

# MACHINE LEARNING OPPORTUNITIES IN FREIGHT TRANSPORTATION OPERATIONS

NORTHWESTERN  
NUTC/CCIT  
October 26, 2016



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**SCHNEIDER**<sup>™</sup>

# SCHNEIDER IS A TRANSPORTATION AND LOGISTICS LEADER WITH A BROAD PORTFOLIO OF SERVICES.



**9,700**  
TRACTORS



**2,200**  
LEASED  
INDEPENDENT  
CONTRACTORS



**13,300**  
DRIVERS &  
INDEPENDENT  
CONTRACTORS



**48,450**  
TRAILERS &  
CONTAINERS



**13,300**  
MULTI-MODE  
THIRD-PARTY  
CARRIERS



**17,000**  
ASSOCIATES

OPERATIONS  
IN U.S.  
**1935**



OPERATIONS  
IN CANADA  
**1989**



OPERATIONS  
IN MEXICO  
**1992**



OPERATIONS  
IN CHINA  
**2005**



## MACHINE LEARNING APPLICATIONS

- *Pricing and Cost Estimation – Spot & Contract*
- *Forecasting Capacity – IC Drivers*
- *Driver Turnover*
- *Driver Safety*
- *Market Strength Forecasting*

## TEXT ANALYTICS

- *Capturing Lost Sales - Demand Forecasting*
- *Customer Relations – Assessing Account Health*



# OPERATIONS CENTER



# TEXT ANALYTICS

## TURNDOWN CAPTURE

- *10,000+ Tendered Orders/day*
- *Turndowns (Lost Sales) vary 5% to 20%*
- *Accurate Demand Forecasting requires understanding of total demand*
- *Difficult to capture via standard data entry*

## CUSTOMER RELATIONS

- *~ 500 Customer Service Reps*
- *Gauge Customer Sentiment*
- *Improve CSR communication skills*
- *Pro-actively address issues that lead to churn or freight reduction*
- *Coaching and discover of systemic issues.*

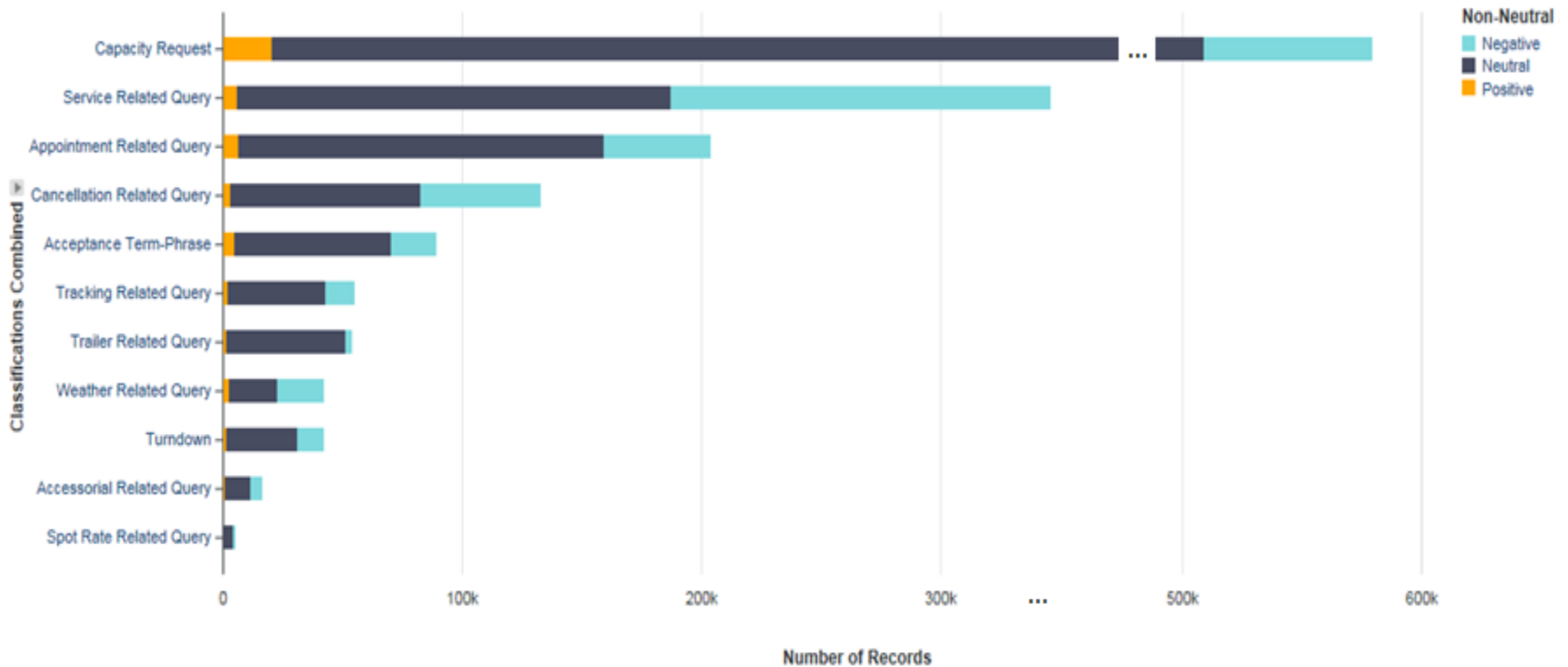
# SOLUTION APPROACH (COMMON)

- *60K Messages/day – email, chat, phone*
- *Collect/ Store - Hadoop/MapR*
- *Preprocessing*
  - *Parsing – Regular Expressions*
  - *Tokenizing – NLTK (Python)*
  - *Feature Extraction via TF-IDF*
- *Classification – ensemble using*
  - *Logistic Regression*
  - *Stochastic Gradient Descent*
  - *Multinomial Naïve Bayes*
  - *Support Vector Machine*
  - *Confidence score voting to determine message topic*

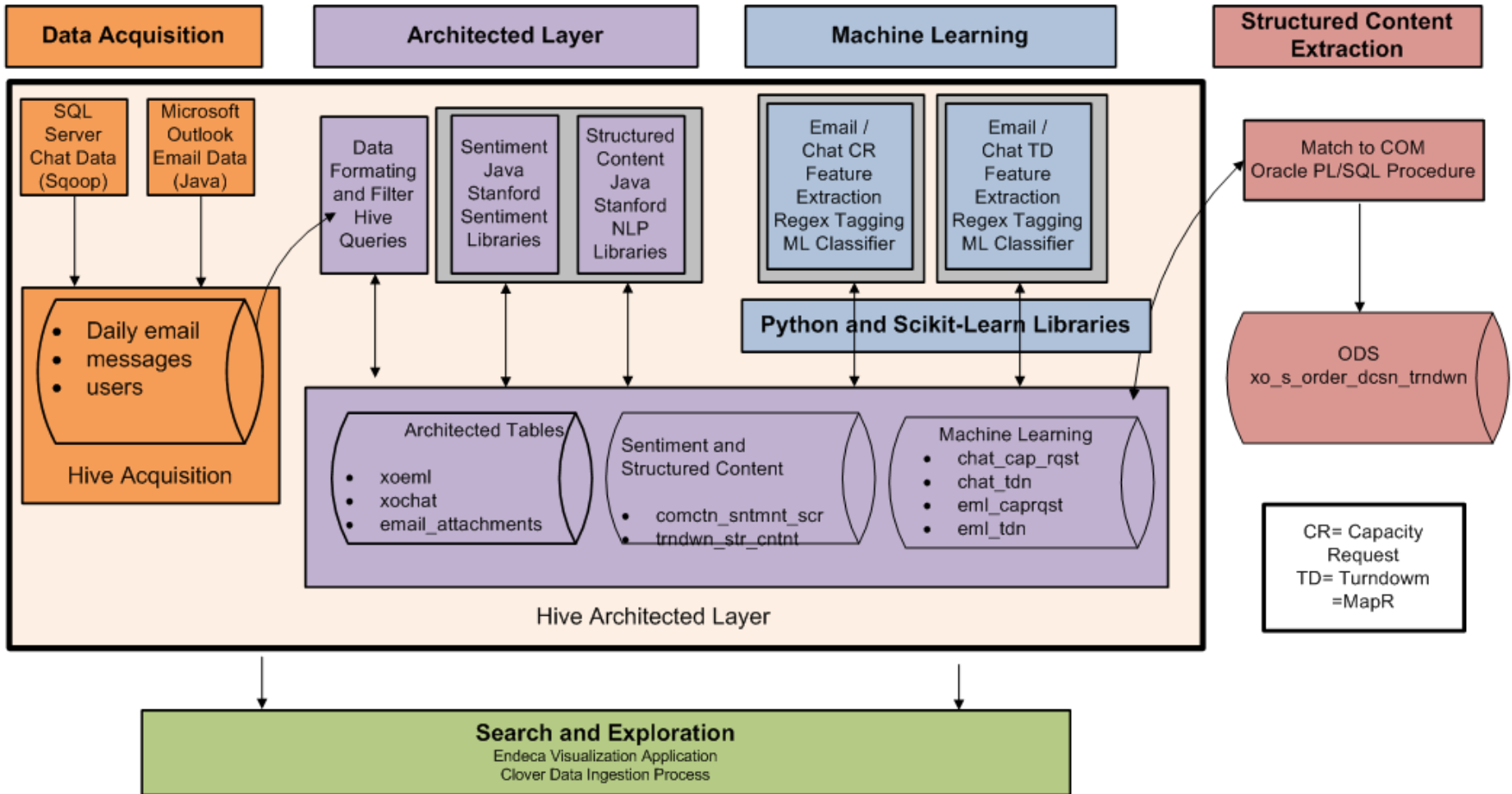
# DISTRIBUTION BY MESSAGE TOPIC

COMMUNICATION TRENDS

Volume by Classification    Sentiment Trend by Week    Volume by Customer Sentiment    Volume by CS Mailbox Sentiment    Classification Trend



# TURN DOWN ANALYTICS PROCESS FLOW



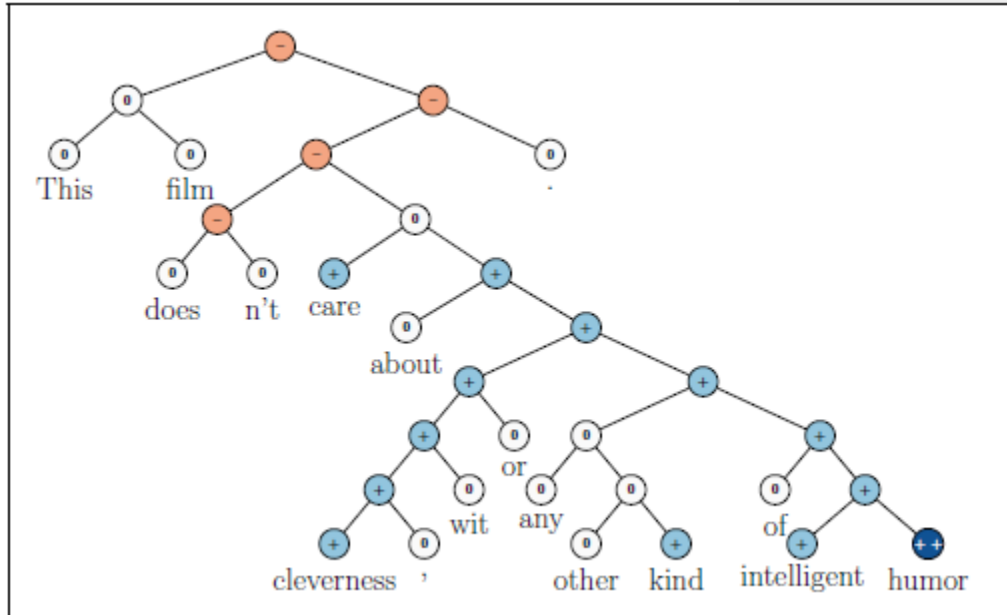


# TURN DOWN CAPTURE

- *Select messages associated with capacity request*
- *Use Content Extraction to create structured records*
- *Identify specific entities that define an order...  
customer, geography, dates and times*
- *Uses Stanford NLP libraries as well as other pattern matching, and data exclusion techniques.*
- *Data is cleansed, normalized, matched to normalized locations, dates, and customers in Enterprise Master Data*
- *Checked against other sources to prevent duplication.*
- *Posted to Order System via Sqoop and ODI.*

# SENTIMENT ANALYSIS

- Use Sentence-based analysis



- Recursive Neural Tensor Networks (Socher et al.)
- Stanford NLP Library – Deep Learning
- Sentiment Treebank includes sentiment labels for 215,154 phrases in parse trees of 11,855 sentences

523 Comments Recursive Deep Models for Semantic Compositionality

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Ivan · 3 years ago

"I studied at Stanford" yields a positive result, while "I studied at Harvard" it's neutral. So I guess it works fine.

294 [^](#) [v](#) · [Reply](#) · [Share](#)

# SENTIMENT ANALYSIS

- *Sentiment packages trained and built with social media and B2C communication do not work for B2B.*
- *In B2B communication expression of dissatisfaction or issues of concern is almost always 'emotionally neutral'.*
- *Using a business-specific set of reference phrases, the Stanford Treebank is about 50% accurate.*
- *Underlying technology and algorithms (RNTN) is valid, but needs to be trained with business-specific and industry-specific phrases.*
- *Re-training with a set of 2200 business sentences, we have raised accuracy to 71%.*
- *Current plan is increased the training set until 80% accuracy is achieved.*

# SENTIMENT ANALYSIS

## Positive:

We are good to go on this load!!!

## Negative:

It's no longer acceptable to miss appointments without communication.

This order is loaded, and we still haven't discovered why we are creating another service failure.

## Negative situation:

Due to the weather advisory in the Gulf Region we are asking that you notify us of any potential weather delays and provide updates of managed loads that will be affected.

The driver is updating a late ETD 8/9 1630 for delivery due to equipment related issues.

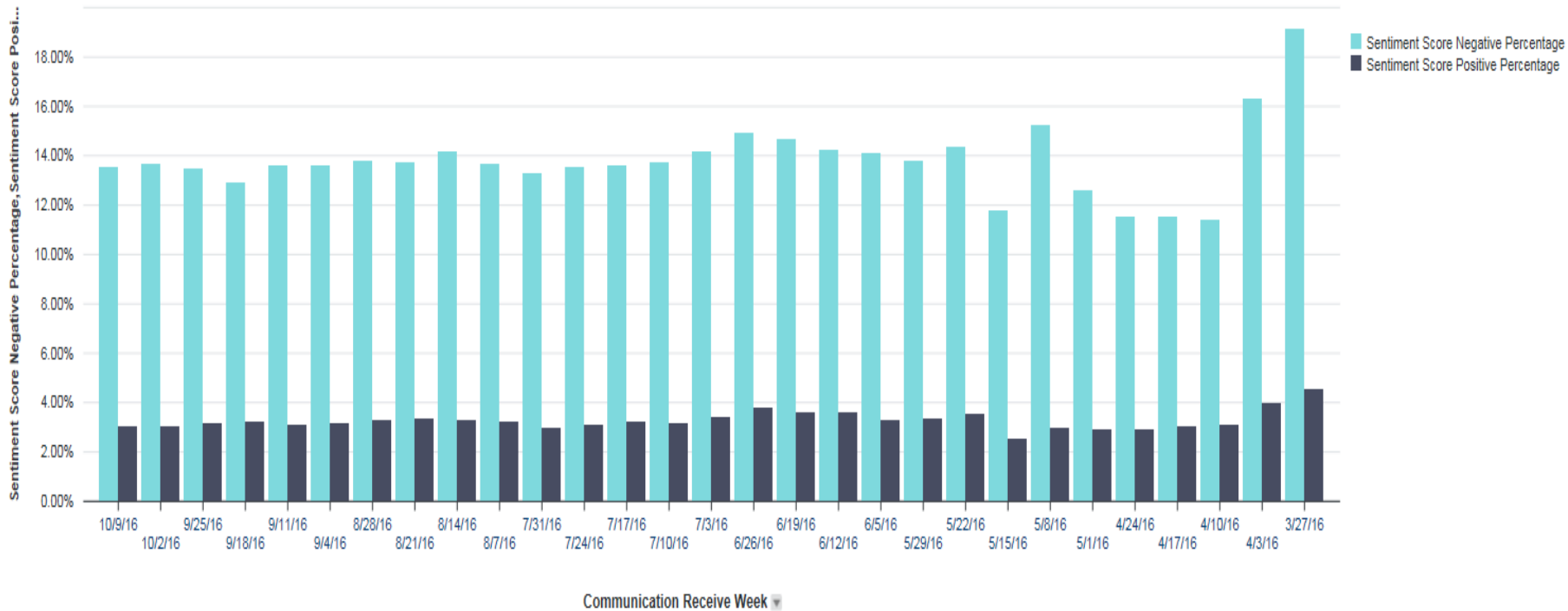
# SENTIMENT TREND

COMMUNICATION TRENDS

- Volume by Classification
- Sentiment Trend by Week
- Volume by Customer Sentiment
- Volume by CS Mailbox Sentiment
- Classification Trend

NEGATIVE COMMUNICATION TREND

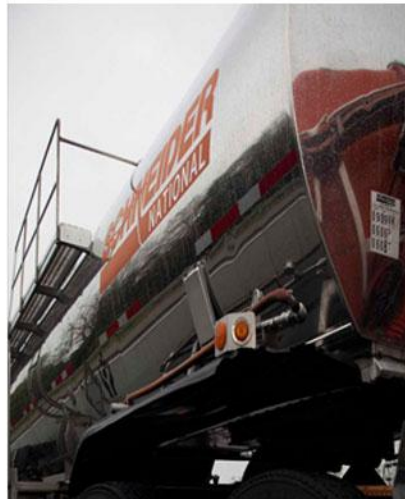
BY: Year | Month | Day





*THANK YOU*

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