenges that need to be circumvented in order for HIM teams to be able to harness the power of machine learning.

Machine Learning and HIM Functions and Practices

A general mission statement that could be found in any HIM department could read as follows:

> *The goal of the HIM department is to ensure the accuracy, confidentiality, and accessibility of health records. HIM professionals are responsible for the collection, storage, coding, processing, analysis, interpretation, application, privacy, and release of information for all inpatient and outpatient health records.*[4]

Many parts of this mission statement are realized through the adoption of technologies such as electronic health records (EHRs), Big Data, centralized data warehousing, standardization of data collection processes, use of robotics and automation, and business process rationalization. However, there are two specific functions of HIM departments where machine learning can significantly enhance effectiveness and save time for HIM professionals:

Coding completeness and coding audits. The need for medical coding completeness and auditing is well documented and understood in the industry.[5] Machine learning can be a valuable tool here in two ways: for ensuring the completeness of medical coding, including ICD-10, CPT, HCPCS Level II, and for accelerating accurate coding audits. Machine learning algorithms scan structured EHR data, unstructured physician notes, and voice data for symptoms of medical conditions and evidence of need of medical procedures. They also validate the medical code currently associated with the patient. The same algorithms, when applied to the medical codes of other similar patients in the database, result in a semi-supervised machine learning algorithm that also identifies the missing codes for a particular patient. It does this through machine learning-based historical code reviews of similar patients. The output of such algorithms result in potentially valid medical codes currently missing from a patient record, enabling faster code audits. Table 1 below is a snapshot showing the results that these algorithms can produce. The first two rows show a sample of outcomes of the coding audit algorithm, and the last two of the coding completeness algorithm. The last two columns (Relevancy and Comments; rationale behind relevancy) in the table give

a snapshot of the results these algorithms produce. In this table, relevancy refers to confidence level or probability that the given code could be associated with this patient, and comments include rationale behind the relevancy.

Table 1: Example of Machine Learning Algorithm Results

Patient Identifier	Type Of Code	Code	Relevancy	Comments
9867657	ICD-10 DX	S52.22A	Low – 25%	Should be subsequent code instead; Initial encounter coded earlier
879879	CPT	11403	Very Low – 15%	Lesion is only 1 cm; Seems to be potential up-coding
9867657	ICD-10 DX - Missing	S52.201E	Medium – 60%	Routine healing code
879879	CPT - Missing	99100	High – 85%	Anesthesia code missing for surgery encounter

Medical Necessity Determination. Approximately 36.78 percent of claims are denied due to reasons related to lack of medical necessity.[6] HIM professionals have a big role to play in determining medical necessity at the time of service and also in ensuring that the medical documentation is appropriate to justify medical necessity. This is a cumbersome task to be done manually, and places a lot of dependency on the clinical knowledge of HIM professionals and billers. Machine learning can be an invaluable aid here. Unsupervised machine learning algorithms are designed to scrape the medical record and documentation available, compare it with past similar documentation and medical necessity determinations (correctly determined and incorrectly determined), and offer a recommendation to HIM—suggesting why the recommended treatment might not be medically necessary. The last two columns in Table 2 below—Degree of medical necessity and Comments—show the kind of recommendations a machine learning algorithm can generate.

Table 2: Example of Machine Learning Medical Necessity Recommendations

Patient Identifier	Patient Name	Service Ordered	Degree of Medical Necessity	Comments
98769769	John Do-kuonk	Chest X-ray to spot for rib fracture	Low	Patient reported bronchitis few weeks ago. Rib pain could be because of inflammation of muscles. Topical gel to be potentially tried before chest X-ray.
87659887	Kaylie Ramin Mog	CT scan	High	In line with Diagnosis present in medical record and historical precedents

A review of patient services that determines a degree of medical necessity as “low” could either force providers to make the medical documentation that is relevant to the service more comprehensive, or could lead to cancellation of the service order.

These machine learning algorithms can be integrated with EHR systems to generate real-time recommendations or in nightly or weekly batches as retrospective reviews. The outputs could either be used to make direct edits to the medical record or could be used by a HIM professional to aid in decision making. As of today, having HIM professionals review the results and then take appropriate action seems to be a better way to proceed. As the accuracy of these algorithms increases with time, however, it might be worthwhile to try to automate the HIM function pertinent to the algorithm. When used effectively, machine learning algorithms will free up time for HIM teams to do more strategic activities related to furthering patient-centered collaborative medical care.[7]

Challenges in Machine Learning

Theoretically, there isn’t an iota of doubt on the benefits of machine learning. But practically, there are some challenges to overcome for HIM professionals to be able to harness the benefits of machine learning.[8]

These challenges include:

1. Designing machine learning algorithms of this type requires a lot of clinical data. Given HIPAA regulations and privacy concerns surrounding patient health information, providing statisticians access to this data to develop algorithms can be a big hurdle.
2. In order to develop accurate models, individuals from computer science, statistics, machine learning, and clinical backgrounds need to come together and work in collaboration to ensure accuracy, robustness, usability, and effectiveness of the algorithm. It can be challenging to get all these folks together in a provider setting. Pure consulting organizations, on the other hand, lack relevant clinical rigor and access to data.
3. Regular monitoring and recalibration of machine learning algorithms is a critical success factor. However, it is easier said than done. Processes have to be developed for this recalibration, and at the same time enough due diligence needs to be done to ensure that the cost of an un-calibrated algorithm run isn't more than the benefit of a machine learning algorithm.
4. If machine learning algorithms are indeed as effective as the healthcare industry envisions them to be, this means a lean HIM function—with less manual and intensive work. This frees up HIM teams for more upstream work, and calls for a rewritten mission statement for HIM teams.

As the industry moves toward artificial intelligence, the Internet of Things, and augmented reality, the day is not far when HIM professionals will have creative solutions to all of the above mentioned challenges. At that point HIM professionals can truly harness the benefits of machine learning.

Notes

[1] Puget, Jean Francois. "What is Machine Learning?" IBM developerWorks. May 18, 2016.

[2] Microsoft Azure. "Machine learning algorithm cheat sheet for Microsoft Azure Machine Learning Studio." March 14, 2017.

[3] Marr, Bernard. "How Machine Learning, Big Data and AI Are Changing Healthcare Forever." *Forbes*. September 23, 2016.

[4] Blue Mountain Hospital District. "Health Information Management Mission Statement."

[5] Bielby, Judy A. "Coding with Integrity: Top Coding Tips from AHIMA Experts." *Journal of AHIMA* 84, no. 7 (July 2013): 28-32.

[6] Prophet, Sue. "Coding Compliance: Practical Strategies for Success." *Journal of AHIMA* 69, no. 1 (1998): 50-61.

[7] AHIMA. "HIM Functions in Healthcare Quality and Patient Safety." *Journal of AHIMA* 82, no. 8 (August 2011): 42-45.

[8] Salvado, Olivier. "Why artificial intelligence has not revolutionised healthcare... yet." *The Conversation*. December 7, 2016.

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