Deep Text
New Approaches in Text Analytics and Knowledge Organization

Tom Reamy
Chief Knowledge Architect
KAPS Group
http://www.kapsgroup.com

Author: Deep Text

KAPS Group
Knowledge Architecture Professional Services

Agenda

- Introduction:
  - What is Text Analytics?
- Text Analytics and Knowledge Organization Today
- New Approaches - Fast and Slow (Thinking)
  - Deep Learning and Deep Text
- New Methods for Text Analytics
  - Unstructured Text Isn't
  - Beyond Simple Sentiment
- Applications
  - Pronoun Patterns
  - Behavior Prediction
- Context and Integration
- Questions

Introduction: KAPS Group

- Network of Consultants and Partners
- Services:
- Strategy – IM & KM - Text Analytics, Social Media, Integration
- Taxonomy/Text Analytics, Social Media development, consulting
- Text Analytics Smart Start – Audit, Evaluation, Pilot
- Partners – Smart Logic, Expert Systems, SAS, SAP, IBM, FAST, Concept Searching, Clarabridge, Lexalytics
- Clients: Genentech, Novartis, Northwestern Mutual Life, Financial Times, Hyatt, Home Depot, Harvard, British Parliament, Battelle, Amdocs, FDA, GAO, World Bank, Dept. of Transportation, etc.
- Presentations, Articles, White Papers – www.kapsgroup.com
- Book –Deep Text: Using Text Analytics to Conquer Information Overload, Get Real Value from Social Media, and Add Big(ger) Text to Big Data

Introduction: What is Text Analytics?

- Text Mining – NLP, statistical, predictive, machine learning
- Extraction – entities – known and unknown, concepts, events
  - Catalogs with variants, rule based
- Sentiment Analysis
  - Positive and Negative expressions – catalogs & rules
- Auto-categorization
  - Training sets, Terms, Semantic Networks
  - Rules: Boolean - AND, OR, NOT
  - Advanced – DIST(#), ORDDIST#, PARAGRAPH, SENTENCE
  - Disambiguation - Identification of objects, events, context
  - Build rules based, not simply Bag of Individual Words
- It is metadata! Meta NOT About

Text Analytics and Knowledge Organization Tools for Building KO

- Add powerful bottom up techniques to taxonomy building
- 250,000+ documents, search logs, emails, etc.
- Text mining = most frequent terms + multiple analysis of output
  - By date, publisher/authors, document type, etc.
  - Future = personality type, learning styles, political, etc.
- Clustering – co-occurring terms – suggest categories
- Entity extraction – existing entities, discover new ones, facets
- Simple categorization – use single or simple set of words as rules
- Text analytics provides speed and depth of coverage
- Additional methods for exploring content – supplement the experience of SME's and taxonomists

Text Analytics and Knowledge Organization Tools for Applying KO

- Tagging documents with taxonomy nodes is tough
  - And expensive – central or distributed
- Library staff –experts in categorization not subject matter
  - Too limited, narrow bottleneck
  - Often don't understand business processes and uses
- Authors – Experts in the subject matter, terrible at categorization
  - Intra and Inter inconsistency, "intertwingleness"
  - Choosing tags from taxonomy – complex task
  - Folksonomy – almost as complex, wildly inconsistent
  - Resistance – not their job, cognitively difficult = non-compliance
- Text Analytics is the answer(s)!

Text Analytics and Knowledge Organization Tools for Applying KO - Hybrid

- Hybrid Model – Internal Content Management
  - Publish Document -> Text Analytics analysis -> suggestions for categorization, entities, metadata - > present to author
  - Cognitive task is simple -> react to a suggestion instead of select from head or a complex taxonomy
  - Feedback – if author overrides -> suggestion for new category
  - Facets – Requires a lot of Metadata - Entity Extraction feeds facets
- External Information - human effort is prior to tagging
  - More automated, human input as specialized process – periodic evaluations
  - Precision usually more important
  - Target usually more general

Text Analytics and Knowledge Organization Tools for Applying KO - Hybrid

- Taxonomy provides a consistent and common vocabulary
  - Enterprise resource – integrated not centralized
- Text Analytics provides a consistent tagging
  - Human indexing is subject to inter and intra individual variation
- Taxonomy provides the basic structure for categorization
  - And candidates terms
- Text Analytics provides the power to apply the taxonomy
  - And metadata of all kinds
- Text Analytics and Taxonomy Together – Platform
  - Consistent in every dimension
  - Powerful and economic

New Approaches in Deep Text Analytics
Thinking Fast and Slow – Daniel Kahneman

- Brain: System 1 and System 2
- System 1 – fast and automatic – little conscious control
- Represents categories as prototypes – stereotypes
  - Norms for immediate detection of anomalies – distinguish the surprising from the normal
  - fast detection of simple differences, detect hostility in a voice, find best chess move (if a master)
  - Priming / Anchoring – susceptible to systemic errors
  - Biased to believe and confirm
  - Focuses on existing evidence (ignores missing – WYSIATI).

New Approaches in Deep Text Analytics
Thinking Fast and Slow

- System 2 – Complex, effortful judgments and calculations
  - System 2 is the only one that can follow rules, compare objects on several attributes, and make deliberate choices
  - Understand complex sentences
  - Check the validity of a complex logical argument
  - Focus attention – can make people blind to all else – Invisible Gorilla
- Similar to traditional dichotomies – Tacit – Explicit, etc
- Basic Design – System 1 is basic to most experiences, and System 2 takes over when things get difficult – conscious control
- Text Analysis and Text Mining
- Categorization by example and categorization by rules

New Approaches in Deep Text Analytics
Deep Learning – System 1

- Neural Networks – from 1980's
- New = size and speed
- Larger Networks = can learn better and faster
- Multiple networks = more automatic – networks learn from other networks
- Strongest in areas like image recognition
- Next is entity / fact extraction & discovering relationships
- Weakest – concepts, subjects, deep language, metaphors, etc.

New Approaches in Deep Text Analytics
Applied Watson – System 1 & 2

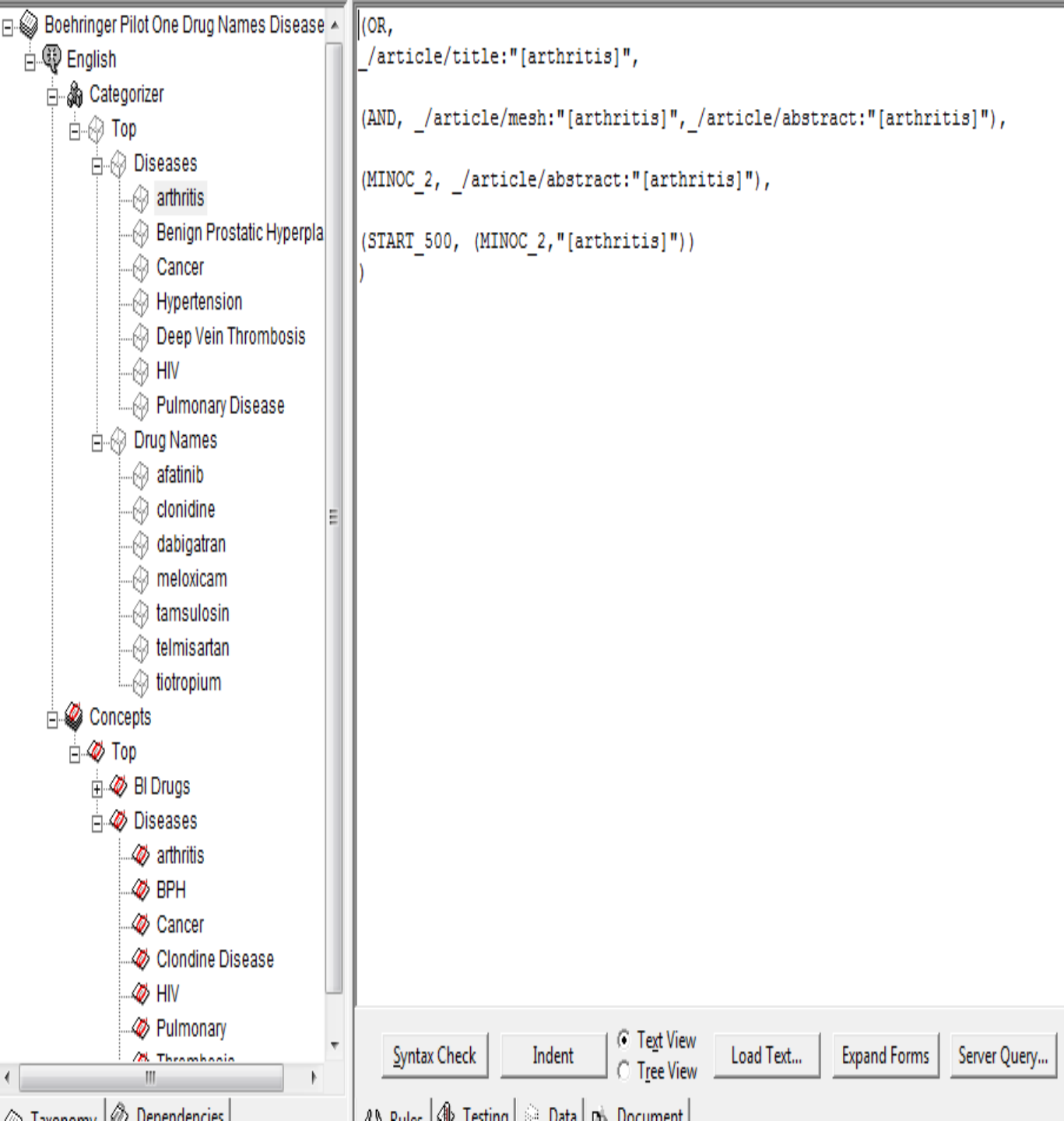
- Key concept is that multiple approaches are required – and a way to combine them – confidence score
- Multiple sources – taxonomies, ontologies, etc.
- Special modules – temporal and spatial reasoning – anomalies
- Taxonomic, Geospatial, Temporal, Source Reliability, Gender, Name Consistency, Relational, Passage Support, Theory Consistency, etc.
- Massive parallelism, many experts, pervasive confidence estimation, integration of shallow and deep knowledge
- Key step – fast filtering to get to top 100 (System 1)
- Then – intense analysis to evaluate (System 2) – multiple scoring

New Approaches in Deep Text Analytics Categorization Rules – System 2

- Representation of Domain knowledge – taxonomy, ontology
- Catonomies – taxonomy + categorization rules
- Categorization – deep analysis
  - Most basic to human cognition
  - Basic level categories
- Beyond Categorization – making everything else smarter,
- No single correct categorization
  - Women, Fire, and Dangerous Things
- Sentiment Analysis to Expertise Analysis(Know How)
  - Know How, skills, “tacit” knowledge

New Approaches in Deep Text Analytics
Adding Structure to Unstructured Content– System 2

- Documents are not unstructured – variety of structures
  - Sections – Specific - “Abstract” to Function “Evidence”
  - Content Type – library of sections per type, department
  - Textual complexity, level of generality
- Beyond Documents – categorization by corpus, by page, sections or even sentence or phrase
- Applications require sophisticated rules, not just categorization by similarity
- Model of human learning – over-generalization, not pattern analysis of a few million examples


Boehringer Pilot One Drug Names Disease
English
Categorizer
Top
Diseases
arthritis
Benign Prostatic Hyperpla
Cancer
Hypertension
Deep Vein Thrombosis
HIV
Pulmonary Disease
Drug Names
afatinib
clonidine
dabigatran
meloxicam
tamsulosin
telmisartan
tiotropium
Concepts
Top
BI Drugs
Diseases
arthritis
BPH
Cancer
Clondine Disease
HIV
Pulmonary
(OR,
_/article/title:"[arthritis]",
(AND, _/article/mesh:"[arthritis]",_/article/abstract:"[arthritis]"),
(MINOC_2, _/article/abstract:"[arthritis]"),
(START_500, (MINOC_2,"[arthritis]"))
)
Syntax Check
Indent
Text View
Tree View
Load Text...
Expand Forms
Server Query...
Testing
Data
Document

New Approaches in Text Analytics
Document Type Rules

- Look at first 2,000 words (and last 2,000) - most important
- Take existing sections – Title – assign strongest relevancy score
- Dynamic define multiple sections – Abstract, Methods, etc.
- "[Abstract]" – multiple words – Summary, Overview, etc.
- Minimum of 2 Phrases "[arthritis]" within 7 words of "[drugs]"
- NOT words like "[Animals]"
- Assign relevancy score
- Primary issue – major mentions, not every mention
  - Combination of noun phrase extraction and categorization
  - Results – virtually 100%

New Approaches in Deep Text Analytics
Beyond Simple Sentiment

- Beyond Good and Evil (positive and negative)
  - Degrees of intensity, complexity of emotions and documents
- Importance of Context – around positive and negative words
  - Rhetorical reversals – “I was expecting to love it”
  - Issues of sarcasm, (“Really Great Product”), slanguage
- New Taxonomies – Appraisal Groups – “not very good”
  - Supports more subtle distinctions than positive or negative
- Emotion taxonomies - Joy, Sadness, Fear, Anger, Surprise, Disgust
  - New Complex – pride, shame, confusion, skepticism
- New conceptual models, models of users, communities
- Essential – need full categorization and concept extraction

New Approaches in Deep Text Analytics
Social Media: Beyond Simple Sentiment

- Analysis of Conversations- Higher level context
- Techniques: self-revelation, humor, sharing of secrets, establishment of informal agreements, private language
- Quality of communication (strength of social ties, extent of private language, amount and nature of epistemic emotions – confusion +)
- Personality types – aggressive, political – disgust = conservative

Deep Text Analytics Applications
Voice of the Customer / Voter / Employee

- Detection of a recurring problem categorized by subject, customer, client, product, parts, or by representative.
- Analytics to evaluate and track the effectiveness of:
  - Representatives, policies, programs, actions, etc.
- Detect recurring or immediate problems – high rate of failure, etc.
- Competitive intelligence – calls to switch from brand X to Y in a particular region
- Subscriber mood before and after a call – and why
- Pattern matching of initial motivation to subsequent actions – optimize responses and develop proactive steps

Deep Text Analytics Applications
Expertise Analysis

- Expertise Characterization for individuals, communities, documents, and sets of documents
- Experts prefer lower, subordinate levels
  - Novice & General – high and basic level
- Experts language structure is different
  - Focus on procedures over content
- Applications:
  - Business & Customer intelligence – add expertise to sentiment
  - Deeper research into communities, customers
  - Expertise location- Generate automatic expertise characterization based on documents

Deep Text Analytics Applications
Behavior Prediction – Telecom Customer Service

- Problem – distinguish customers likely to cancel from mere threats
- Basic Rule
  - (START_20, (AND, (DIST_7,"[cancel]", "[cancel-what-cust]"),
  - (NOT,(DIST_10, "[cancel]", (OR, "[one-line]", "[restore]", “[if]”)))))
- Examples:
  - customer called to say he will **cancell** his **account** **if** the does not stop receiving a call from the ad agency.
  - and context in text
- Combine text analytics with Predictive Analytics and traditional behavior monitoring for new applications

Deep Text Analytics Applications
Pronoun Analysis: Fraud Detection; Enron Emails

- Patterns of “Function” words reveal wide range of insights
- Function words = pronouns, articles, prepositions, conjunctions.
  - Used at a high rate, short and hard to detect, very social, processed in the brain differently than content words
- Areas: sex, age, power-status, personality – individuals and groups
- Lying / Fraud detection: Documents with lies have
  - Fewer and shorter words, fewer conjunctions, more positive emotion words
  - More use of “if, any, those, he, she, they, you”, less “I”
  - More social and causal words, more discrepancy words
- Current research – 76% accuracy in some contexts

Context and Integrated Solutions
System 1 & 2 – and Text Analytics Approaches

- "Automatic Categorization" – System 1 prototypes
  - Limited value -- only works in simple environments
  - Shallow categories with large differences
  - Not open to conscious control [Black Box]
- System 2 – categories – complex, minute differences, deep categories
- Together:
  - Choose one or other for some contexts
  - Combine both – need to develop new kinds of categories and/ or new ways to combine?

Context and Integrated Solutions
Deep Learning and Deep Text

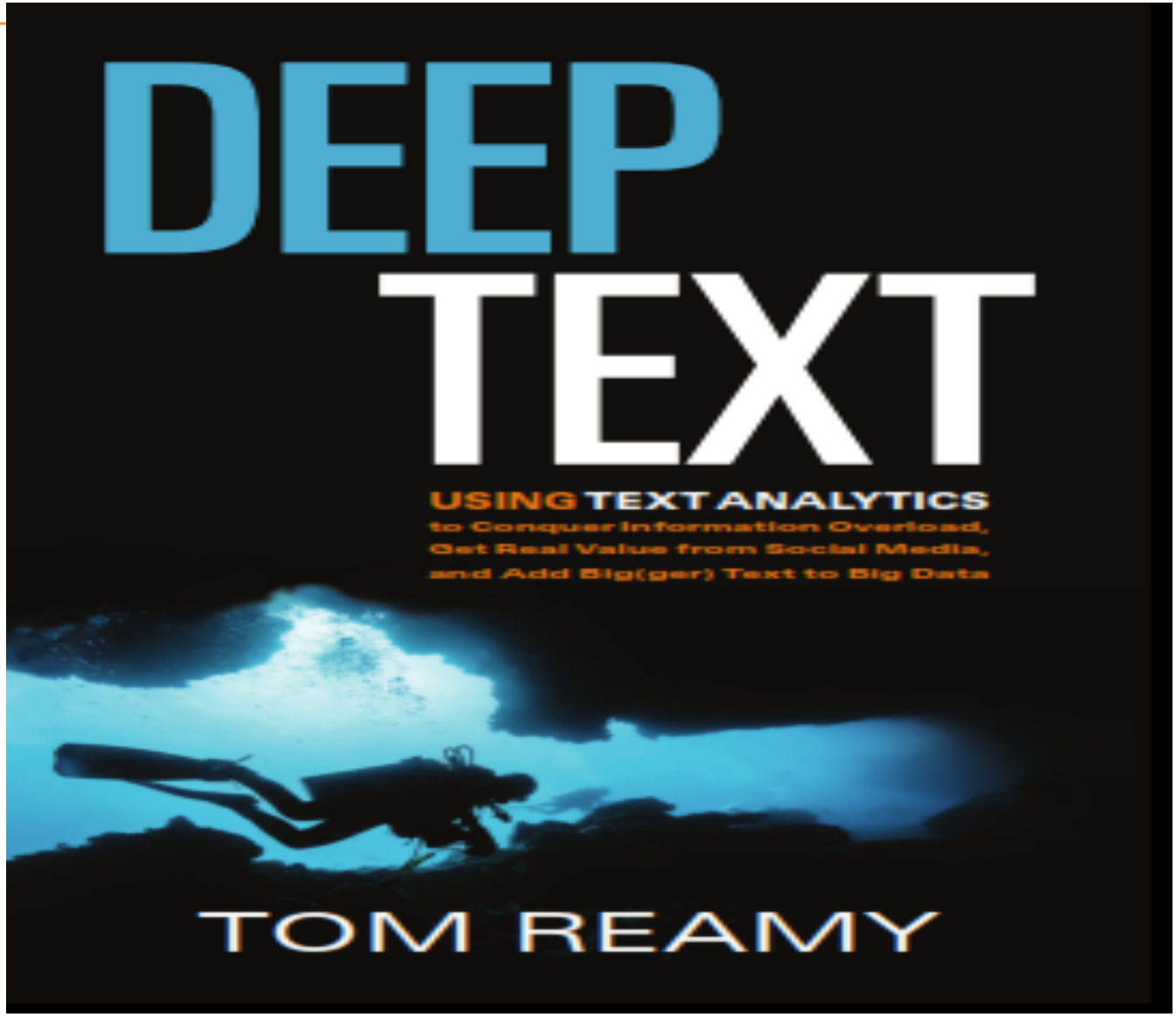
- Text Analytics and Big Data enrich each other
  - Data tells you what people did, TA tells you why
- Text Analytics – pre-processing for Text Mining
  - Discover additional structure in unstructured text
  - Behavior Prediction – adding depth in individual documents
  - New variables for Predictive Analytics, Social Media Analytics
  - New dimensions – 90% of information, 50% using Twitter analysis
- Text Mining for TA– Semi-automated taxonomy development
  - Apply data methods, predictive analytics to unstructured text
  - New Models – Watson ensemble methods, reasoning apps
- Extraction – smarter extraction – sections of documents, Boolean, advanced rules – drug names, adverse events – major mention

Context and Integrated Solutions
Integration of Text and Data Analytics

- Expertise Location: Case Study: Data and Text
- Data Sources:
  - HR Information: Geography, Title-Grade, years of experience, education, projects worked on, hours logged, etc.
- Text Sources:
  - Document authored (major and minor authors) – data and/or text
  - Documents associated (teams, themes) – categorized to a taxonomy
  - Experience description – extract concepts, entities
- Self-reported expertise – requires normalization, quality control
- Complex judgments:
  - Faceted application
  - Ensemble methods – combine evaluations

Deep Text: New Approaches Conclusions

- Two major techniques changing the world of text
  - Deep Text – depth and intelligence
  - Deep Learning – power and scale, machine learning
- Present applications – fix search (finally), smart Info Apps- eDiscovery, fraud detection, BI, CI, social media, smart summaries, etc., etc.
- Full Integration of the two - ongoing
  - Understand black box / learning for rules systems
- Make automated smarter, make manual scale
- Make humans work smarter – assistant reader – add depth to reading - like hybrid tagging taken to next level


DEEP
TEXT
USING TEXT ANALYTICS
to Conquer Information Overload,
Get Real Value from Social Media,
and Add Big(ger) Text to Big Data
TOM REAMY

Questions?

Tom Reamy
tomr@kapsgroup.com
KAPS Group
http://www.kapsgroup.com

Upcoming: ASIS&T – Copenhagen Oct 14

Taxonomy Boot Camp – London Oct 18-19

Taxonomy Boot Camp & Enterprise Search – DC Nov 14-17

KAPS Group
Knowledge Architecture Professional Services