Automated Coding Solutions Using Machine Learning:

A New Era for Emergency Medicine Revenue Cycle Management

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"The future is generative, which is the reason they call it generative AI, which is the reason why this is a brand-new industry."

Jensen Huang, co-founder and CEO of Nvidia.

Advances in generative artificial intelligence (AI) - and natural language processing (NLP)- enabled medical coding technologies allow healthcare organizations to address improper documentation and coding that currently costs the U.S. healthcare system about $54 billion annually.[1]

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In the fast-paced environment of emergency medicine, quick turnaround times with highly accurate coding is essential for patient care, health plan denial reduction, and the financial sustainability of healthcare clinicians. Overall, the complexity of emergency department (ED) encounters, combined with growing patient ED volumes, and stringent regulatory requirements, has traditionally made ED coding a critical, yet often labor-intensive, task. Errors in coding can lead to delays in reimbursement, compliance issues, and increased denials that further lengthen “encounter to cash” timeframes. Therefore, streamlining the RCM process and reducing administrative costs in emergency medicine is more important than ever.

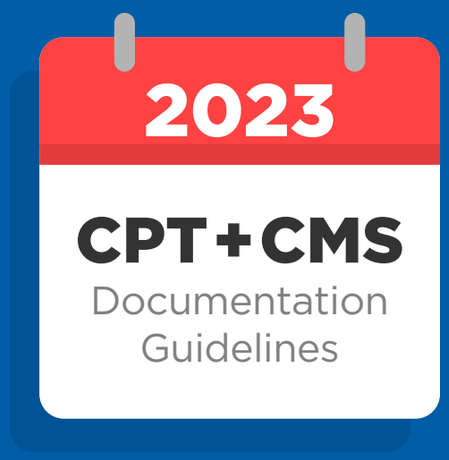
Recent advances in ML and NLP are transforming medical coding, particularly in emergency settings where documentation is extensive and intricate.

AI-driven solutions

- offer opportunities for higher coding accuracy,
- faster claim processing,
- and reduced administrative burdens,
- reducing ED claim denials while maintaining compliance.

ML coding will also provide clinician medical record feedback with the speed of a computer but at detailed levels heretofore practically unavailable with human medical coding, given the growing numbers of ED encounters and complexity of code selections.

Innovation in AI for medical billing is only possible now because of what Edward R. Gaines III, JD, CCP, calls a generational change in coding standards which occurred in 2023 with the adoption of the CPT and CMS 2023 Documentation Guidelines (2023 DGs). These standards replaced the Medicare DGs that were previously updated in 1995.



Prior to 2023, CPT had its own standards, but now the CPT and Medicare standards are one in the same. “It opened the gates to machine learning” said Mr. Gaines, the Vice President of Regulatory Affairs and Industry Liaison at Zotec Partners (Zotec). He has been a member of ACEP’s Reimbursement Committee since 2009 and is a longtime faculty member at ACEP’s Reimbursement and Coding Conference as well as an honorary ACEP member.

According to Mr. Gaines, the new standards took away much of the subjectivity under the 1995 DGs, the old way of coding. Zotec responded by hiring engineers from Google to develop its machine learning system, which they currently use for hospital clients and physician groups of all sizes.

“A substantial portion of our coding is done with that engine, and it allows us to give feedback to doctors at a level we’ve never been able to, so accuracy and clinician feedback are a huge part of our process,” Mr. Gaines said. “The machine will call out if you are down coded from a 5 to a 4. It will call out why that happened and will show that maybe you didn’t include certain notes that you should have. The machine can develop a profile about how you can document. That activity would take thousands of hours with human coders but now, ML engine can do it with relative ease.”[2]

In a recent Annals of Emergency Medicine article ED physicians with the Mayo Clinic used an open-source bot known as “WG Boost” from 2014 to evaluate whether ML ED coding could be as accurate as human coders. The ED encounters were all adults ages 18 or older and included both trauma centers and suburban and critical access hospitals with over 321,000 patient encounters. This study measured the accuracy of the ML coding for CPTs 99282-85 and critical care (99291). The decision confidence was established at 95%, meaning that the ML model had to predict that the code selected had a 95% or greater probability of belonging to that category. Morey et al found in the study that 80% of the CPT 99284 and 92% of the CPT 99285 records achieved 95% or greater probability.[3]

Zotec's ML coding uses technology more advanced than the open-source bot used in the Annals study, and the open-source bot preceded the ChatGPT bot by nearly 10 years. With a higher decision confidence level than the Annals study, Zotec has achieved greater accuracy levels for CPTs 99283-85, as described below.

In this new capacity, coders are supported by emerging technologies like Robotic Process Automation (RPA). These AI-powered tools, often referred to as "bots," handle repetitive and manual tasks such as claims reviews. While RPA has gained traction in industries outside of healthcare, it is now being adopted by clinician organizations to optimize operations and drive greater efficiency across the enterprise.

In a blog post titled "The Bots are Here," Stephanie Wong, Head of Storytelling at Google Cloud, highlights how bots can automate mundane, rules-based processes, enabling humans to focus on more valuable, mission-critical tasks.[4]

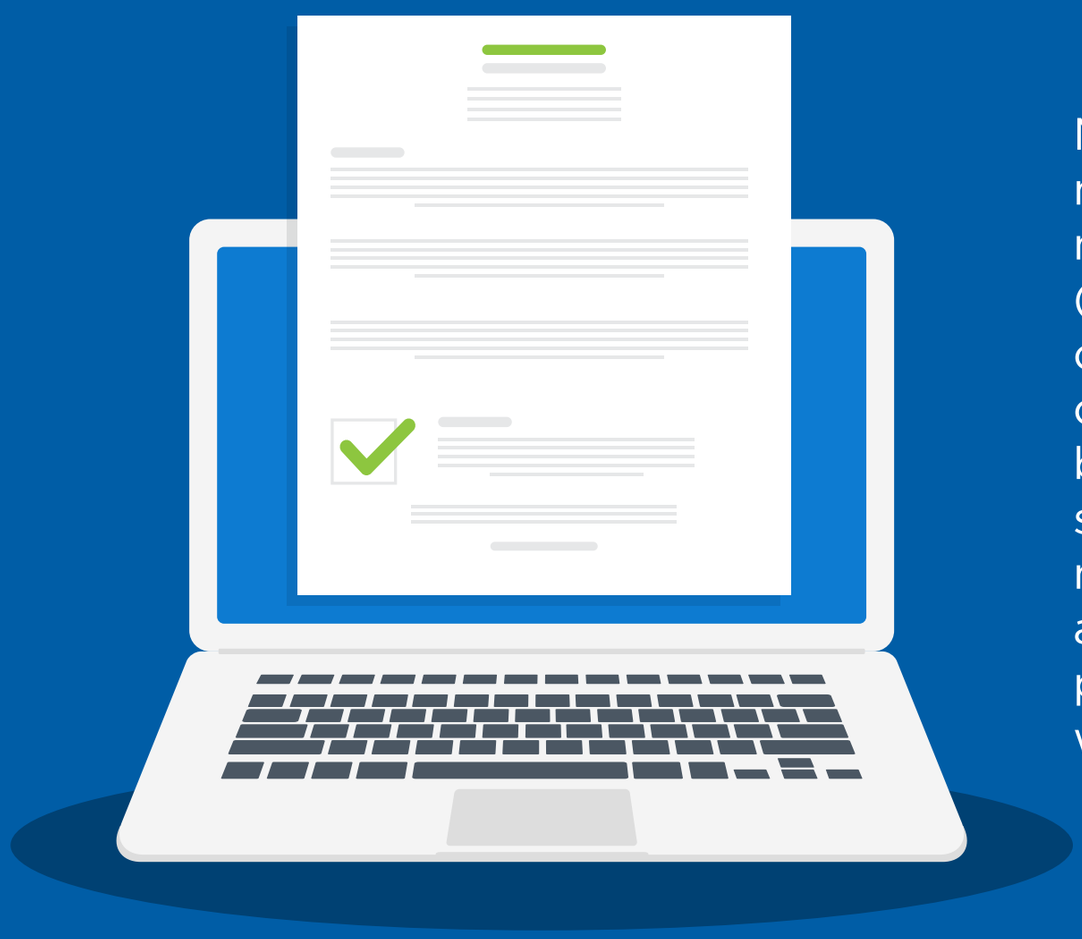
The Emergence of ML-Driven Coding Solutions in Emergency Medicine

A recent article from the Emergency Medicine Resident Association (EMRA) notes that AI algorithms can predict patient flow,

which helps

- reduce overcrowding,[5]
- improve patient care,[6]
- and increase staff satisfaction.[7]

AI can also majorly enhance operational efficiency in prehospital environments and triage which, in the end, help facilitate better flow in the emergency department.[8]



ML-driven coding solutions in emergency medicine use advanced machine learning models to predict evaluation and management (E/M) billing codes from clinical notes, physician orders, and patient data. These systems analyze complex documentation to generate accurate billing codes that comply with industry standards. For emergency departments, which manage high volumes of diverse cases, AI can automate repetitive aspects of the coding process, reducing the need for manual coding while improving efficiency and accuracy.

Zotec's Autocoder: Tailored for Emergency Medicine

Zotec has developed an advanced autocoding solution specifically designed to meet the challenges of emergency medicine coding. Trained on millions of complex ED visits and procedures, Zotec's autocoder reads the entire clinical report for each patient encounter, ensuring that all relevant information is accounted for. The system's AI engine not only identifies procedure codes but also assigns necessary modifiers and organizes diagnosis codes for each procedure. The ML engine can code for CMS's quality payment program and the Merit-based Incentive Payment System (MIPS). ML coding enhances the opportunity that all aspects of a patient's care are captured accurately, even in scenarios involving multiple clinicians, such as an attending physician, resident, or advanced practice clinician (APC). Key advantages of Zotec's autocoder include:

1. Comprehensive Report Reading

Zotec's autocoder was built to analyze full clinical reports rather than isolated sections. This allows the ML to connect documentation from various sources, ensuring that no details are missed, which is critical in emergency settings where documentation often involves multiple clinicians.

2. Clinician-Specific Billing

In emergency departments, cases frequently involve multiple clinicians, such as attending physicians and residents. Zotec's autocoder accurately assigns billing to the correct clinician for each procedure, ensuring that reimbursement is distributed appropriately among all contributors.

3. Handling Complex Cases

Emergency department encounters often involve multiple diagnoses and treatments, and a "team approach" to patient care. Zotec's autocoder can manage this complexity by systematically organizing diagnosis codes to match the corresponding procedures. For particularly complex cases, if the ML engine is uncertain about a specific coding decision, it defers to human coders for final validation.

Ensuring High Confidence and Accuracy in Emergency Department Coding

Zotec's autocoder operates with a high level of confidence by assigning a probability score to each coding prediction. Only predictions that exceed a predefined confidence threshold are allowed to proceed directly to billing. The ML coding is audited by the ED quality assurance (QA) team with methods similar to the QA that is completed for human coders. This quality control measure ensures that all automated coding meets or exceeds industry accepted standards for accuracy

1. Human Coder Review for Complex Cases

In cases where the ML encounters uncertainty - particularly in complex emergency department scenarios - the system automatically sends the case to human coders for review. This combination of automation and human oversight guarantees both speed and accuracy.

2. Training Data and Continuous Improvement

Zotec's autocoder is trained on large datasets of successfully adjudicated claims, ensuring that it learns from complete and accurate coding patterns. As regulatory guidelines change and new coding practices emerge, the system continuously updates its training data to remain aligned with current best practices.

Auditing and Compliance: Critical for Emergency Medicine

Given the regulatory complexities in emergency medicine, maintaining coding compliance, appropriate reimbursement, and accuracy are essential. Zotec's autocoder incorporates multiple layers of auditing to ensure ongoing accuracy and compliance with coding guidelines.

1. Daily and Quarterly Audits

A portion of automated reports are audited daily by Zotec's internal teams to verify the system's performance over time. Additionally, quarterly reviews are conducted by Zotec's Quality Assurance (QA) team, ensuring the system remains compliant with the latest coding guidelines.

2. Rules Engine for Accuracy

In addition to machine learning, Zotec's system integrates a robust rules engine that applies hard-coded rules and edits to ensure completeness and accuracy before any claim is finalized. This extra layer of validation helps avoid errors and ensures that all claims meet the rigorous standards required for emergency department billing.

3. Secure Deployment and Data Privacy

Security and privacy are paramount in healthcare, particularly in emergency departments where sensitive patient data is handled daily. Zotec's autocoder deploys in a secure, HIPAA-compliant Virtual Private Cloud (VPC) within Google Cloud Platform (GCP). All data, including AI-generated codes, is encrypted both in transit and at rest, ensuring the highest levels of security. Access to the system is governed by strict protocols, following the Principle of Least Privilege, which restricts access to only the personnel who need it.

Continuous Updates to Meet Evolving Guidelines

Emergency medicine is subject to frequent updates in coding standards and regulatory guidelines. Zotec's autocoder was designed to adapt to these changes seamlessly through a continuous integration/continuous deployment (CI/CD) pipeline. This system automatically reprocesses encounters from the previous week to ensure that any updates or changes to the model are functioning as expected.

1. Targeted Audits for Major Coding Changes

When significant updates to coding guidelines occur, such as the 2023 Evaluation and Management (E/M) updates, Zotec conducts targeted audits to ensure the autocoder is fully compliant with the new rules. This proactive approach ensures accurate and reliable performance from day one of the new guidelines' implementation.

2. Zero Downtime for Updates

Zotec's autocoder updates are deployed automatically, ensuring zero downtime. This means that emergency departments can rely on the autocoder for continuous, accurate coding even during system updates or coding guideline changes.

Where Coding Meets Data Analytics

For coders, data analytics can be used to improve productivity, accuracy, and revenue cycle outcomes. For example, the coding team can tell if optimal productivity has been achieved by monitoring everything from begin/end times, average number of charts coded per hour, percentage of charts exceeding standard minutes to code, case assignments, quantity of systems accessed per case, frequency of and turnaround times for physician queries, and the volume of coding and non-coding tasks assigned to each coder.

Analytics can also be a powerful tool in reducing claim denials due to coding and documentation miscues, which are behind an average annual loss of $5 million for hospitals and write-offs of up to 5% of a physician practice's net patient revenue,

Average annual loss caused by
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according to Becker's Hospital Review. Identifying denial trends is critical as rates are on the rise, having already increased more than 20 percent over the past five years to ~10 percent for hospitals9 and ~20 percent for practices. Adding to the problem is the cost to rework or appeal denials, which averages $25 per claim for practices and $181 per claim for hospitals.[10]

In addition to optimizing the revenue cycle, data analysis and predictive analytics can facilitate more timely interventions by generating alerts and reminders along with matching patient needs with available services – reducing 30-day readmission rates and supporting reimbursement under value-based care models. It helps minimize third-party audit risks by validating claims before they leave the facility, accelerates the revenue cycle, and reveals waste and fraud.[11]

In summary, Emergency medicine presents unique challenges for coding and revenue cycle management due to the complexity of cases, large volumes of patient encounters, multi-clinician care, and the need for appropriate reimbursement and compliance. ML-driven solutions, like Zotec's autocoder, provide an effective way to address these challenges, offering a reliable, accurate, and efficient solution for coding in emergency departments.

By automating repetitive coding tasks and integrating continuous auditing and updates, Zotec's autocoder helps emergency departments reduce administrative burdens, improve accuracy, and optimize reimbursement. As healthcare moves towards greater automation, solutions like Zotec's autocoder represent a crucial step in enhancing the efficiency and financial health of emergency medicine departments, allowing clinicians to focus on what matters most—patient care.

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