Deep learning for retail analytics and reference data management

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Nielsen Scope

Nielsen measures what people...

100+ countries

40,000+ employees

10M+ active products

Nielsen Reference Data

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

Layered Reference Data

Market Behavior Dynamic Chars	• Dynamic Characteristics based on market place data • e.g. On-Line only, Purchasing Demographic based
Client Maintained Characteristics	• Characteristics are fully created, coded and maintained by Client
Innovation	• Characteristics are managed and maintained by Nielsen • Dynamically maintained from Analytical Ready and Foundational Characteristics
Health & Wellness	• Characteristics are managed and Maintained by Nielsen or Nielsen Partners • Utilize Analytical Ready and Foundational Characteristics • Can cover H&W, Sustainability, Ethical Sourcing, etc.
Client Ready Content	• Characteristics are created by mapping rules by Nielsen following Client Definition • Utilize Analytical Ready • May include Client Custom views of H&W, Innovation, Analytical Ready, etc.
Analytical Ready	• Universal and Category relevant Characteristics identified and designed by Nielsen • Harmonized, dictionary based, values consistent & ready for use
Foundational Characteristics	• All pack specific information included, i.e. Ingredients, nutrition panel, claim • Pack in Hand/Picture based coding required • Unstructured and not dictionary managed

Why Deep Learning?

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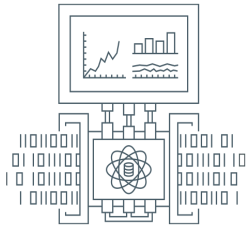
BIG DATA SCIENCE



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

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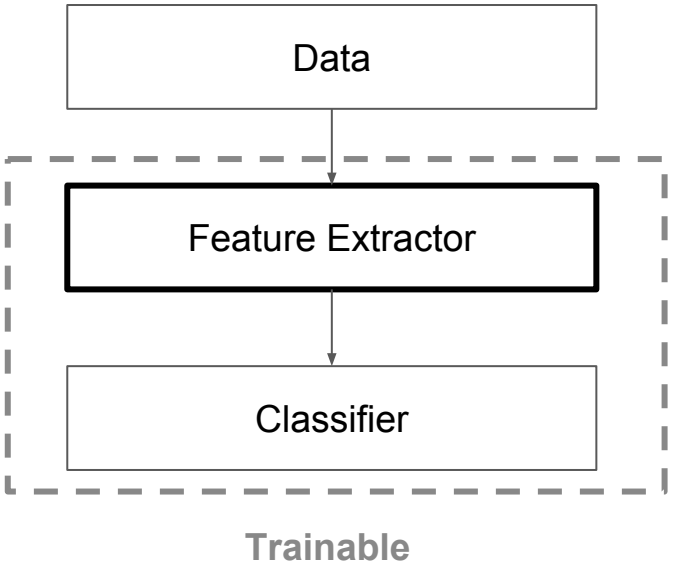
Deep Learning



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
- ....

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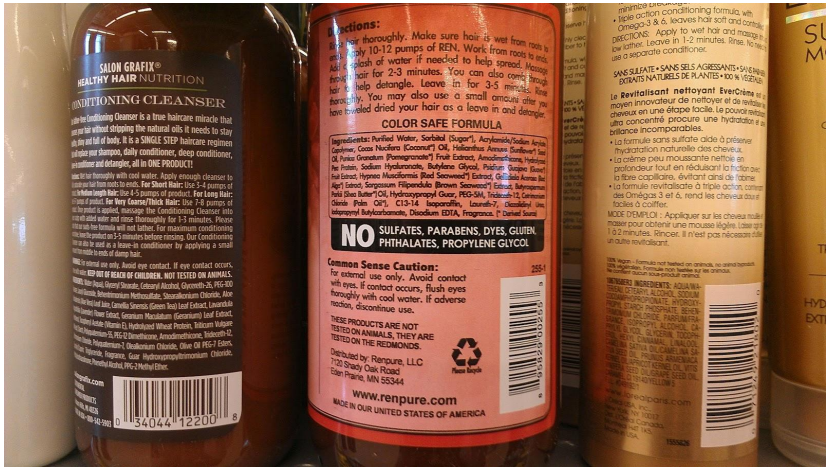
Case Study: Ingredients

Problem:

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

Challenges:

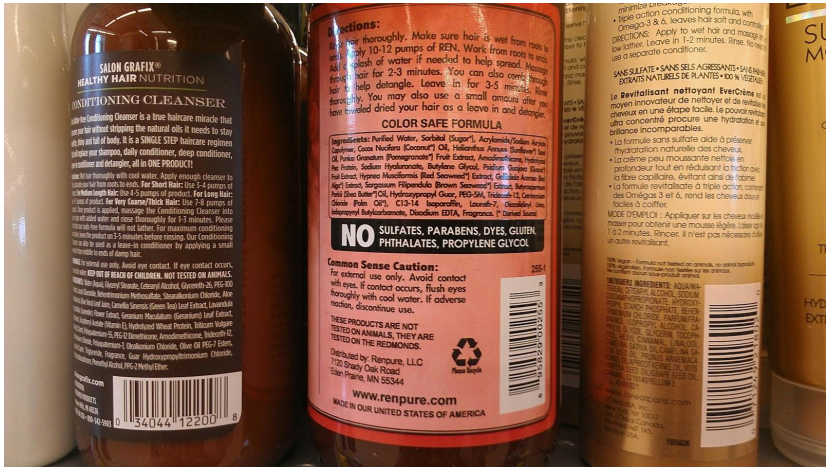
- Reflections
- Bends
- Foil
- Close to impossible without understanding the text
- ...



Case Study: Ingredients

How would a human being do this?

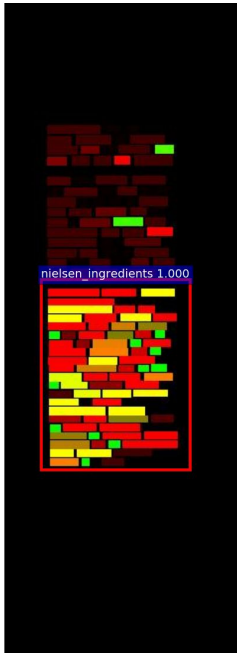
- “An area with words that look like ingredients.”
- “An area with some text starting with the word ingredients.”

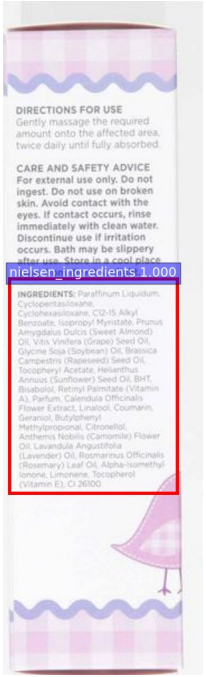


Case Study: Ingredients

Feature engineering:

- Heatmap of ingredients-like words
- Commas
- The word “Ingredients”





Case Study: Ingredients

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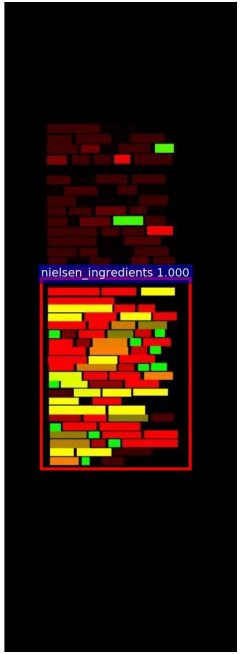
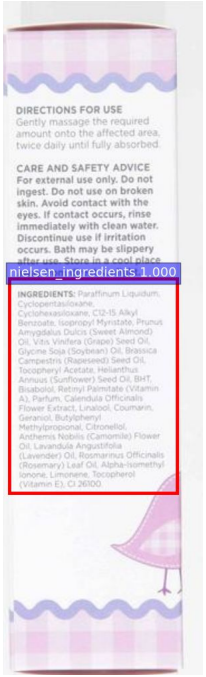
Simple heuristics:

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

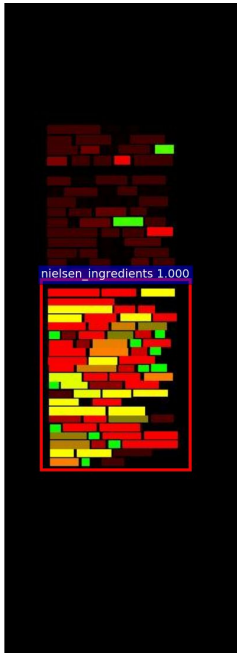


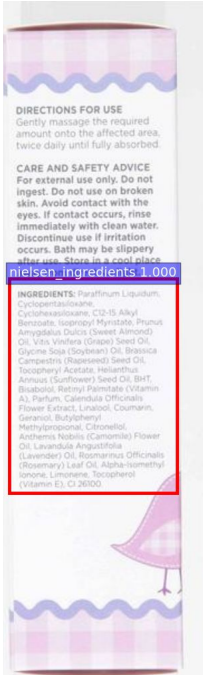


Case Study: Ingredients

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





Case Study: Ingredients

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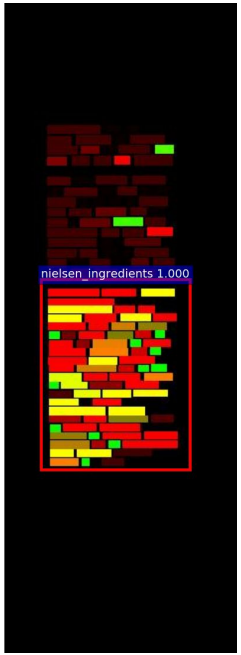
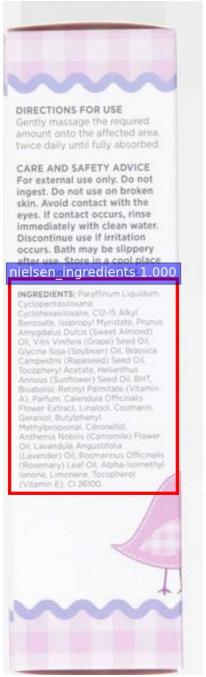
- Heatmaps give us the way to understand the content, but they ignore the visual information





Case Study: Ingredients

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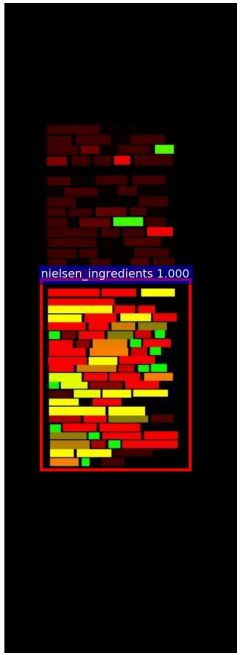
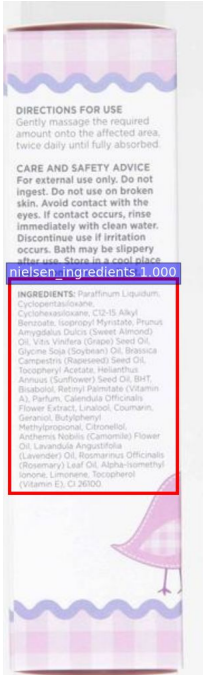
- But it’s easy to have both with deep learning!

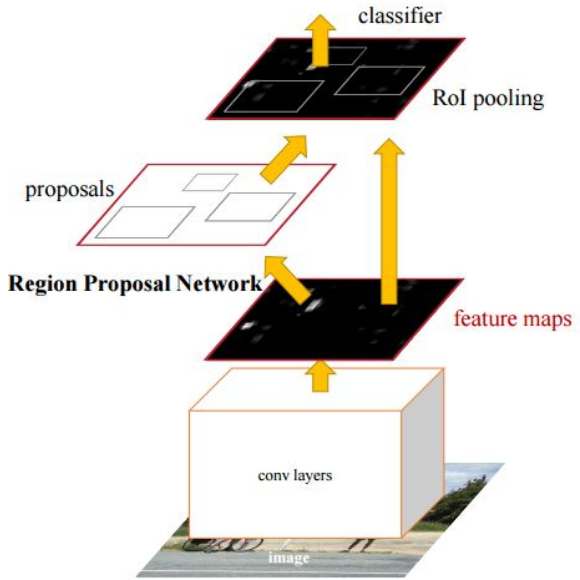




Case Study: Ingredients

Faster RCNN:

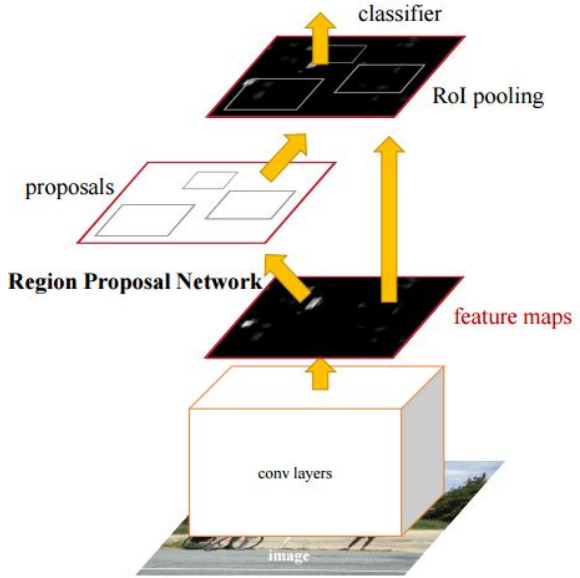
- State of the art object detection network
- Region Proposal Network:
  “where to look”
- Detector Network:
  “what do I see”
- Both networks use the same feature maps
- Based on VGG-16



Case Study: Ingredients

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

Some examples

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nielsen_ingredients detections

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- 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:

BCG IBM intel JUNIPER NETWORKS EY

NTT docomo nielsen NTT Group NVIDIA L'ORÉAL PARIS

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Thank you for your attention