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Deep Learning @WalmartLabs

Alessandro Magnani
@WalmartLabs, Walmart Global eCommerce
California, USA

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Outline

- @WalmartLabs overview
- Deep Learning @WalmartLabs
  - Product visual search
  - Product recommendation
  - Spell correction and query interpretation
- Deeper technical dive:
  - Product Matching
    - Challenges and insight
  - Product Classification
    - Challenges and insight
- Questions?

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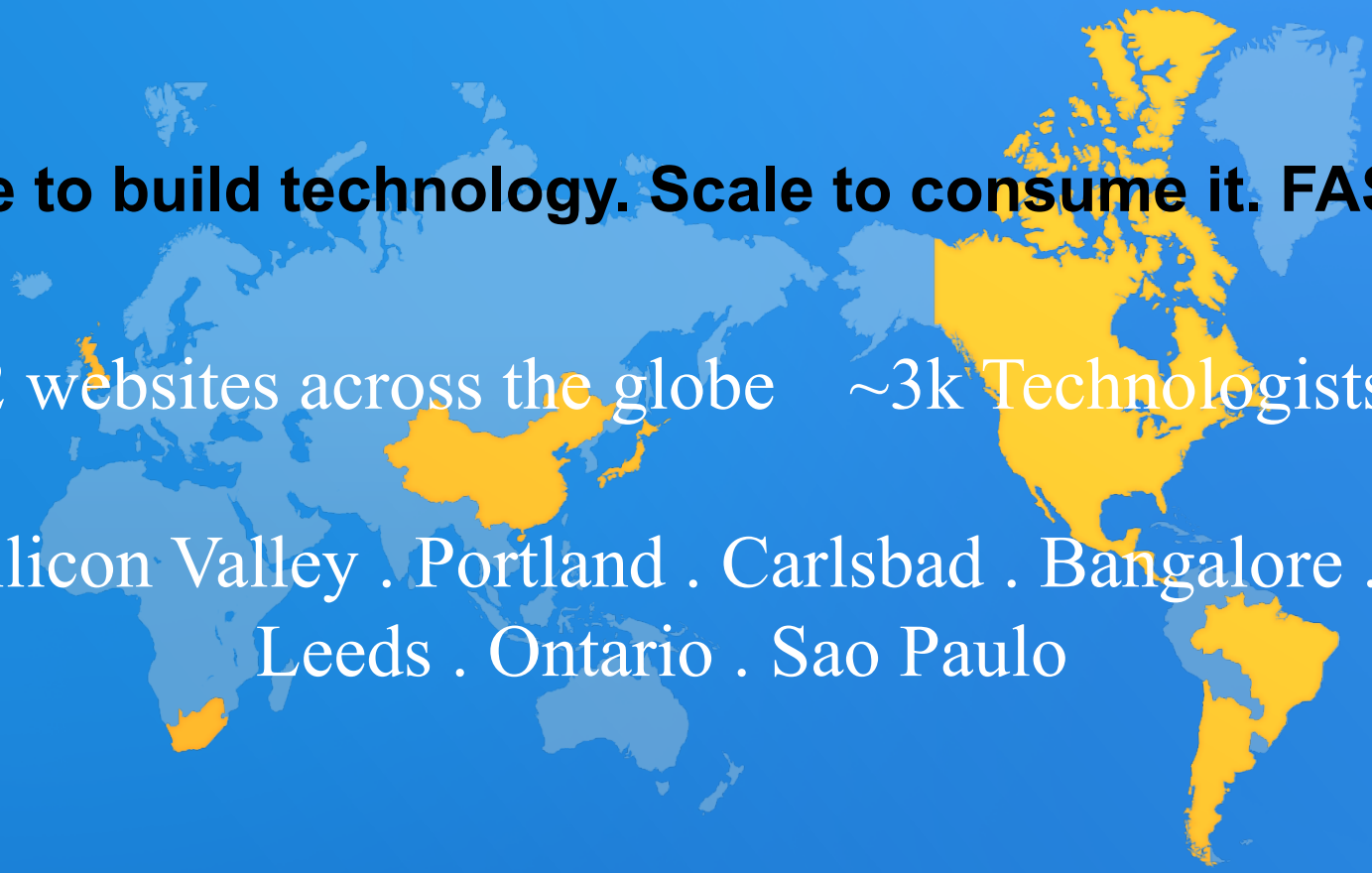
Scale to build technology. Scale to consume it. FAST.



12 websites across the globe ~3k Technologists

Silicon Valley . Portland . Carlsbad . Bangalore .
Leeds . Ontario . Sao Paulo

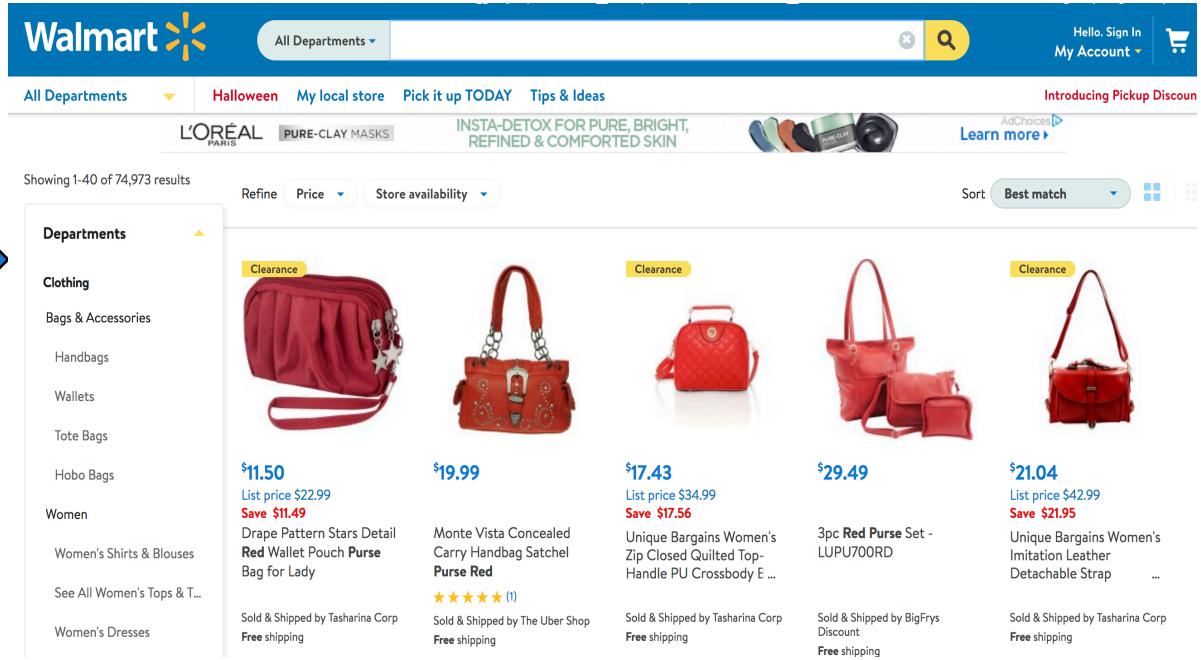
Data @WalmartLabs

- User interaction with website and apps
  - Search queries
  - Product views, clicks, purchases, …
- Product catalog (millions of products)
  - Title, descriptions
  - Product attributes
  - Images, videos
  - User Reviews
  - Prices
  - Curated product tags

ML and Deep Learning @WalmartLabs

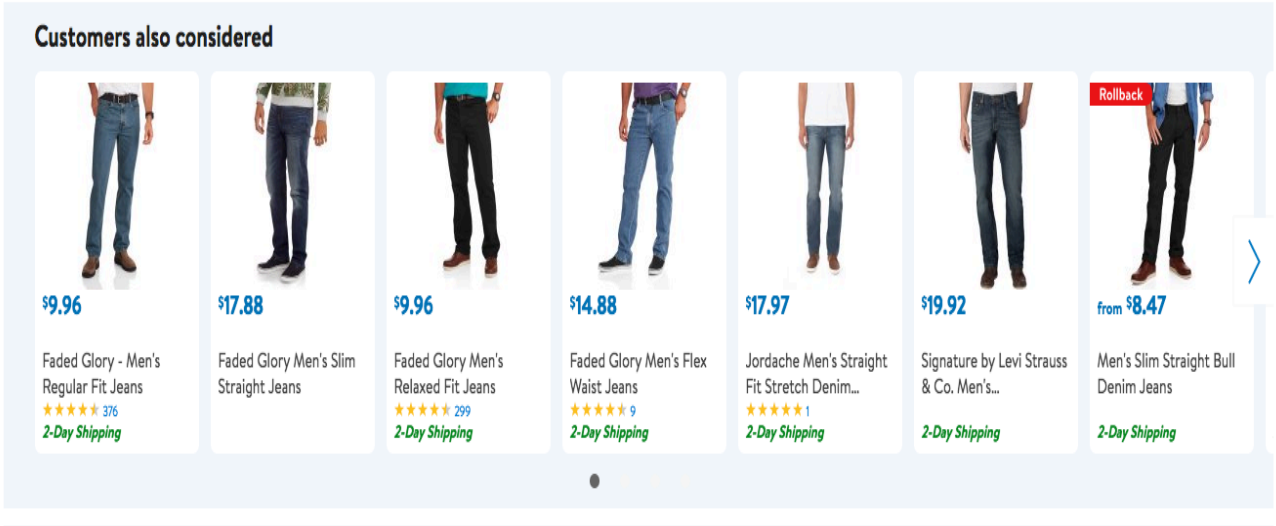
- ML and deep learning used extensively both in stores and online
- Many teams from product ingestion to last mile delivery use ML
- Multiple teams have embedded data scientists
- This presentation doesn't cover everything ML

Visual Search @WalmartLabs



- Working on a **new user experience** for shoppers
- Extract attributes style, brand, material, from user taken images
- Retrieve **visually "similar"** results
- Deep learning at the core of this new experience
- Using: CNN, GAN networks

Product recommendation @WalmartLabs



- Products recommended based on user history
- Each product can be abstracted using an embedding (Word2Vec)
- Can suggest products that don't have a "big" history
- Can use image similarities (CNN embedding)

Query interpretation and Spell correction @WalmartLabs

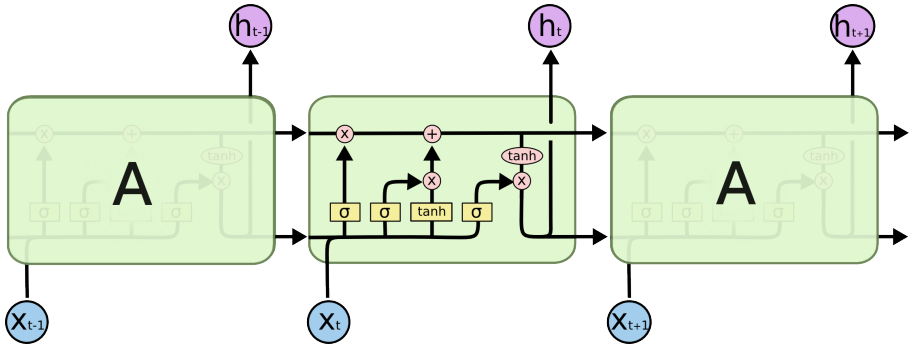
Black and decker coffee maker under 50$

Brand

Item

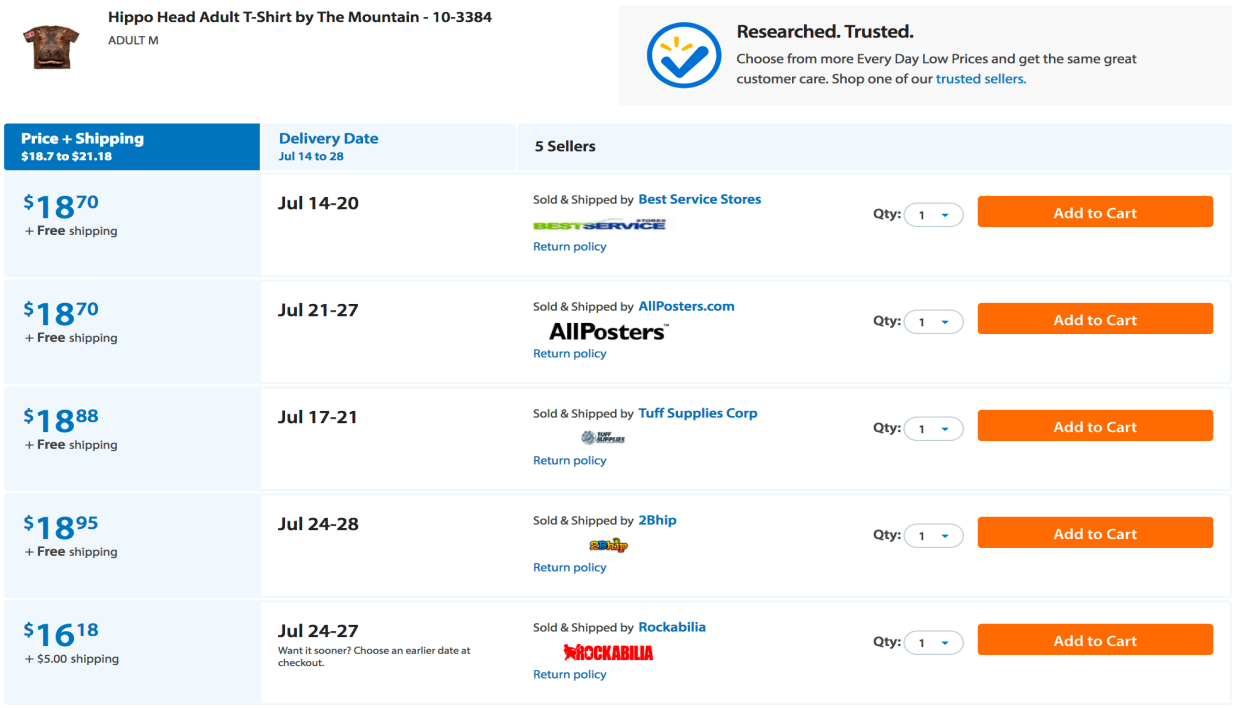
Price

- Understand the user intent
- Suggest query refinement
- Corrects user misspelling
- Using: Language model for user queries (RNN models)



Product Matching @WalmartLabs

- Walmart sells same product from multiple vendors
- Products have to be matched
- Errors can be costly and have big impact on user satisfaction



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Product Matching @WalmartLabs

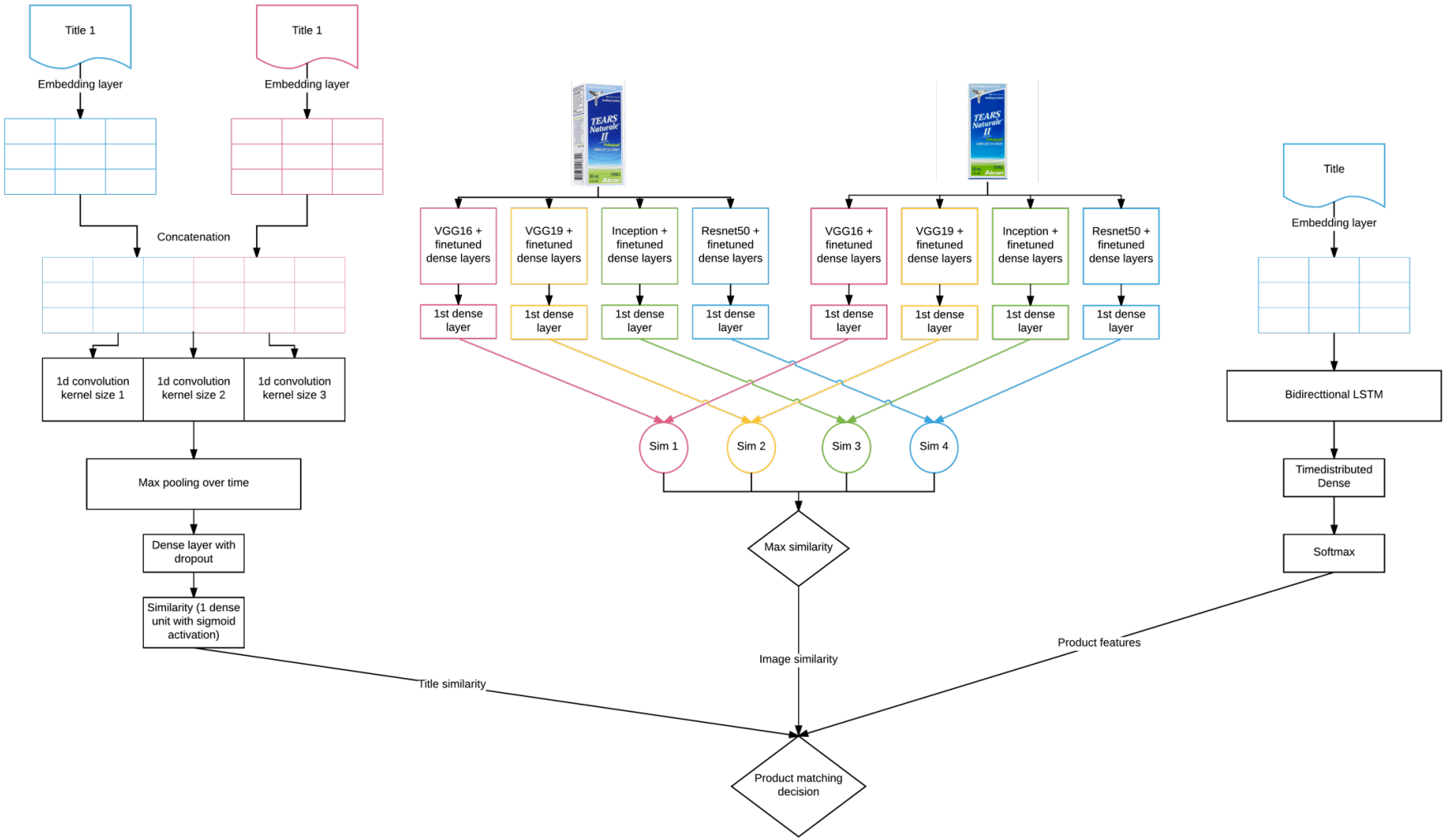
Challenges

- Unique identifiers (UPC, gtin, …) **don't always work**
- Titles/images can be different
- Price can have large differences for matching products
- Product attribute are missing/wrong

Approach

- Use all available signals (Title, Image, price, …)
- Extract attributes if not available to compare products
- CNN embedding used for image comparison
- Word embedding + CNN for title comparison
- CNN for attribute extraction

Product Matching @WalmartLabs



Insights

- Matching is a hard problem
  - Unique Ids don’t completely solve the problem
- An error can be very costly
- A solution requires careful evaluation of all the data sources

Product classification @WalmartLabs

Goal: given product (title, image) find product category

- Walmart has multiple taxonomies
  - For product placement on website
  - For internal reporting
- Each taxonomy has **thousands** of categories

Title: Top Headwear
Safari Explorer Bucket Hat

extract

- "Hat" in Taxonomy_1
- "Explorer Hat": Taxonomy_2
- …

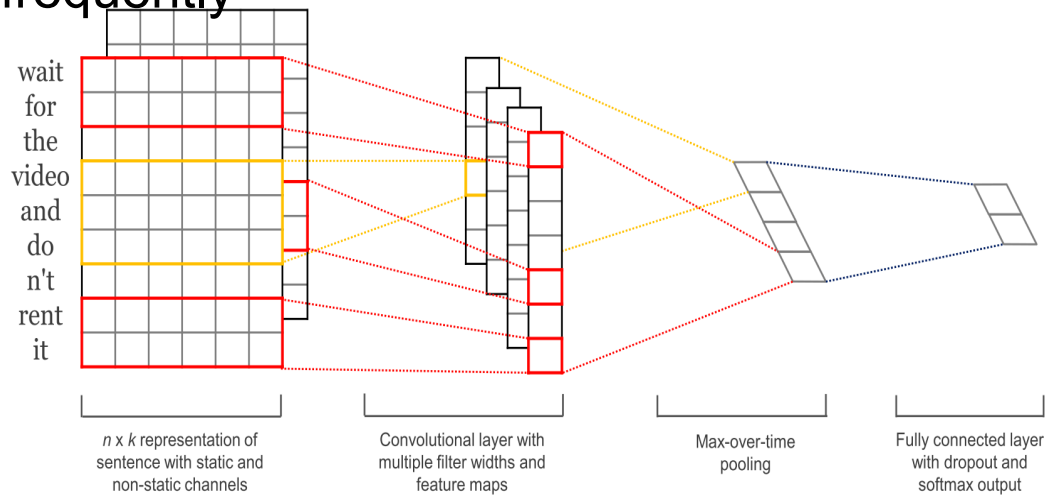
Product classification @WalmartLabs

Challenges:

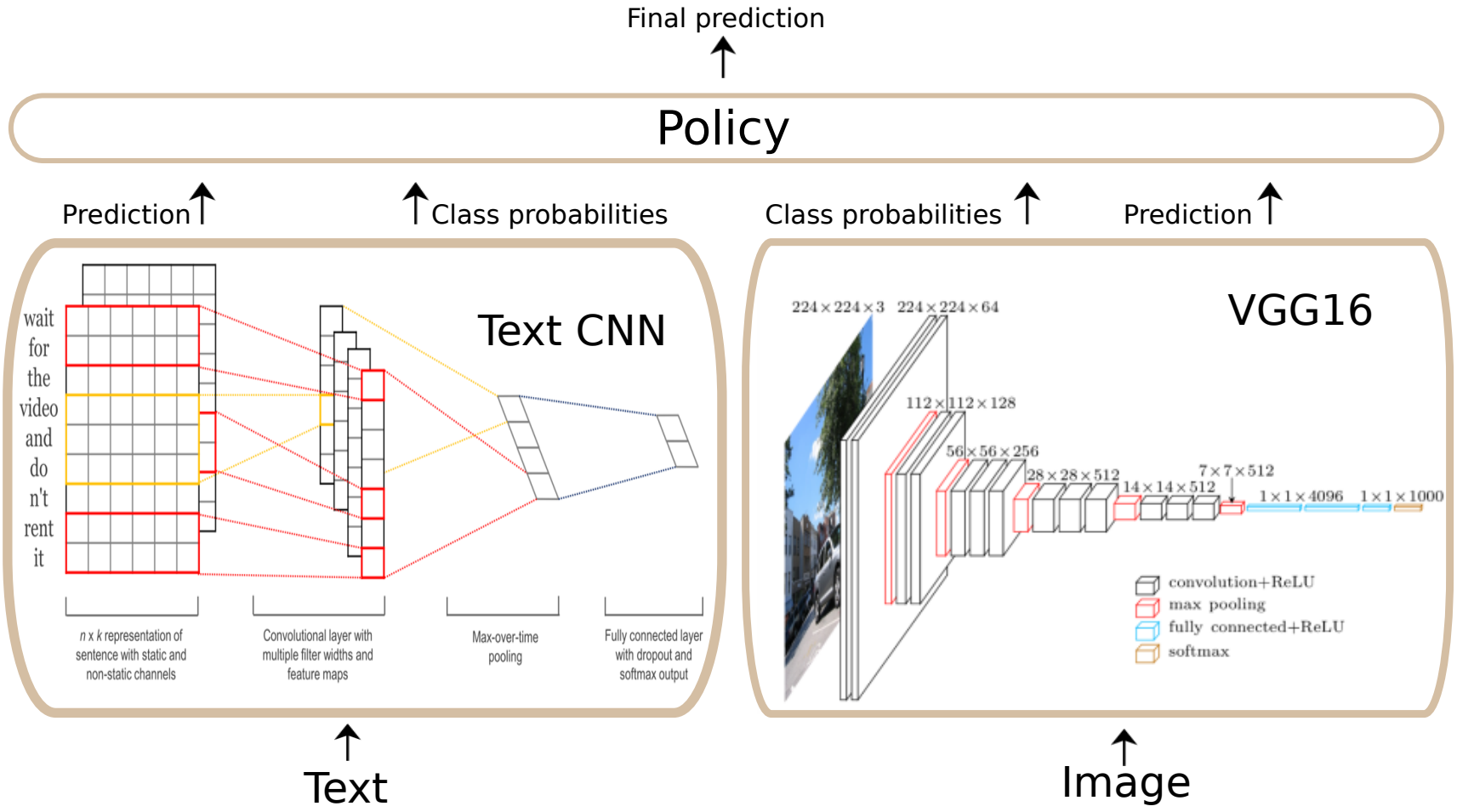
- Manual classification is too expensive
- Data can be noisy
- Large number of categories
- Manual classification requires domain knowledge
  - Hard to know the entire taxonomy
  - Crowd can produce noisy data
  - Categories created internally can also be noisy
- Taxonomies can change frequently

Approach for text:

- Word embedding
- CNN (shallow)



Product Classification @WalmartLabs



- Leverage all data from products (image, text, …)
- Research paper currently under review: “Is a picture worth a thousand words?”

Insights:

- Accuracy is not always the “best” metric
  - Not all errors are the same
  - Classes are not equally important
- Title is the most important signal
- Improving classification accuracy with image is hard
- Data quality is a challenge
  - Change in taxonomy makes this harder
- Leveraging crowd requires careful design of tasks
  - Vetting of people knowledge of space

Much More Deep Learning @WalmartLabs

- Attribute extraction from product images
- Product image recognition scan-less checkout
- Detecting “offending” images
- Detecting other image problems
- Automate recognition of inbound cases in distribution centers

We are hiring!

Any question?