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Natural Language Processing Solutions, Trends, and Potential Impact

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Agenda

- Natural Language Processing in healthcare - where are we today?
- Opportunity in chart review/abstracting
- NLP use cases across the healthcare enterprise
- Exploring success and failure of NLP technology based solutions
- Words of wisdom when evaluating NLP technology

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What is NLP?

Natural Language Processing (NLP)

- Software that can 'read' physician documentation, identify key clinical facts and map those facts to codes
- Physicians use standard dictation/transcription, speech recognition, or templates with free-text fields
- There are multiple types of technology that can be used for NLP
- NLP is one form of Artificial Intelligence

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NLP approaches

Standard measures of NLP accuracy

Precision measures the number of accurate results compared to total results. Higher rates of precision mean fewer false positives. *Precision for CAC for example: Percentage of codes presented by NLP being kept by coders*

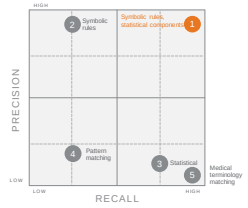
Recall measures the number of accurate results compared to potential accurate results. Higher rates of recall mean fewer false negatives (or missed codes). *Recall for CAC for example: Percentage of final billed codes presented by NLP.*

PRECISION

False positives (incorrect result)

RECALL

False negatives (missed result)



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CAC Recall / Precision Examples

High Recall / Low Precision

- *20 Final Billed Codes*
- *15 found by NLP (high recall)*
- *40 presented by NLP*
- *25 deleted by Coder (low precision)*

Summary: Coder only needed to add five additional codes, but they had to spend time validating and subsequently deleting 19 false positives.

75% Recall; 38% Precision

Low Recall / Low Precision

- *20 Final Billed Codes*
- *6 found by NLP (low recall)*
- *25 presented by NLP*
- *19 deleted by coder (low precision)*

Summary: Coder need to find and add 14 additional codes, but they also had to spend time validating and subsequently deleting 19 false positives.

30% Recall; 24% Precision

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CAC Recall / Precision Examples

Low Recall / High Precision

- *20 Final Billed Codes*
- *7 found by NLP (low recall)*
- *9 Presented by NLP*
- *2 deleted by Coder (high precision)*

Summary: CAC found 35% of the final billed codes. The positive was that what was presented by NLP was mostly correct. The coder researched additional 13 codes.

35% Recall; 90% Precision

High Recall / High Precision

- *20 Final Billed Codes*
- *16 found by NLP (high recall)*
- *19 presented by NLP*
- *3 deleted by coder (high precision)*

Summary: Coder only needed to add four additional codes, and they only needed to delete three codes that were either false positives or not specific enough.

80% Recall; 84% Precision

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NLP approaches

All of the NLP methodologies in the grid at the right are currently being utilized by vendors in the HIM market.

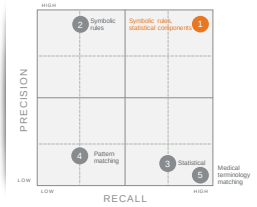
Key Learning Point: *It is of critical importance to understand exactly what type of NLP is being utilized for the solution being evaluated. Not all NLP's are suitable to specific applications, which is why six vendors have failed/withdrawn from the CAC market alone since ICD-10.*

PRECISION

False positives (incorrect result)

RECALL

False negatives (missed result)



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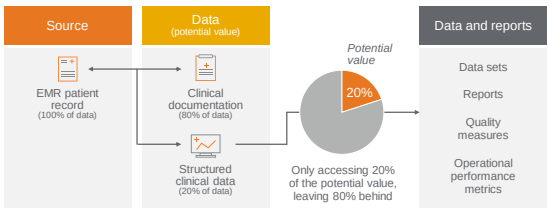
Opportunity in chart review/abstracting



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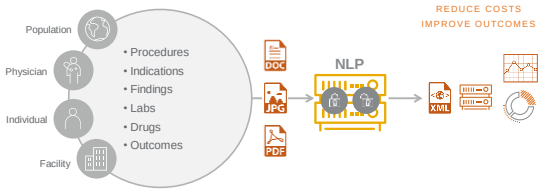
NLP: Unlocking unstructured medical record data



NLP can transform **unstructured data** into the **structured data** analytics require

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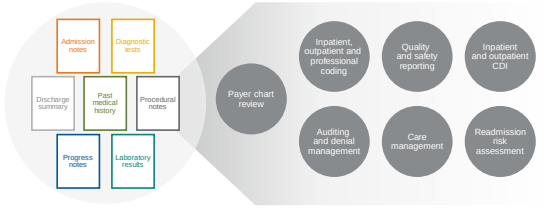
Administrative silos — duplicative chart review



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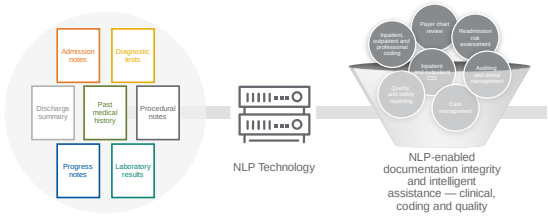
NLP documentation integrity vision



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3 Minute Real-Time NLP Demo

A brief look at an NLP engine in action. This is not a product demonstration, rather a look at a core NLP technology and how NLP can read and interpret language.

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Natural Language Processing - High Use

Computer-assisted coding (CAC)

- Professional/Ambulatory started around 1999
- Fast growth for hospitals/health systems starting in 2010 pre – ICD-10. Approximately 900 – 1,000 hospitals utilize some form of NLP for coding. Another growth mode now post ICD-10 transition.
- CAC is software that evaluates clinician documentation, identify key clinical facts, translate those facts to codes
- Clinicians use standard transcription, speech, or EMR templates with free-text fields
- There are multiple technologies used for NLP in the CAC industry, ranging from basic terminology matching to advanced artificial intelligence

Natural language processing (NLP)

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NLP - Quickly Emerging Use

Clinical documentation improvement (CDI)

- Emerging starting in 2013 to use NLP for automated case finding for CDI specialists
- Approximately 225 hospitals have implemented NLP driven CDI with case exclusion since 2013
- Not limited to finding only "code-able" facts, but clinically significant facts that are evidence of an information gap
- Relies upon potentially complex combination of clinical evidence versus well-defined guidelines of coding
- Finds what the physician didn't say — different thought process from coding

Natural language processing (NLP)

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NLP - High Interest Emerging Use

Computer Assisted Physician Documentation (CAPD)

- Marketed extensively starting around 2007, with an estimated <100 hospitals utilizing today at some level
- Provide real-time documentation alerts during voice to text, or templated documentation regarding documentation deficiencies or inconsistencies, sometimes referred to as real-time CDI.
- Relies upon potentially complex combination of clinical evidence to provide proper alerts
- Primary challenge is that feedback is typically based upon context of individual document being completed and does not always take entire EMR into account. This accounts for false positive alerts.
- Has potential for expanded use and benefits with advanced NLP and full EMR context.

Natural language processing (NLP)

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Emerging Use
NLP use cases across enterprise

- Risk adjustment
- Significant incidental findings
- Quality and safety
- Population analytics
- Medical necessity

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Risk adjustment

PATIENT RECORD
- Outpatient and inpatient visits
- Longitudinal view of patient records

HCC CAPTURE
- HCCs map from ICD-10-CM codes
- Clinical indicators of disease
- Dates of service

REPORTING
- Retrospective
- Prospective
- CAC effective platform

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Quality and safety

PATIENT RECORD
- Hospital inpatient visits
- Concurrent quality review

QUALITY MARKERS
- Complex coding scenarios
- NLP assist to identify exclusions
- Alignment with coding and CDI

QUALITY MEASURES
- Hospital-acquired conditions (HAC)
- Patient Safety Indicators (PSI)

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Medical necessity

PATIENT RECORD
- Hospital ER and observation visits
- Decision for observation vs. inpatient

CLINICAL EVIDENCE
- NLP capture of acuity indicators
- Disease markers
- Critical diagnoses

PHYSICIAN ADVICE
- Second opinion
- Real-time guidance on appropriate care setting
- Research and data-driven

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Significant incidental findings

PATIENT RECORD
- Diagnostic studies
- High volume
- Critical findings handled with urgency

INCIDENTAL FINDINGS
- Not reported for rev cycle coding
- Risk of over-treatment if not targeted
- NLP unlocks findings narrative

SAFETY NET
- Early indicator of serious disease
- Notification to referring physician

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Population analytics

PATIENT DATA
- Clinical and administrative
- NLP capture provides more complete patient view

MODELING
- Population health profiles
- Configurable views
- Time sequence for trending
- Consistent with coding and CDI

ACTIONS
- Patient outreach
- Targeted follow-up for clinicians
- Care transition support

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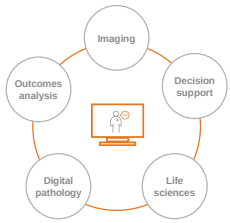
Emerging artificial intelligence applications

Despite the hype …

- Artificial intelligence (AI) and machine learning (ML) will grow in health care.
- Effective and safe applications rely upon complete and accurate data — clinical and administrative.
- Health care NLP is key infrastructure to enable AI and ML.
- Smart applications in health care must also provide rationale and traceability of decisions.



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Additional NLP Use Cases Emerging & Expanding

- Life/Health risk adjustment
- Phenotyping and genomics matching
- Predictive Analytics for life sciences and pop health
- Physician alerts at point of service
- Pharmacy Control
- Protocol optimization
- Disease/market analysis
- Pharmaceutical large scale impact studies
- Physician Order Entry guides
- Patient recruitment for CTs
- Payer validation of coding of claims

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Many NLP Based Solutions have failed. Should I avoid NLP?

In short, no you should not. Let's look at why.

- NLP as a technology has tremendous potential, however, it has been utilized incorrectly by many vendors in a rush to deploy product solutions.
- When CAC was rapidly growing, many vendors jumped into the market with CAC solutions utilizing third party NLP engines, or self-developing. Six of those vendors have vanished from the market. Multiple university medical centers also attempted self-development.
- Why have so many failed?
  - The vendor used the wrong NLP methodology for the specific use case solution
  - The vendor severely underestimated the complexity of NLP technology
  - The vendor underestimated the breadth and depth of medical knowledge required for an NLP engine to reach an appropriate level of performance.
  - The vendor chose an NLP technology to get to market quickly, not necessarily to provide the best technology.

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Recommendations/Observations Moving Forward

NLP methodology is the driver behind the success or failure of any NLP driven solution.

- Although the NLP technology determines whether or not a specific use case will be successful, the NLP technology itself is almost never seriously evaluated.
- Virtually no organizations that I have worked with in my 20 years have had any internal expertise in NLP and do not know what questions to ask. That has exposed many organizations to failed or below expectation performing solutions.
- Health systems need evaluation mechanisms for NLP technologies.
- Engage your information systems department to evaluate the NLP technologies behind the solution, not just the integration of the solution. If you don't have the expertise internally, find the expertise outside of the organization.
- Six vendors have failed or withdrawn from the CAC market since 2013, and it was due to the underlying NLP technology methodology, not the end user application.
- NLP has tremendous potential if applied properly within each particular market segment/solution.

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Additional Ideas for Vendor NLP Evaluation

Focus on the NLP technology in addition to the end user solution

- When possible, have vendor demonstrate the NLP technology in action, not just a canned demonstration of NLP output. Find ways to look for proof of concept of the technology.
- Have the vendor explain the NLP methodology (Pattern Matching, Statistical, Symbolic, etc.) as well as the underlying architecture.
- Have vendor correlate the NLP methodology to the process and solution it was intended. For example, underlying explanation of how the NLP methodology identifies a code, what does it take to program in a new code, etc.
- Have vendor explain the NLP refinement process for ongoing improvement. Is it a national engine, user specific, health system specific, locally tuned?
- Evaluate papers published by the vendor on their NLP technology, taking special note of statistics regarding performance.
- Has the NLP received industry recognition/awards? Has the NLP engine been awarded any industry patents that contribute significantly to differentiate capabilities for the solution presented?

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Thank you.

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