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Deep learning for retail analytics and reference data management

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Nielsen measures what people...







Nielsen Reference Data: industry standard for analytics

What is Reference Data?

It's the glue that brings Nielsen's assets together, enabling internal and external data exchange.



Our Strategy:

- 1. Create Foundational Content, leveraging internal resources and partners
- 2. Build normalized layer of Analytic Ready content
- 3. Deploy **automation** to deliver faster and with quality
- 4. Enable content ecosystem and data exchange

Nielsen RD Layered Content







Why Deep Learning?







Machine & Deep Learning is extracting knowledge from data

- no need to know how to solve the problem to solve it
- works with all sort of data (text, images, signals and more)
- similar techniques viable across many problems and sectors

Why Deep Learning?





Deep Learning





Fully Trainable Model:

- End-to-end learning
- Self-generated high-level features
- Fine-tuned to your problem

What's on the package?





Things you may be interested in:

- Barcode
- Brand logo
- Nutritional facts
- Ingredients
- Size
- Recycling information
- Allergy advice
- Producer information

-



What's on the package?





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Problem:

Find the region containing the **ingredients** of the product images

Challenges:

- Reflections
- Bends
- Foil

- - -

- Close to impossible without understanding the text

<section-header><section-header>



- "An area with words that look like ingredients."
- "An area with some text starting with the word ingredients."



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Feature engineering:

- Heatmap of ingredients-like words
- Commas
- The word "Ingredients"



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DIRECTIONS FOR USE Gently massage the required amount onto the affected area twice daily until fully absorbed

CARE AND SAFETY ADVICE For external use only. Do not ingest. Do not use on broken skin. Avoid contact with the eyes. If contact occurs, rinse immediately with clean water. Discontinue use if irritation occurs. Bath may be slippery

nielsen_ingredients 1.000

NodEDURTS: Parafrum Loyaldm, Cyclopertasiloadm, CL9:5 Aby Cyclopertasiloadm, CL9:5 Aby Anygdalo, Dulos, Sweet Almond, Anygdalo, Dulos, Sweet Almond, Anygdalo, Dulos, Sweet Almond, Carpeters, Stagesweet Steed OI, Grupters, Sage Steeman, Old, Branca, Carpeters, Stagesweet Steed OI, Annua (Scantowski) Seed OI, BH, Busbold, Berby, Benntae, Clamina, Delay, Carpeters, Berby, Carpeters, Berby, Carpeters, Berby, Carpeters, Carpeters, Steel Carpeters, Steel Carpeters, Steel Carpeters, Steel Carpeters, Carpeters, Steel Carpeters, Ste



Feature engineering:

- Heatmap of ingredients-like words
- Commas
- The word "Ingredients"

Simple heuristics:

- A decent sized rectangular shape with many blobs inside
- A decent sized rectangular shape starting from the "ingredient blob"...



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nielsen ingredients 1.000

NetREDENTS: Paraffram: Equidation: Cyclopentaulosci (Sever Almond) Cyclopentaulosci (Sever Almond) Amygdala Dulcas (Sever Almond) Ol, Van Vinlera (Sever Almond) Teophysics (Sever Almond) Teophysic



We need to go deeper:

- Original image gives us a good feeling where the area is, but we may not be able to decide without reading the words



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nielsen ingredients 1.000

HOREDURTS: Parafinum Liquidatin, Cyclopentaliolane, ai, Aky Cyclopentaliolane, ai, Aky Cyclopentalion, and an Cyclopentalion, and Cyclopentalion, Cyclopentalion, Steven Almond Oci, Vito Viotea (Case) Steven Almond Oci, Vito Viotea (Case) Steven Almond Cyclopentalion, Steven Almond Cyclopentalion, Steven Almond Colorenty, Acatae, Helianthua Annua (Scothows) Seed Ol, BHT, Bioastolia, Hethyl Yannatak (Volamin Hethylapenood), Lionello, Lionello, Acatemen Nabilis, Canonina, Bhaver Acatemen Vitak, Casoline U



We need to go deeper:

- Original image gives us a good feeling where the area is, but we may not be able to decide without reading the words
- Heatmaps give us the way to understand the content, but they ignore the visual information



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DIRECTIONS FOR USE Gently massage the required amount onto the affected area twice daily until fully absorbed

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nielsen_ingredients 1.000

NOREDURTS: Prantifican Laquidatis, Cyclopherataloxiano, B-b. Adayi Benzatak: supproto (Myntatak, Prusov Angladian Duzia), Soverk Manipoli Caytom Soa (Soykean) (Al, Ibancia Campedian, Duzia, Soverk Manipoli Gycom Soa (Soykean) (Al, Ibancia Campedia), Suberatak (Volumatian Annuas (Sunthown) Seed OJ, Bert, Basholan, Hintory Preseda (Volumatian Rower Extract, Linatol, Common, Campon, Bachytherm, Michael Antherns, Nathis (Campening), Fower OL, Layandda Angusthia (Ol, Layandda Angusthia)



We need to go deeper:

- Original image gives us a good feeling where the area is, but we may not be able to decide without reading the words
- Heatmaps give us the way to understand the content, but they ignore the visual information
- But it's easy to have both with deep learning!



ielcen



twice daily until fully absorbed. CARE AND SAFETY ADVICE For external use only. Do not ingest. Do not use on broken skin. Avoid contact with the eyes. If contact occurs, rinse immediately with clean water. Discontinue use if irritation

occurs. Bath may be slippery after use. Store in a cool place nielsen_ingredients 1,000

> NOREDURTS: Parafrum: Logiadam Cyclorebinetacione, Chis Aday Ecclorebinetaciones, Chis Aday Benchate, Lispothol (Myntabla, Prusus Aday), Chis va Adara, Chis Shari, China China and Chis Shari, Chis Shari, China China and China Shari, China Aday Annua (Sunthours) Seed CA, Bert, Basholon Retroy, Brenator (Xiana Roberto, Bashydan (Shari), China Roberto, Bashydan (Shari), China Roberto, Bashydan (Shari), Shari Anthens Nobile (Camorine) Foreer Chis Lavanda Adaytathia Roberto, Lavanda (Camorine) Foreer Chis Shari (Camorine) Foreer Chis Shar



Faster RCNN:

- State of the art object detection network
- Region Proposal Network: "where to look"
- Detector Network:
 - "what do I see"
- Both networks use the same feature maps
- Based on VGG-16



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Final solution in a nutshell:

- Use original image input
- Add text-based additional features as images on different channels
- Run Faster RCNN

Outcome:

- Over 90% accuracy



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Some examples





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nielsen ingredients detections



Nourished care shampoo Directions for use nielsen ingredients I ur Ingredients: Aqua, Sodium Lave opyl Betaine Chur

> one Quaternium-22, Panthe astanum Seed Extract, Pr Itate, Inositol, Calcium P BOTTLE - PLASTIC widely recycled CAP - PLASTIC check local recycling

Produced in the UK for www.sainsburys.co.uk BAM Creating

TILL THE WELLER'S

nielsen ingredients detections

Some examples





nielsen ingredients detections



nielsen ingredients detections



Some examples





nielsen ingredients detections elsen_ingredients 0.994 oml

soft Drink nielsen ingredients 0.999 - Boos El INGREDIENTS Carbonated Water, Sugar, Acid (Citric Acid), Stabilisers (Gum Arabic Quillaia Extract), Preservative (Sodium Benzoate), Playourings UTRITION INFORMATION Typical values per 100ml Store in a cool, dry place out of direct sunlight. 260kJ/61kcal Energy Produced in the UK by of which saturates Cott Beverages Ltd, Carbohydrate Kegworth, DE74 2FJ, UK of which sugars www.oldjamaicagingerbeer.com Protein <0.10 www.facebook.com/OldJamaica Salt Best Before End: See Base Of Can SERVE COOL CAN SH120503

nielsen ingredients detections

deepsense.ai



- A data-analytics brand by CodiLime ranked 2nd in Deloitte CE 2016 Technology Fast 50 list
- 200 people on board in two locations Poland and California
 - > 120 Software Engineers, > 40 Data Scientists and growing
 - Winners at Kaggle & various algorithmic competitions
- Providing machine and **deep learning** solutions and consultancy
- Working with market leaders, such as:







Thank you for your attention