Using Analytics to Improve Consumer Choice in the US

KNIME Fall Summit 2018
Michelle Leonard & Doris Sullivan
We Are Consumer Reports

Consumer Reports is an independent, nonprofit member organization that works side by side with consumers to advance truth, transparency, and fairness in the marketplace.

We use our rigorous research, consumer insights, journalism, and policy expertise to drive understanding and impact in areas that matter most to consumers, inform purchase decisions, improve the products and services that people rely on everyday, and drive regulatory and fair competitive practices for all.

“We are passionate about our work because we know how much is at stake for you.”
<table>
<thead>
<tr>
<th>Category</th>
<th>Number</th>
</tr>
</thead>
<tbody>
<tr>
<td>Members</td>
<td>6M+</td>
</tr>
<tr>
<td>Employees/Testing experts</td>
<td>500+/140+</td>
</tr>
<tr>
<td>CR.org ratings</td>
<td>14.5K+</td>
</tr>
<tr>
<td>Monthly CRO unique visitors</td>
<td>15M+</td>
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<tr>
<td>Labs/Acres</td>
<td>63/327+</td>
</tr>
<tr>
<td>Survey responses/Social participants</td>
<td>1M/3M+</td>
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<tr>
<td>Volunteers + online activists</td>
<td>1.5M+</td>
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<tr>
<td>Testing budget</td>
<td>27M+</td>
</tr>
<tr>
<td>Advertising/Consumer 101</td>
<td>$0/1</td>
</tr>
</tbody>
</table>
Ratings from Testing + Surveys

- Cameras: 151 RATED
- Generators: 38 RATED
- Headphones: 159 RATED
- Leaf Blowers: 50 RATED
- Mattresses: 139 RATED
- Space Heaters: 40 RATED
- SUVs: 96 RATED
- Tires: 170 RATED
- TVs: 282 RATED
- Vacuum Cleaners: 168 RATED
- Washing Machines: 131 RATED
- All Products A-Z: 8,000+ RATED
CR Analytics – Pick the Tools for the Problem

KNIME + Tableau

Text analysis of injuries related to holiday lights
Example case: Text Analysis of Injuries Related to Holiday Lights

- Emergency Department Records: National Electronic Injury Surveillance System (NEISS) from the Consumer Product Safety Commission. CPSC.gov
- Filter records for injuries related to holiday lights for 2014-2017
- Use KNIME’s text processing features to perform text mining on ER narratives + build on it
- Use Tableau for enhanced visualization + use in dashboards
Example Case: Text Analysis of Injuries Related to Holiday Lights - KNIME Topic Extraction

KNIME Examples > 08_Other_Analytics_Types > 01_Text_Processing > 17_TopicExtraction_with_the_ElbowMethod
Example Case: Text Analysis of Injuries Related to Holiday Lights – Enhance Visualization

KNIME Examples > 08_Other_Analytics_Types > 01_Text_Processing > 17_TopicExtraction_with_the_ElbowMethod
Example Case: Text Analysis of Injuries Related to Holiday Lights – Enhance Visualization w Tableau
Example Case: Text Analysis of Injuries Related to Holiday Lights – Adding Bi-Gram frequencies

Modify "Term Count" Module for co-occurrence.
Add flow after “Modifiable term filter” node.
Example Case: Text Analysis of Injuries Related to Holiday Lights – Adding Bi-Gram frequencies

network diagram - bi-gram frequency >= 5

table of bi-gram frequency >= 5

<table>
<thead>
<tr>
<th>Word 1</th>
<th>body</th>
<th>bulb</th>
<th>contusion</th>
<th>Head</th>
<th>Ingestion</th>
<th>injury</th>
<th>ladder</th>
<th>light</th>
<th>mouth</th>
<th>yam</th>
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</thead>
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</tr>
</tbody>
</table>
Consumer Reports Cloud Based Taxonomy

7 CIAs: Home, Food, Tech, Health, Money, Cars, Cross-CIA

70 Sub-CIAs: Large Appliances, Small Appliances, Cooking

400+ Categories: Refrigerators, Washing Machines, Meat & Poultry

1500+ Sub-Categories: Side-By-Side, Bottom Freezer, Top Freezer

Home

Laundry & Cleaning

Large Kitchen Appliances

Washing Machines

Top-Load Agitator

Top-Load HE

Front-Load

Compact
Prescriptive Analysis for Decision Making

This taxonomy framework helps answer key strategic questions:

● What should we be doing?
● Can we improve what we are doing?
Internal Performance

Value:
- Satisfaction Data (survey)
- Web Data (from our website)
- Audience/Reach
- Impact

Expense:
- Production Costs
- Labor Costs
- Marketing Costs
External Opportunity

- Industry & Consumer Trends (e.g., Google data)
- Competitor Tracking
Optimize Our Portfolio

Looking at the internal performance with external opportunities we can better optimize our content portfolio for growth:

- **Invest:** Dog food
- **Maintain:** Washing Machines
- **Divest:** TVs

(Illustrative)
Strategic Decisions

CIA Level Performance

- Home
- Cars
- Tech
- Health
- Money
- Food
- Cross-CIA

Sub-CIA Level Performance

- Home
  - Laundry & Cleaning
  - Large Kitchen Appliances
  - Bed & Bath
  - Heating, Cooling & Air
  - Outdoor Maintenance & Equipment
  - Home Improvement & Remodeling
  - Small Kitchen Appliances
  - Cooking & Grilling

Drill Down: More granular view
Example Case: Keyword Classification of Web Data

CRO: Appliances: Refrigerators: RatingsOverview: French-doorRefrigerators
CRO: Electronics: Blu-rayPlayers: Overview
CRO: SEM: Refrigerators
CRO: Appliances: Refrigerators: 2016:07: MostReliableRefrigeratorBrands
CRO: Electronics: Blu-rayPlayers: Overview
CRO: SEM: WashingMachines-Long
CRO: Appliances: WashingMachines: LGWT5680HVA: Overview
CRO: Appliances: Appliances: 2013:03: Today'sSlimmerRefrigeratorsFitTightSpa
CRO: Appliances: KitchenAppliances: 2011:07: ShouldYouRepairOrReplaceThat
CRO: Electronics: Blu-rayPlayers: Blu-rayPlayers: Overview
CRO: Electronics: Blu-rayPlayers: SamsungBD-H6500: Overview
CRO: Electronics: Tvs: 2015:01: 4KBlu-rayPlayersAreFinallyComingLaterIn2015
CRO: Electronics: Blu-rayPlayers: SamsungBD-JM57C: Overview
CRO: Electronics: Blu-rayPlayers: 2016:07: 4KBlu-rayPlayersPromiseTopPicture
CRO: Electronics: Blu-rayPlayers: ProductSelector: RatingsOverview: Blu-ray
CRO: WashingMachines: 2016:05: WasherAndDryerSetsThatMatchYourBudge
CRO: Electronics: TVs: 2016:01: SamsungLaunchesBrighterSUHDTVsAndA4KBlu
## 1st Goal: Classify Each Page into Hierarchy

<table>
<thead>
<tr>
<th>Key</th>
<th>Sub-Category</th>
<th>Category</th>
<th>Sub-CIA</th>
<th>CIA</th>
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</thead>
<tbody>
<tr>
<td>CRO: Appliances: WashingMachines: 2013:06: TheBestMatchingWas...</td>
<td>Washing machines</td>
<td>Washing machines</td>
<td>Laundry &amp; Cleaning</td>
<td>Home</td>
</tr>
<tr>
<td>CRO: Appliances: Refrigerators: RatingsOverview: French-doorRefrigerators</td>
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<td>Refrigerators</td>
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<td>Home</td>
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<tr>
<td>CRO: Electronics: Blu-rayPlayers: Overview</td>
<td>Blu-ray players</td>
<td>Blu-ray players</td>
<td>TV &amp; Home Entertaini Tech</td>
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<tr>
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<td>Blu-ray players</td>
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<tr>
<td>CRO: Electronics: Blu-rayPlayers: 2016:07: 4K Blu-ray Players Promise Top Picture Quality</td>
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<tr>
<td>CRO: WashingMachines: 2016:05: Washer And Dryer Sets That Match Your Budget</td>
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<td>Blu-ray players</td>
<td>Blu-ray players</td>
<td>TV &amp; Home Entertaini Tech</td>
<td></td>
</tr>
</tbody>
</table>

Get every web page accurately classified into one hierarchy.
Future Goal: Build the automated process in KNIME

- Daily pagename file
  - Grab from Adobe FTP
- Taxonomy Hierarchy Export
  - Export from SmartLogic
- Taxonomy Classification Model
  - Send classified file back to Adobe FTP
- Export Adobe web metrics by taxonomy levels
  - Send to Tableau
Using analytics to help make things better for consumers

Ian Ferrell – Which
Presented by Phil Winters

With support from Christoph Hansmann – Dymatrix (KNIME Trusted Partner)
Our Mission

Which? exists to make you as powerful as the organisations you deal with in your daily life
Our Products & Services


- Find the Best – Product Reviews, Which? Switch, Which? Trusted Traders

Where we use analytics & the data sources

- Product Reviews: Price Prediction – is it a good time to buy?

- Investigations (in the magazine & online): Black Friday – are deals what they seem?

- Product Reviews: Product Matching – improving our coverage of the market with not tested products.

- Data sources: Pricerunner.co.uk – price comparison site. Used to populate our where to buy pages & to provide the data needed to do pricing analysis. Etilize.co.uk – part of the GFK group. Provides data on products selling in a particular month, including quartile sales performance.
Samsung QE55Q6F review £995.00 73% BEST BUY
LAUNCHED NOV 2017 / REVIEWED FEB 2018

55"
View specifications

£995.00
Lowest price (in stock)
Compare 6 retailers

Price is falling, wait for a lower price

Picture quality
Sound quality
Ease of use
Samsung QE55Q6F review £995.00 73% BEST BUY
LAUNCHED NOV 2017 / REVIEWED FEB 2018

Lowest price (in stock)
£995.00

Price is falling, wait for a lower price
What does this mean? ▲

Our price predictor uses trends in historical pricing data to determine our prediction on whether we think the price of a product is likely to go up, go down, or remain stable over the next seven days. It’s obviously not a definitive verdict because we have no control over how prices are set, when sales are likely to occur or stock availability, but it should go some way towards helping you make your purchasing decision with more confidence. Today’s best price is updated daily and lists the most accurate pricing information available to us. However, in some instances, the prices shown in our graph will only be correct up to the previous day.
## Where & When to Buy

### Compare retailers

<table>
<thead>
<tr>
<th>Retailer</th>
<th>Price</th>
<th>Delivery</th>
<th>In stock</th>
<th>Go to store</th>
</tr>
</thead>
<tbody>
<tr>
<td>Appliance Electronics</td>
<td>£955.00</td>
<td>Free</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Currys</td>
<td>£955.00</td>
<td>Free</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Hughes</td>
<td>£955.00</td>
<td>Free</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>PRC Direct</td>
<td>£955.00</td>
<td>Free</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Simply Electricals</td>
<td>£955.00</td>
<td>Free</td>
<td>❌</td>
<td></td>
</tr>
<tr>
<td>Tesco Direct</td>
<td>£955.00</td>
<td>£7.95</td>
<td>✓</td>
<td></td>
</tr>
</tbody>
</table>

*The retailers shown are supplied by PriceRunner.co.uk. This may not include every retailer selling the product online. When a retailer link is followed we receive a payment from PriceRunner, irrespective of whether a purchase is made.*

*Which? is a participant in the Amazon EU Associates Programme, an affiliate programme designed to provide a means for sites to earn affiliate fees by linking to Amazon.co.uk. For products subsequently purchased via Amazon, we receive a payment from them rather than from PriceRunner.*
The price prediction process is completely built in KNIME:
Price Prediction

- The collected data is used to predict the future price of a product
- After many data preparation steps, linear regression models are used for the prediction
The Data: Some facts

- Collected since June 27 2013
- Every day, 1.4G of data is received
  - +590 k Products in +77 Categories
  - +38 k Manufacturers
  - +830 Retailers
- Which? currently price prediction analysis:
  - 22072 Products in +18 Categories
  - 1144 Manufacturers
  - 186 Retailers
  - 45 months of data per product (average)
  - 55 m minimum price points collected to date
Investigation – Black Friday ‘Deals’

- Almost half the deals we tracked were cheaper before or after Black Friday
- Some shops may be breaching sales rules
- How to tell a good deal from a dud
Black Friday deals: how to check if a Black Friday deal is real

By Ellie Simmonds

Don't get duped by dodgy deals this Black Friday. Follow these tips to find out whether the 'special offer' you've got your eye on is genuine.

The hype around Black Friday creates the impression that every offer is worth trampling over fellow shoppers to get to, with retailers slashing prices to historically low levels for one day only. But our research has found that few Black Friday deals actually follow that trajectory.
Black Friday Analysis: KNIME in Action
Black Friday Analysis: KNIME in Action

<table>
<thead>
<tr>
<th>Table: Black Friday Analysis - Full Analysis for PM 22.09.18 17:30 (Black Friday 2019)</th>
<th>Rows: 83</th>
<th>Spec: Columns: 5 Properties: # variables</th>
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<tbody>
<tr>
<td><strong>Row ID</strong></td>
<td><strong>Retailer</strong></td>
<td><strong>Product</strong></td>
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<tr>
<td>1</td>
<td>Amazon</td>
<td>Headphones</td>
</tr>
<tr>
<td>2</td>
<td>Amazon</td>
<td>Camera</td>
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<tr>
<td>3</td>
<td>Amazon</td>
<td>TV</td>
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<tr>
<td>4</td>
<td>Amazon</td>
<td>Speaker</td>
</tr>
<tr>
<td>5</td>
<td>Amazon</td>
<td>Vacuum Cleaner</td>
</tr>
<tr>
<td>6</td>
<td>Argos</td>
<td>TV</td>
</tr>
<tr>
<td>7</td>
<td>Argos</td>
<td>Speaker</td>
</tr>
<tr>
<td>8</td>
<td>Argos</td>
<td>Toaster</td>
</tr>
<tr>
<td>9</td>
<td>Argos</td>
<td>Fridge</td>
</tr>
</tbody>
</table>

Excel Reader (XLS) - actual Black Friday Data from Advertisements

Table Reader

Historical Lowest Price Data

no. days price appears before
Black Friday Analysis: KNIME in Action

Black Friday Analysis

Excel Reader (XLS)
- actual Black Friday Data from Advertisements

Data Preparation

Table Reader
- Historical Lowest Price Data

Select and prepare

7 days before/after
- extract 6 months before
- no. days price appears before

Re Join & Prepare Report
- no. days price appears before

XLS Sheet Appender (deprecated)
## Black Friday Analysis: KNIME in Action

<table>
<thead>
<tr>
<th>Product Category</th>
<th>Brand/Product</th>
<th>Total Number of Days where price data appears</th>
<th>Days in the 6 months before BF where condition existed</th>
<th>Prices (and counts)</th>
<th>Status After BF</th>
<th>Days in the 6 months after BF where condition existed</th>
<th>Prices (and counts)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Electric kettle</strong></td>
<td>Amazon.co.uk</td>
<td>82</td>
<td>11 (94.90%1)</td>
<td>Even Lower Price than BF</td>
<td>100%</td>
<td>99.90%</td>
<td>99.90%</td>
</tr>
<tr>
<td><strong>Vacuum cleaner</strong></td>
<td>Argos</td>
<td>101</td>
<td>1 (99.50%1)</td>
<td>Same Low Price as BF</td>
<td>99.99%</td>
<td>99.99%</td>
<td>99.99%</td>
</tr>
<tr>
<td><strong>Coffee machine</strong></td>
<td>Whiteleys</td>
<td>189</td>
<td>2 (97.00%1)</td>
<td>Same Low Price as BF</td>
<td>99.99%</td>
<td>99.99%</td>
<td>99.99%</td>
</tr>
<tr>
<td><strong>Speaker</strong></td>
<td>Argos</td>
<td>198</td>
<td>3 (94.00%1)</td>
<td>Even Lower Price than BF</td>
<td>99.99%</td>
<td>99.99%</td>
<td>99.99%</td>
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<tr>
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<td>Argos</td>
<td>166</td>
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<td>99.99%</td>
<td>99.99%</td>
<td>99.99%</td>
</tr>
<tr>
<td><strong>Vacuum cleaner</strong></td>
<td>Argos</td>
<td>128</td>
<td>1 (722.00%1)</td>
<td>Same Low Price as BF</td>
<td>229.99%</td>
<td>229.99%</td>
<td>229.99%</td>
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<tr>
<td><strong>Air fryer</strong></td>
<td>Argos</td>
<td>186</td>
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<td>Not Lower</td>
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<td>99.90%</td>
<td>99.90%</td>
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<td><strong>Fitness tracker</strong></td>
<td>Argos</td>
<td>131</td>
<td>1 (79.90%1)</td>
<td>Same Low Price as BF</td>
<td>99.99%</td>
<td>99.99%</td>
<td>99.99%</td>
</tr>
<tr>
<td><strong>Headphones</strong></td>
<td>Argos</td>
<td>128</td>
<td>1 (99.90%1)</td>
<td>Same Low Price as BF</td>
<td>99.99%</td>
<td>99.99%</td>
<td>99.99%</td>
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<tr>
<td><strong>Speaker</strong></td>
<td>Argos</td>
<td>48</td>
<td>0</td>
<td>Not Lower</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
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<tr>
<td><strong>Headphones</strong></td>
<td>Argos</td>
<td>58</td>
<td>0</td>
<td>Not Lower</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Fridge freezer</strong></td>
<td>Argos</td>
<td>117</td>
<td>1 (69.00%1)</td>
<td>Same Low Price as BF</td>
<td>99.99%</td>
<td>99.99%</td>
<td>99.99%</td>
</tr>
<tr>
<td><strong>TV</strong></td>
<td>Argos</td>
<td>117</td>
<td>1 (69.00%1)</td>
<td>Same Low Price as BF</td>
<td>99.99%</td>
<td>99.99%</td>
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<td>99.99%</td>
<td>99.99%</td>
<td>99.99%</td>
</tr>
<tr>
<td><strong>Vending machine</strong></td>
<td>Asda</td>
<td>79</td>
<td>6 (49.00%1)</td>
<td>Not Lower</td>
<td>329.99%</td>
<td>329.99%</td>
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<td>Argos</td>
<td>99</td>
<td>1 (100.00%1)</td>
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<td>100%</td>
</tr>
<tr>
<td><strong>Media streaming device</strong></td>
<td>Argos</td>
<td>44</td>
<td>0</td>
<td>Not Lower</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Washing machine</strong></td>
<td>Argos</td>
<td>79</td>
<td>1 (99.00%1)</td>
<td>Same Low Price as BF</td>
<td>99.99%</td>
<td>99.99%</td>
<td>99.99%</td>
</tr>
<tr>
<td><strong>TV</strong></td>
<td>Argos</td>
<td>79</td>
<td>6 (49.00%1)</td>
<td>Not Lower</td>
<td>329.99%</td>
<td>329.99%</td>
<td>329.99%</td>
</tr>
<tr>
<td><strong>Vacuum cleaner</strong></td>
<td>Argos</td>
<td>99</td>
<td>1 (100.00%1)</td>
<td>Same Low Price as BF</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Washing machine</strong></td>
<td>Argos</td>
<td>90</td>
<td>0</td>
<td>Not Lower</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
<tr>
<td><strong>Fridge freezer</strong></td>
<td>Asda</td>
<td>177</td>
<td>96 (99.90%1)</td>
<td>Same Low Price as BF</td>
<td>99.99%</td>
<td>99.99%</td>
<td>99.99%</td>
</tr>
<tr>
<td><strong>Coffee machine</strong></td>
<td>Asda</td>
<td>50</td>
<td>0</td>
<td>No Price Info</td>
<td>0%</td>
<td>0%</td>
<td>0%</td>
</tr>
</tbody>
</table>

**Notes:**
1. The percentages denote the proportion of days within the specified period where the condition was met.
2. BF stands for Black Friday, and the status (Lower, Same, Not Lower) indicates whether the price was lower, the same, or not lower, respectively, compared to the previous day.

*Source: KNIME in Action*
Conclusions

- Analytics have helped us provide very useful buying advice, uncover misleading selling practices and provide more product coverage in our reviews.

- All of this helps towards achieving our mission, by giving consumers the knowledge & advice they need to buy what’s right for them, at the best price.