

Text Mining, Sentiment Analysis, and Social Analytics

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Subject code : FNT 631
Data Analysis

Lecture 10



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Explain the role of Association Rule Mining in marketing and sales promotion?

Answer:

- Association Rule Mining is a technique used to discover significant relationships between items in large datasets. In marketing and sales promotion, it helps analyze customer behavior and identify products that are frequently bought together. For example, if a rule shows that customers who buy "Bagels" often also buy "Potato Chips," a store can use this information to boost sales by placing these items near each other or offering discounts on "Potato Chips" when "Bagels" are purchased. This targeted promotion can increase overall sales and enhance the customer shopping experience.

Describe the benefits and limitations of using clustering in market segmentation.

Answer:

Benefits:

- - Targeted Marketing: Tailored strategies for each segment, leading to effective campaigns.
- - Customer Understanding: Insights into different groups for better service.
- - Resource Allocation: Efficient focus on high-potential segments.

Limitations:

- - Data Quality: Depends on accurate data.
- - Dynamic Markets: Changing preferences can make clusters less relevant.
- - Computational Complexity: Intensive and time-consuming for large datasets.

How does data preprocessing improve the quality of data mining results? Provide examples of data preprocessing tasks

Answer:

Data preprocessing enhances data mining by ensuring data is clean, accurate, and well-formatted. Key tasks include:

1.Data Cleaning:

1. Handling Missing Values: Fill missing values using techniques like mean imputation.
2. Removing Noisy Data: Smooth data to remove errors or outliers.
3. Correcting Inconsistent Data: Ensure consistency in data formats and coding.

2.Data Transformation:

1. Normalization: Scale data to a standard range (e.g., 0 to 1).
2. Aggregation: Summarize data to reduce volume (e.g., daily to monthly sales data).

3.Data Reduction:

1. Sampling: Select a representative subset to reduce processing time.
2. Dimensionality Reduction: Use techniques like PCA to reduce variables while retaining essential information.

Learning Objectives

- Describe text mining and understand the need for text mining
- Differentiate among text analytics, text mining and data mining
- Understand the different application areas for text mining
- Know the process of carrying out a text mining project
- Appreciate the different methods to introduce structure to text-based data
Describe sentiment analysis
- Develop familiarity with popular applications of sentiment analysis
- Learn the common methods for sentiment analysis
- Become familiar with speech analytics as it relates to sentiment analysis
- Learn three facets of Web analytics—content, structure, and usage mining
- Know social analytics including social media and social network analyses

Why Text & Sentiment Analysis Matter in 2025

- Most business data today is **text**: social media, reviews, emails, chats.
- Companies want to know: “**Are people happy or angry?**”
- Sentiment analysis helps managers see **customer mood in real time**.
- New AI models (Transformers, Large Language Models) make analysis **faster and more accurate** than before.
- This is now used in **marketing, finance, risk, HR, and customer service**.



How Sentiment Analysis Works Today?



- **Collect text:** From social media, product reviews, surveys, emails.
- **Clean the text** Remove spam, emojis if not needed, strange symbols.
- **Turn text into numbers** Use **word embeddings** or **Transformer/LLM models**.
- **Predict sentiment** Model says: **positive / negative / neutral** (or a score 0–1).
- **Show results to managers** Easy dashboard, graphs, alerts (e.g., “brand crisis rising”).

Where Businesses Use Sentiment Analysis

- **Marketing & Social Media**

- Track mood about brand on **Instagram, TikTok, X (Twitter)**.
- See which campaign makes customers **happy or angry**.

- **Customer Experience (CX)**

- Analyze **chat, email, call transcripts** to see common problems.
- Find “pain points” and improve service.

- **Finance**

- Analyze **news + social media** to see investor mood.
 - Support decisions in **stock market and risk management**.
-
- A bank checks Twitter complaints each morning and sends top 3 issues to call center manager.
 - An e-commerce company checks reviews to see why one product has more **1-star** than others.



Simple Tools for Social & Sentiment Analytics (2024–2025)

Social media suites

Sprout Social, Hootsuite, Buffer – show sentiment and engagement for posts.

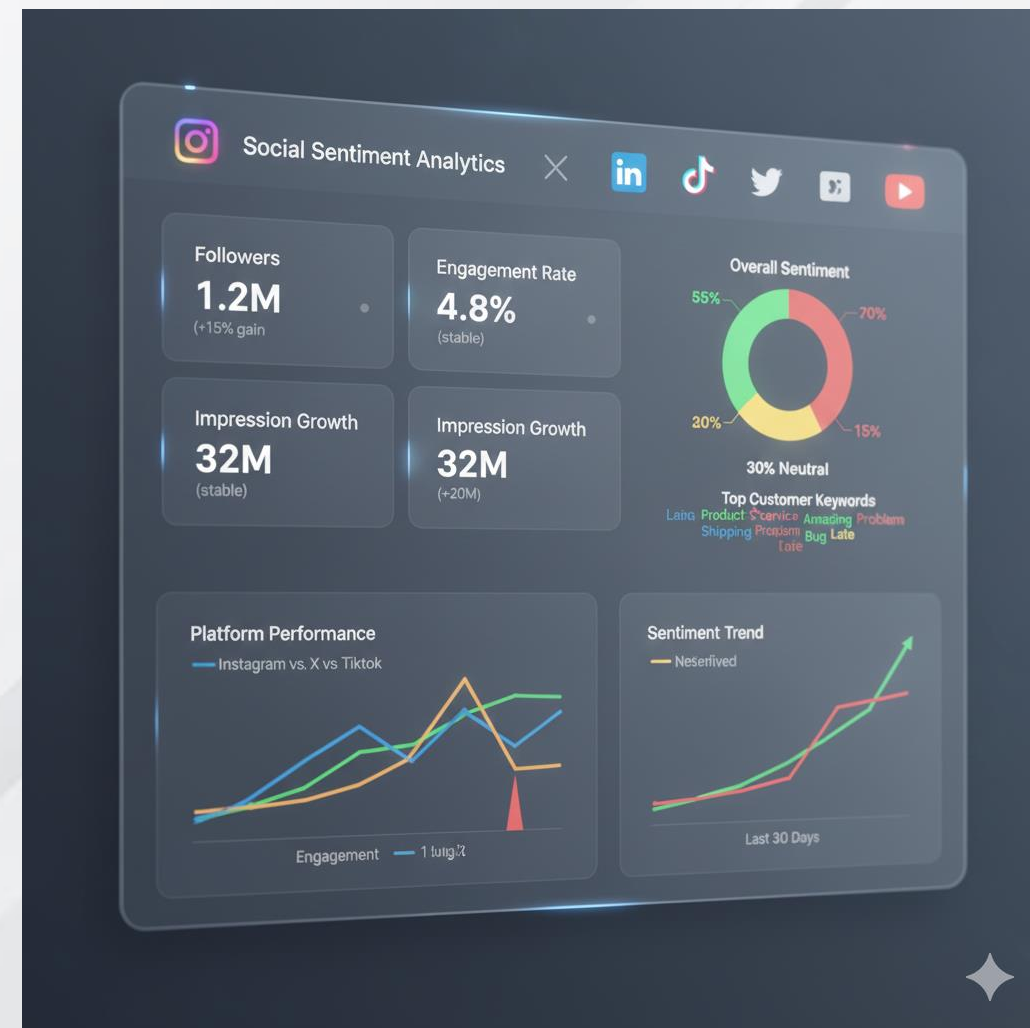
Listening & Review tools

Brandwatch, Talkwalker, Google Reviews dashboards – track brand mention and reviews.

AI / LLM-based text tools

Many platforms now add **AI summaries**: show main topics and mood from thousands of comments.

For this course: focus on **reading dashboards** and **interpreting charts**, not coding.



New Challenges in Sentiment & Social Analytics

Sarcasm & Nuance



- Context is Key
- Cultural Idioms

Evolving Language



- New Slang/Memes
- Multilingual Content

Deepfakes & Deception



- Synthetic Text
- Bot Detection

Fake or paid reviews Bots and fake accounts can trick sentiment models.

Bias in AI models Models may treat some languages, cultures, or slang **unfairly**.

Context problems Sarcasm (“great job 🙄”) and mixed feelings are still hard.

Data privacy Must respect platform rules and **data protection laws**.

Manager role MBA managers must **question the dashboard**, not trust AI 100%.

TikTok & YouTube comments can show mostly positive sentiment, but a **small but strong negative group** may drive real risk for the brand

Text Analytics and Text Mining (1 of 2)

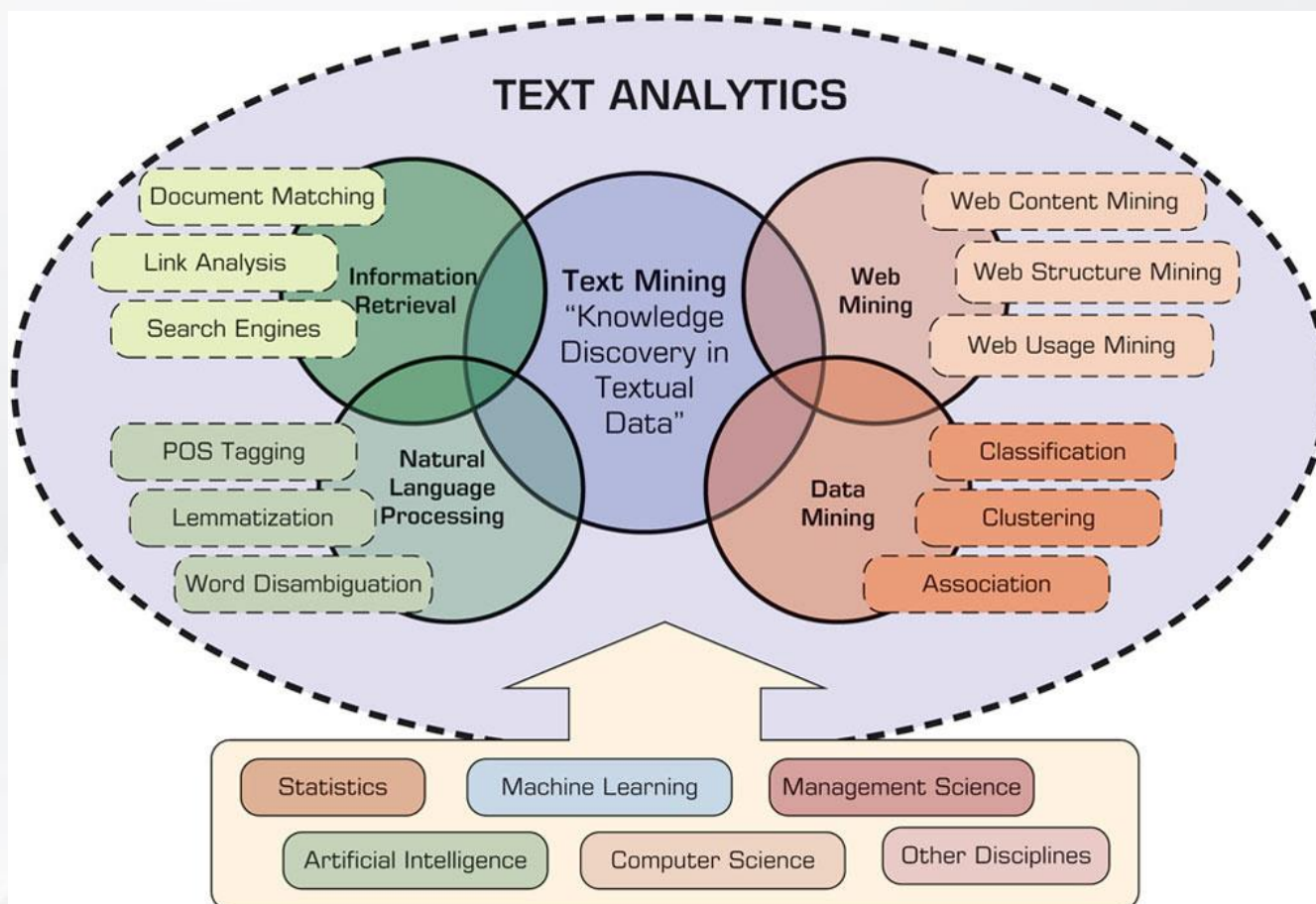
- Text Analytics versus Text Mining
- Text Analytics =
 - Information Retrieval +
 - Information Extraction +
 - Data Mining +
 - Web Mining

or simply

- ***Text Analytics = Information Retrieval + Text Mining***

Text Analytics and Text Mining (2 of 2)

Figure Text Analytics, Related Application Areas, and Enabling Disciplines.



Text Mining Concepts

- 85-90 percent of all corporate data is in some kind of unstructured form (e.g., text)
- Unstructured corporate data is doubling in size every 18 months
- Tapping into these information sources is not an option, but a need to stay competitive
- Answer: text mining
 - A semi-automated process of extracting knowledge from unstructured data sources
 - a.k.a. text data mining or knowledge discovery in textual databases

Data Mining versus Text Mining

- Both seek for novel and useful patterns
- Both are semi-automated processes
- Difference is the nature of the data:
 - Structured versus unstructured data
 - **Structured data:** in databases
 - **Unstructured data:** Word documents, PDF files, text excerpts, XML files, and so on
- **To perform text mining** – first, impose structure to the data, then mine the structured data.

Text Mining Concepts (2 of 2)

- Benefits of text mining are obvious especially in text-rich data environments
 - e.g., law (court orders), academic research (research articles), finance (quarterly reports), medicine (discharge summaries), biology (molecular interactions), technology (patent files), marketing (customer comments), etc.
- Electronic communication records (e.g., Email)
 - Spam filtering
 - Email prioritization and categorization
 - Automatic response generation

Text Mining Application Area

- Information extraction
- Topic tracking
- Summarization
- Categorization
- Clustering
- Concept linking
- Question answering

Text Mining Terminology (1 of 2)

- Unstructured or semistructured data
- Corpus (and corpora)
- Terms
- Concepts
- Stemming
- Stop words (and include words)
- Synonyms (and polysemes)
- Tokenizing

Text Mining Terminology (2 of 2)

- Term dictionary
- Word frequency
- Part-of-speech tagging
- Morphology
- Term-by-document matrix
 - Occurrence matrix
- Singular value decomposition
 - Latent semantic indexing

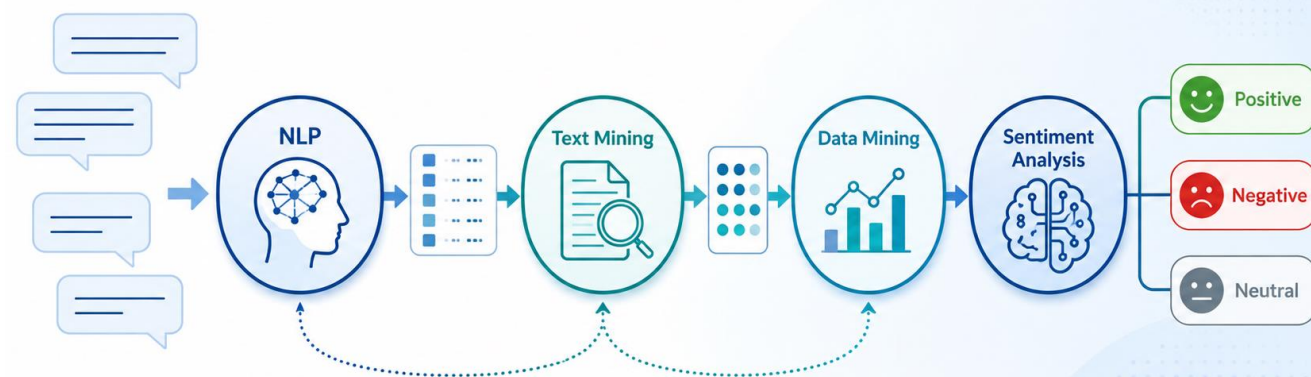
Natural Language Processing (NLP)

NLP: a key concept in text mining: a subfield of AI and computational linguistics focused on understanding natural human language.

Text mining: extracts useful knowledge from unstructured text after structure is imposed on it.

Data mining: discovers novel and useful patterns after the text has been transformed into structured features.

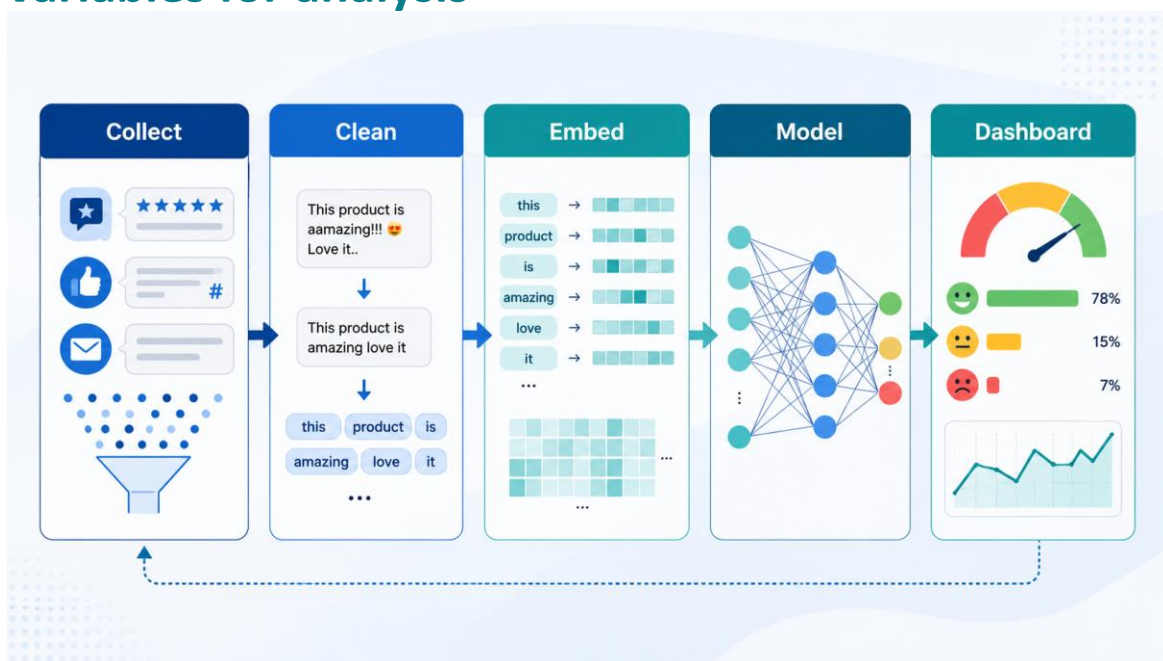
Sentiment analysis: answers: “What do people feel about a topic?” by analyzing opinions via automated tools.



NLP structures language → data mining finds patterns → sentiment labels opinions

NLP Starts with Text Mining: Turning Language into Mineable Data

From unstructured documents to structured variables for analysis



Key terminology to recognize: corpus/corpora, terms, concepts, tokenizing, stop words, stemming, term dictionary, word frequency, part-of-speech tagging, term-by-document matrix, occurrence matrix, SVD, latent semantic indexing.

85–90% of corporate data is unstructured text.

Unstructured corporate data doubles in size about every 18 months.

Text analytics = Information Retrieval + Information Extraction + Data Mining + Web Mining.

Simpler view: Text Analytics = Information Retrieval + Text Mining.

Data mining vs. text mining

Both seek novel and useful patterns using semi-automated methods.

Data mining mainly uses structured database data. Text mining begins with unstructured data: Word documents, PDFs, text excerpts, XML files, emails, reviews, and social media.

Before mining, text must be cleaned, tokenized, represented, and converted into structured features.

NLP Understanding: Why Sentiment Analysis Is Hard

Sentiment depends on meaning, context, ambiguity, and imperfect human language

What “understanding” means in NLP

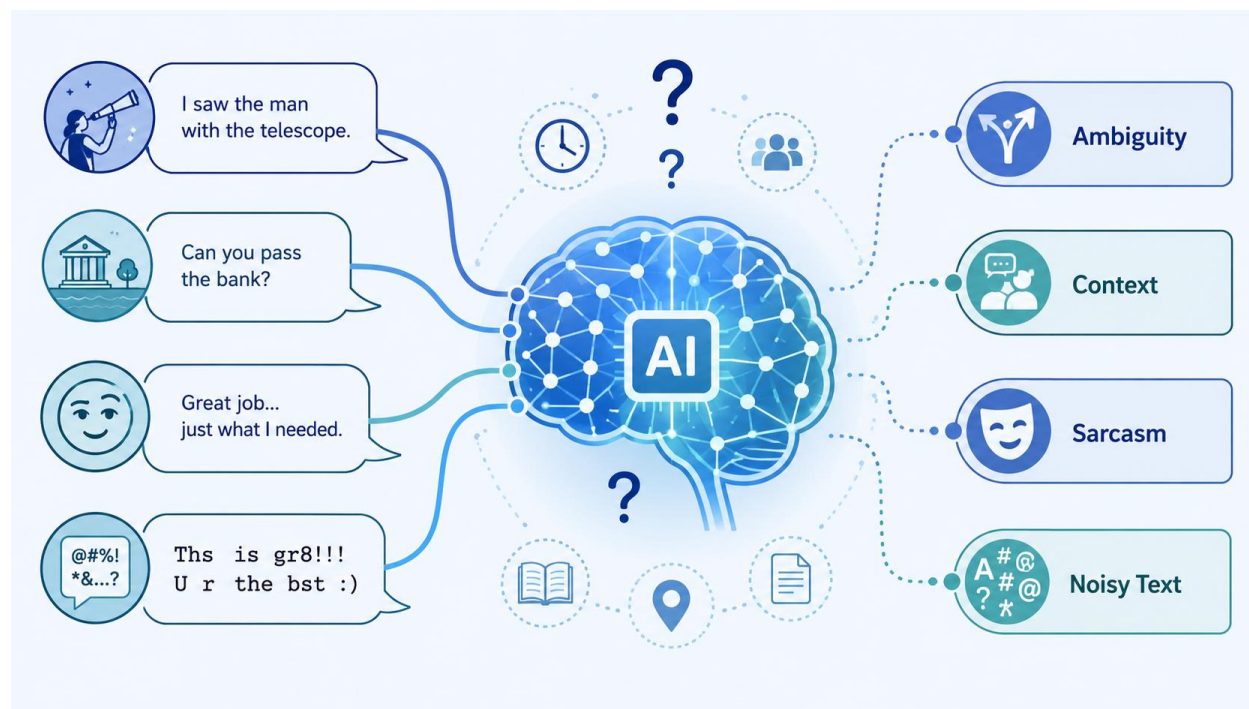
Human language is vague and context driven.
True understanding requires extensive topic knowledge.
NLP moves text mining beyond simple bag-of-words toward syntax- and semantics-based analysis.

NLP challenge list

- Part-of-speech tagging
- Text segmentation
- Word-sense disambiguation
- Syntax ambiguity
- Imperfect or irregular input
- Speech acts

Task categories

- Question answering
- Automatic summarization
- Natural language generation and understanding
- Machine translation
- Speech recognition
- Text proofing and OCR



Sentiment Analysis Using Data Mining: From Text to Managerial Action

NLP provides the language interpretation; data mining classifies opinions and detects patterns



Managerial caution: fake or paid reviews, bots, model bias, sarcasm, mixed feelings, data privacy, and over-trusting dashboards can distort decisions.

Sentiment analysis definition and process

Definition: sentiment means belief, view, opinion, or conviction.

Main question: What do people feel about a certain topic?

Process: collect text → clean it → transform it into features or embeddings → model sentiment → report dashboards/alerts.

Typical model output: positive, negative, neutral, or a sentiment score.

Applications you must know

Voice of the Customer (VOC), Voice of the Market (VOM), Voice of the Employee (VOE).

Brand management, financial markets, politics, and government intelligence. Especially important in CRM because it captures customer and consumer opinions.

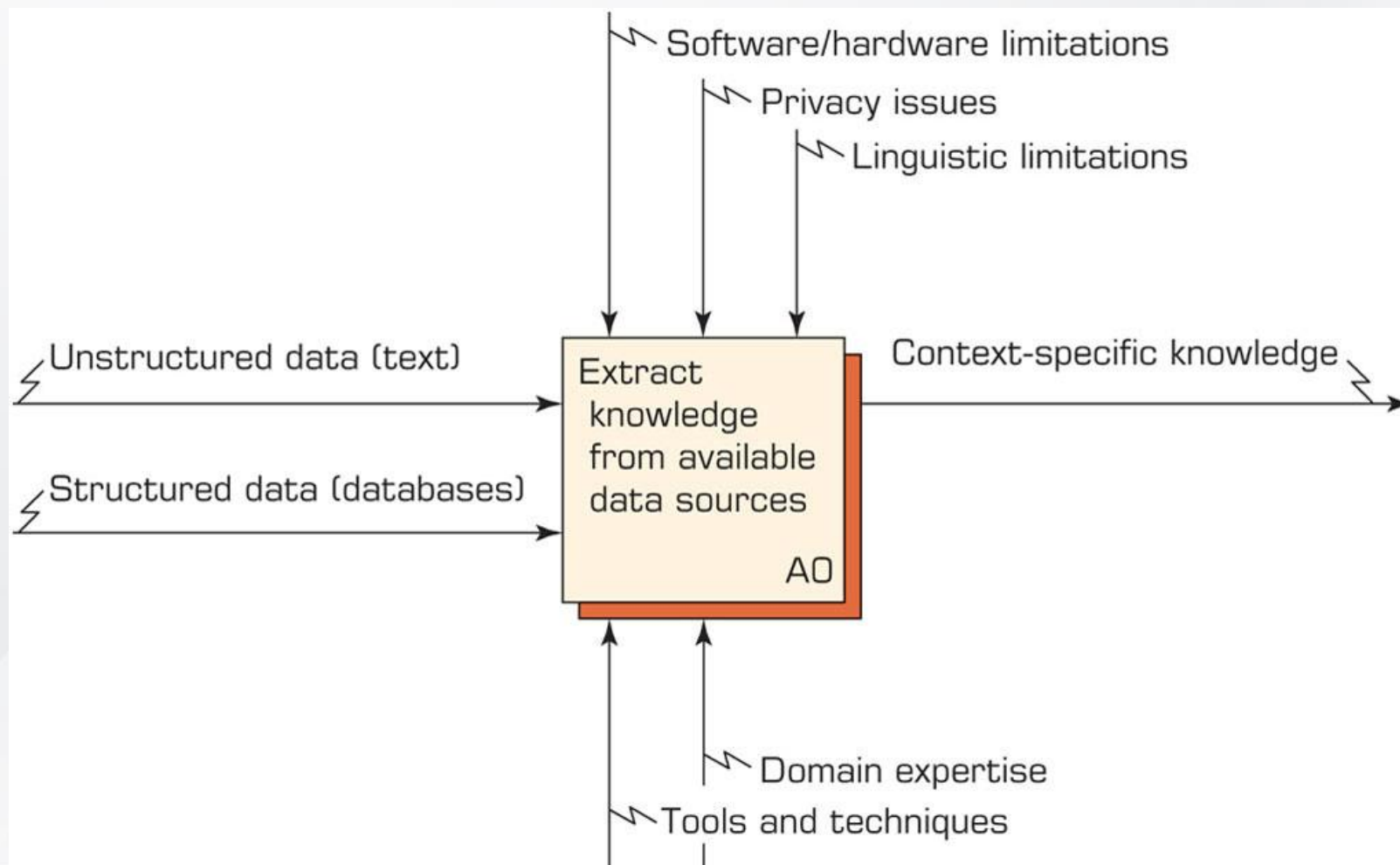
Check questions: difference between text mining and data mining; how sentiment analysis benefits CRM; main NLP challenges in text mining.

Text Mining Applications (1 of 2)

- Marketing applications
 - Enables better CRM
- Security applications
 - ECHELON, OASIS
 - Deception detection (...example coming up)
- Medicine and biology
 - Literature-based gene identification (...)
- Academic applications
 - Research stream analysis

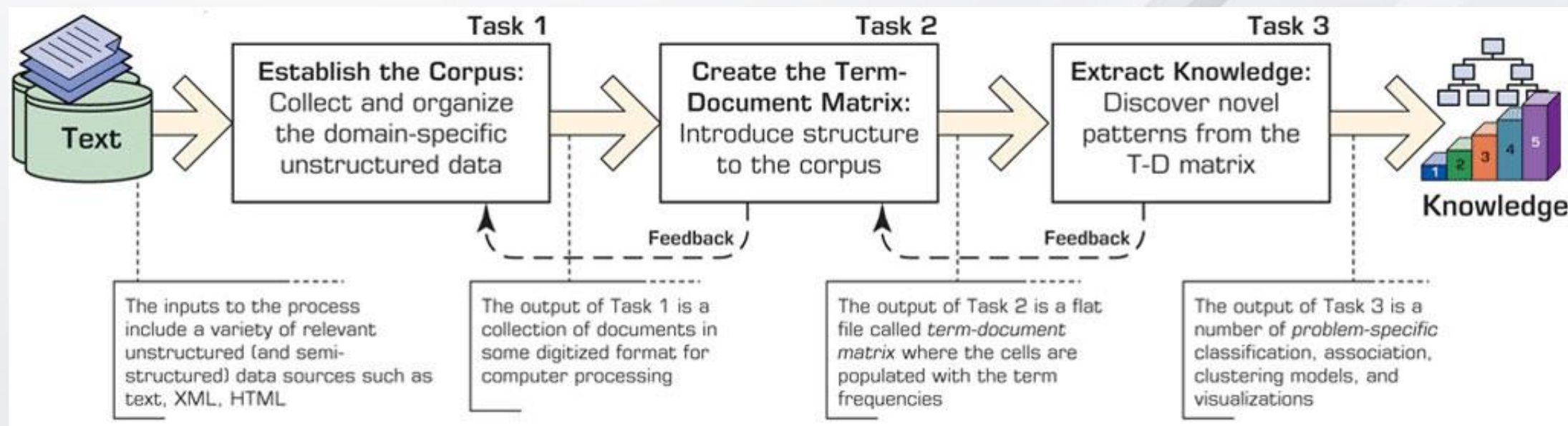
Text Mining Process (1 of 7)

- A Context Diagram for Text Mining Process



Text Mining Process (2 of 7)

Figure 7.6 The Three-Step/Task Text Mining Process.



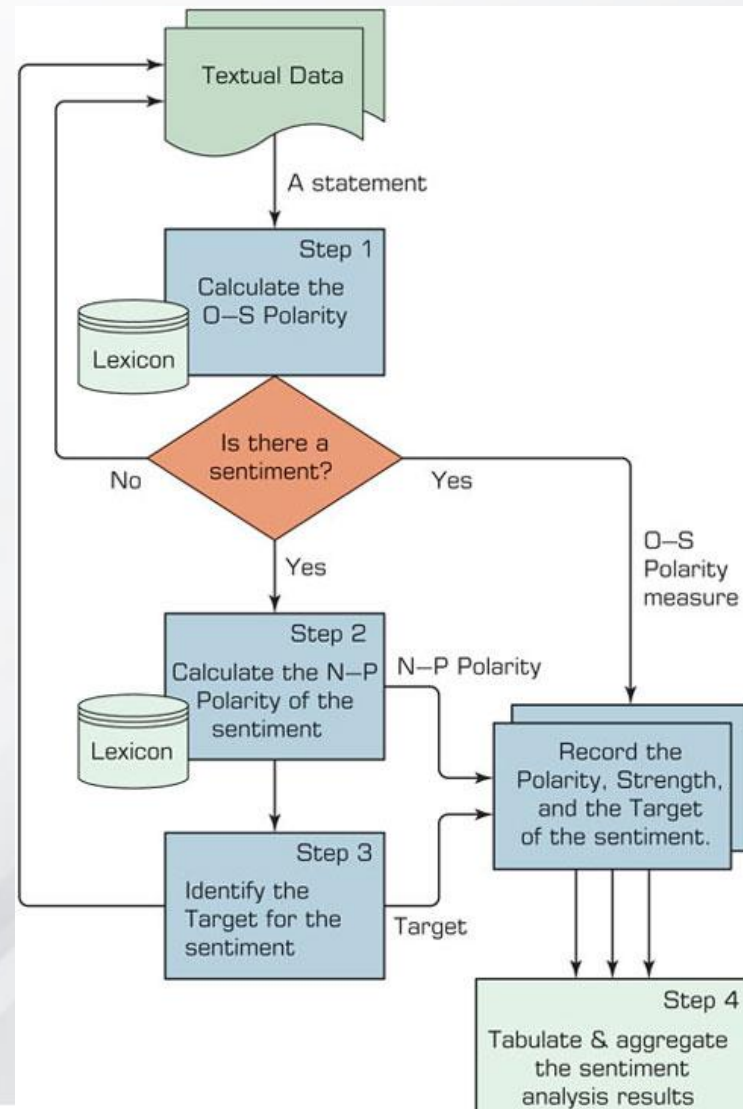
Sentiment Analysis

- Sentiment → belief, view, opinion, and conviction
- Sentiment analysis is trying to answer the question “What do people feel about a certain topic?”
- By analyzing data related to opinions of many using a variety of automated tools
- Used in variety of domains, but its application in CRM are especially noteworthy (which related to customers/consumers’ opinions)

Sentiment Analysis Applications

- Voice of the customer (VOC)
- Voice of the Market (VOM)
- Voice of the Employee (VOE)
- Brand Management
- Financial Markets
- Politics
- Government Intelligence
- ... others

Sentiment Analysis Process (1 of 3)

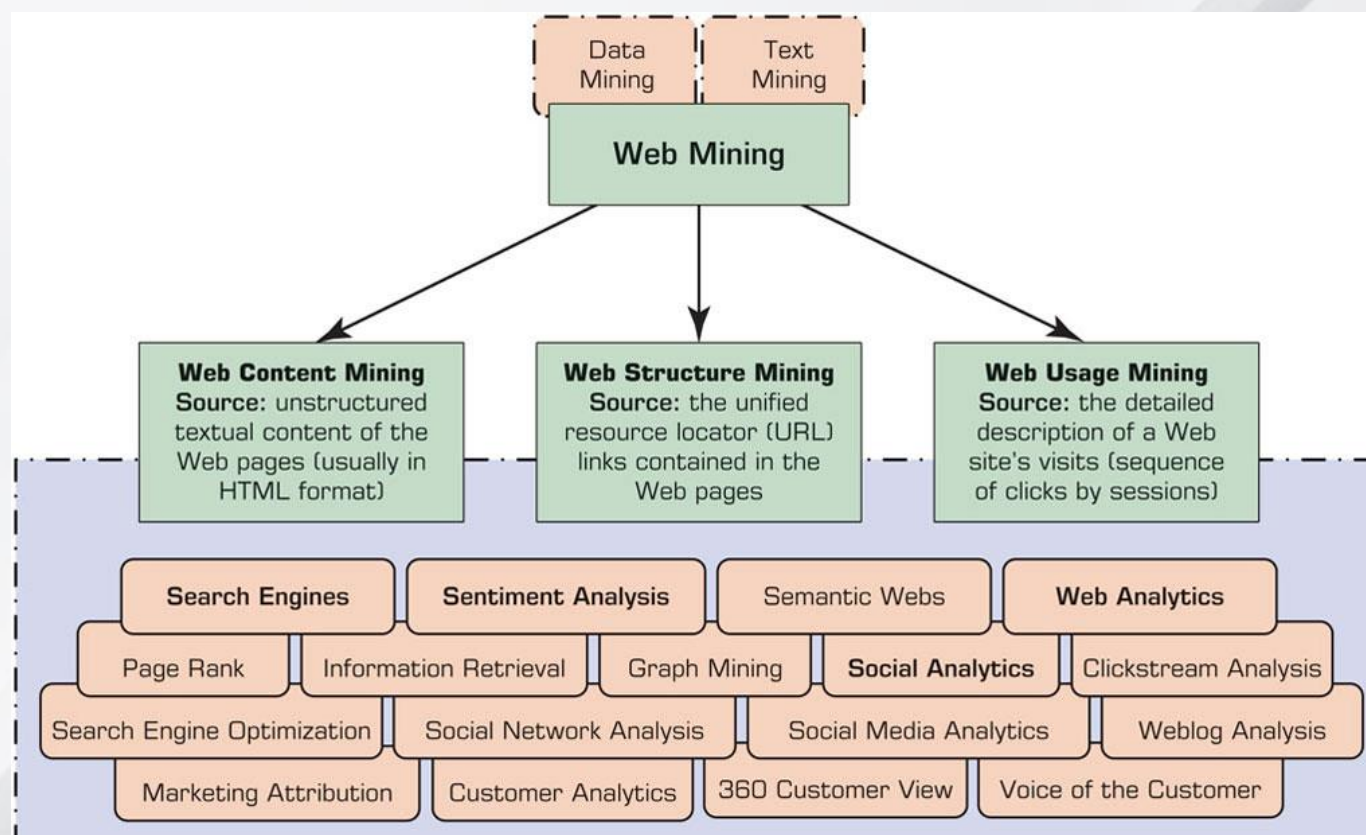


Web Mining Overview

- Web is the largest repository of data
- Data is in HTML, XML, text format
- Challenges (of processing Web data)
 - The Web is too big for effective data mining
 - The Web is too complex
 - The Web is too dynamic
 - The Web is not specific to a domain
 - The Web has everything
- Opportunities and challenges are great

Web Mining

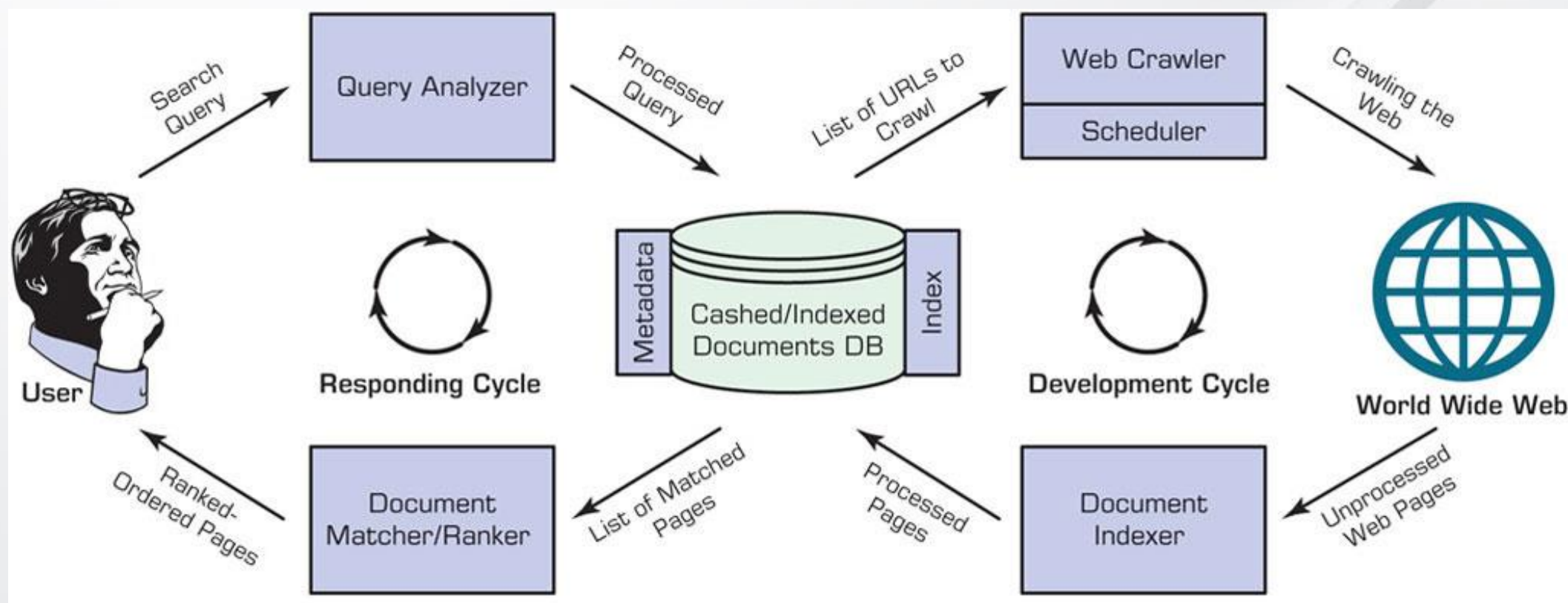
Web mining (or Web data mining) is the process of discovering intrinsic relationships from Web data (textual, linkage, or usage)



Search Engines

- Google, Bing, Yahoo, ...
- For what reason do you use search engines?
- Search engine is a software program that searches for documents (Internet sites or files) based on the keywords (individual words, multi-word terms, or a complete sentence) that users have provided that have to do with the subject of their inquiry
- They are the workhorses of the Internet

Structure of a Typical Internet Search Engine



Search Engine Optimization

- It is the intentional activity of affecting the visibility of an e-commerce site or a Web site in a search engine's natural (unpaid or organic) search results
- Part of an Internet marketing strategy
- Based on knowing how a Search Engine works
 - Content, HTML, keywords, external links, ...
- Indexing based on ...
 - Webmaster submission of URL
 - Proactively and continuously crawling the Web

Top 15 Most Popular Search Engines

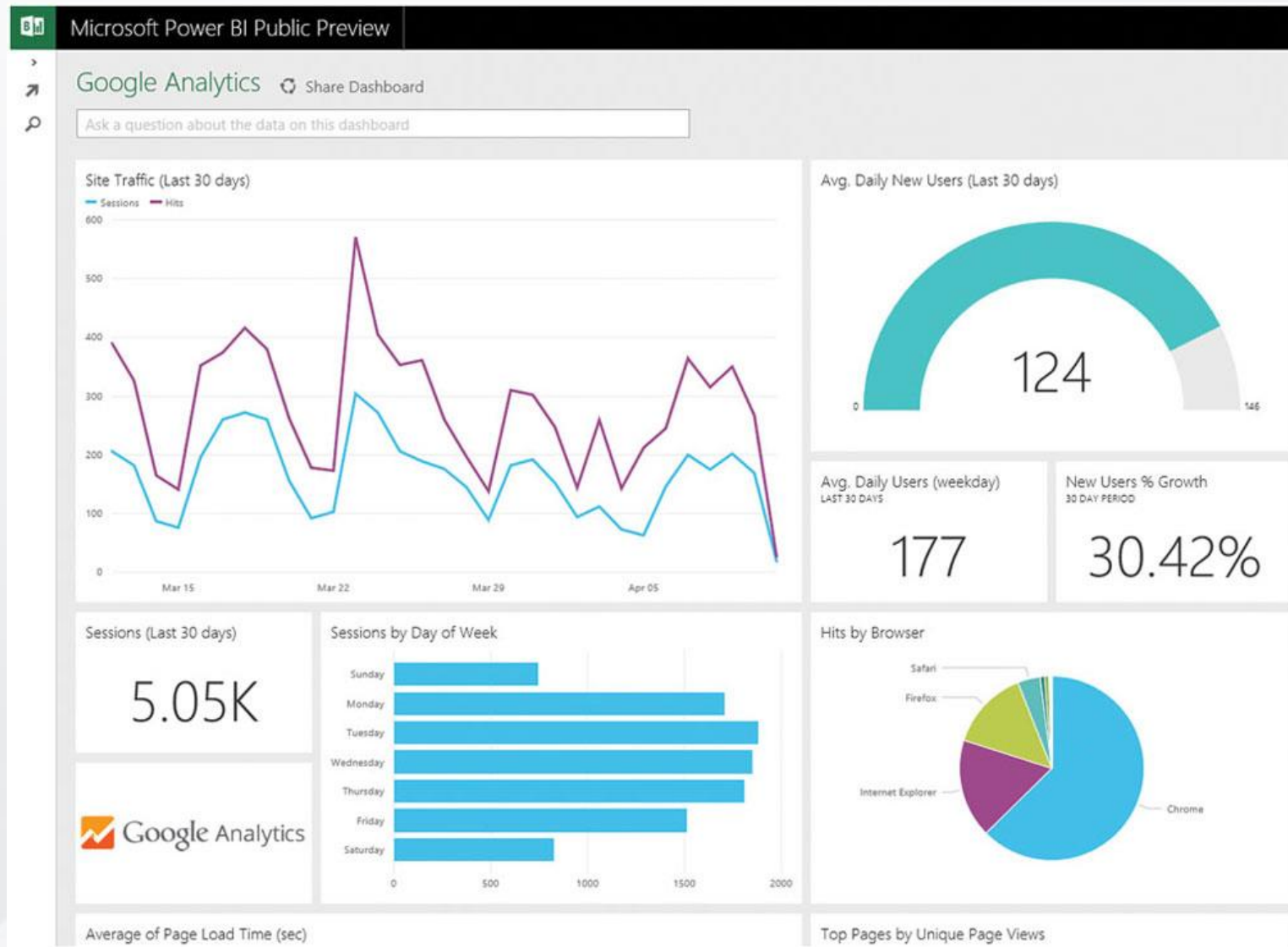
(by eBizMBA, August 2016)

Rank	Name	Estimated Unique Monthly Visitors
1	Google	1,600,000,000
2	Bing	400,000,000
3	Yahoo! Search	300,000,000
4	Ask	245,000,000
5	AOL Search	125,000,000
6	Wow	100,000,000
7	WebCrawler	65,000,000
8	MyWebSearch	60,000,000
9	Infospace	24,000,000
10	Info	13,500,000
11	DuckDuckGo	11,000,000
12	Contentko	10,500,000
13	Dogpile	7,500,000
14	Alhea	4,000,000
15	ixQuick	1,000,000

Web Analytics Metrics (1 of 3)

- Web site usability
 - How were the visitors using my Web site?
- Traffic sources
 - Where did they come from?
- Visitor profiles
 - What do my visitors look like?
- Conversion statistics
 - What does it all mean for the business?

A Sample Web Analytics Dashboard



Social Analytics Social Network Analysis (1 of 2)

- **Social Network** - social structure composed of individuals link to each other
- Analysis of social dynamics
- Interdisciplinary field
 - Social psychology
 - Sociology
 - Statistics
 - Graph theory

Social Analytics Social Network Analysis (2 of 2)

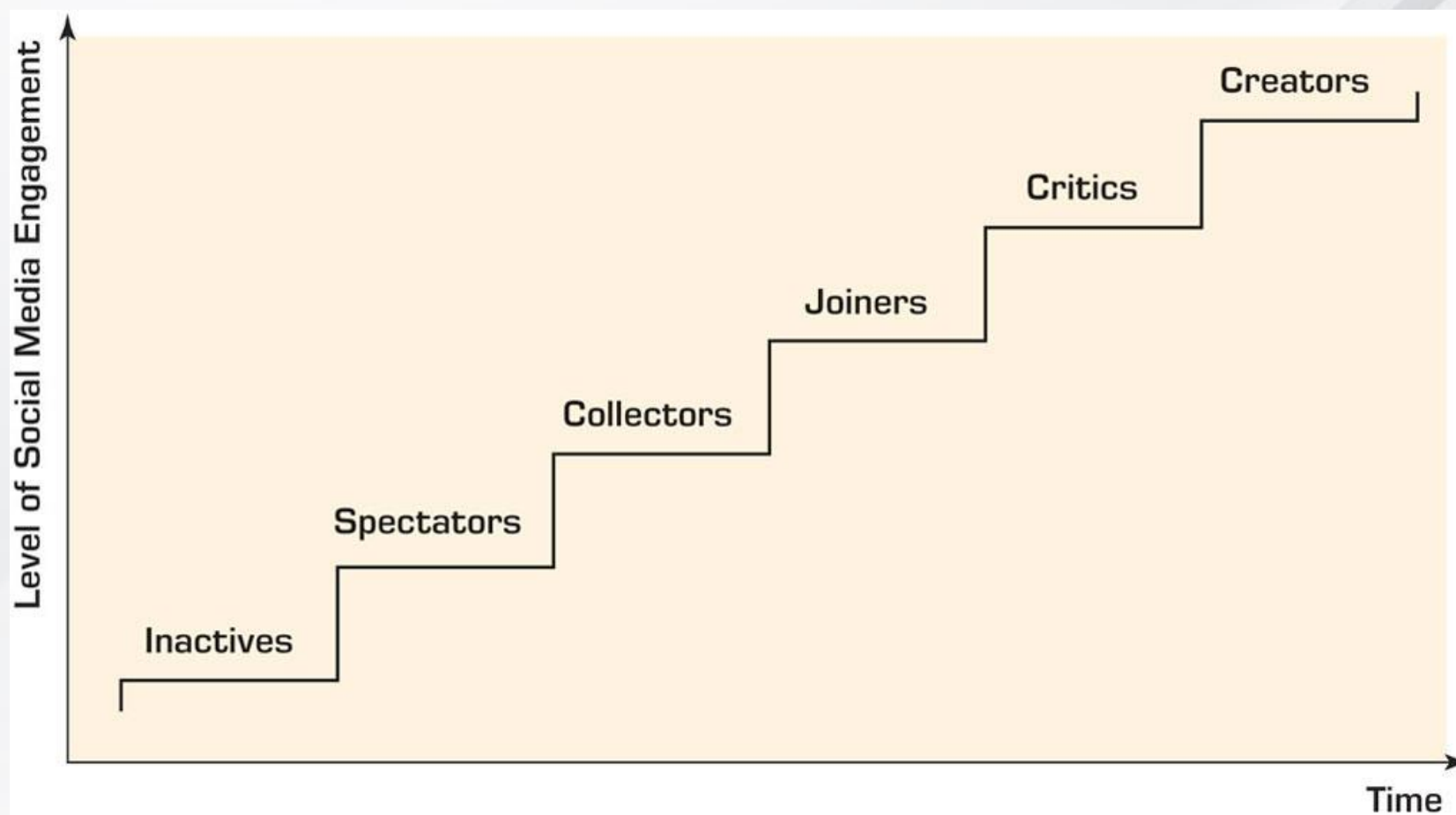
- **Social Networks** help study relationships between individuals, groups, organizations, societies
 - Self organizing
 - Emergent
 - Complex
- Typical social network types
 - Communication networks, community networks, criminal networks, innovation networks, ...

Social Media Definitions and Concepts

- Enabling technologies of social interactions among people
- Relies on enabling technologies of Web 2.0
- Takes on many different forms
 - Internet forums, Web logs, social blogs, microblogging, wikis, social networks, podcasts, pictures, video, and product reviews
- Different types of social media
 - Based on **media research** and **social process**

How Do People Use Social Media?

- Different engagement levels



Social Media Analytics

- It is the systematic and scientific ways to consume the vast amount of content created by Web-based social media outlets, tools, and techniques for the betterment of an organization's competitiveness
- Tools to measure social media impact:
 - Descriptive analytics
 - Social network analysis
 - Advanced analytics

Best Practices in Social Media Analytics

- Think of measurement as a guidance system, not a rating system
- Track the elusive sentiment
- Continuously improve the accuracy of text analysis
- Look at the ripple effect
- Look beyond the brand
- Identify your most powerful influencers
- Look closely at the accuracy of your analytic tool
- Incorporate social media intelligence into planning

Review Questions:

- What is the primary difference between text mining and data mining?
- How does sentiment analysis benefit Customer Relationship Management (CRM)?
- What are the main challenges associated with Natural Language Processing (NLP) in text mining?

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Thank You