machine learning conference

Identifying Miscategorized Products

M. Hidayath Ansari hidayata@
Applied Scientist II | Browse

Subhadeep Chakraborty sdeep@
Sr SDE | Browse

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Customer Experience – Shopping Funnel

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Humidifier
Sleeves

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Sleeves

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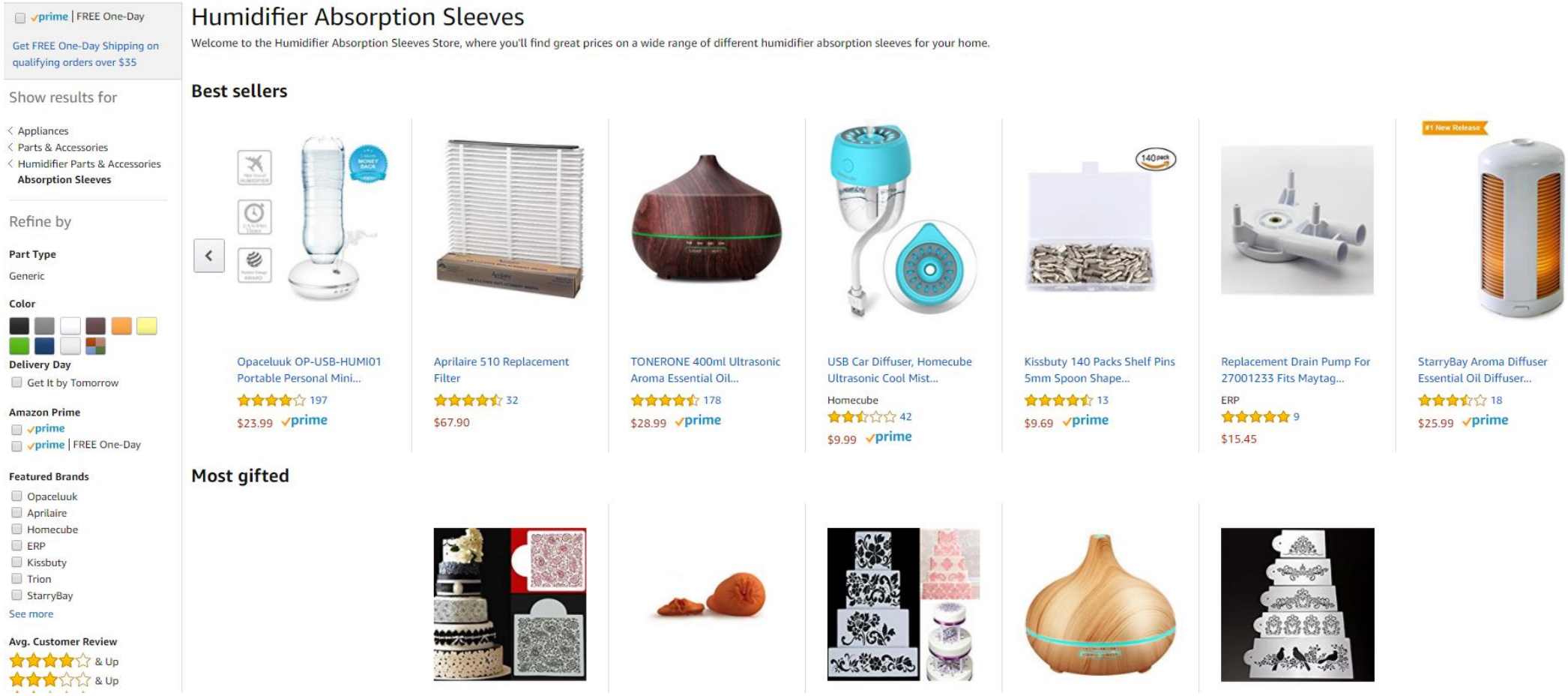
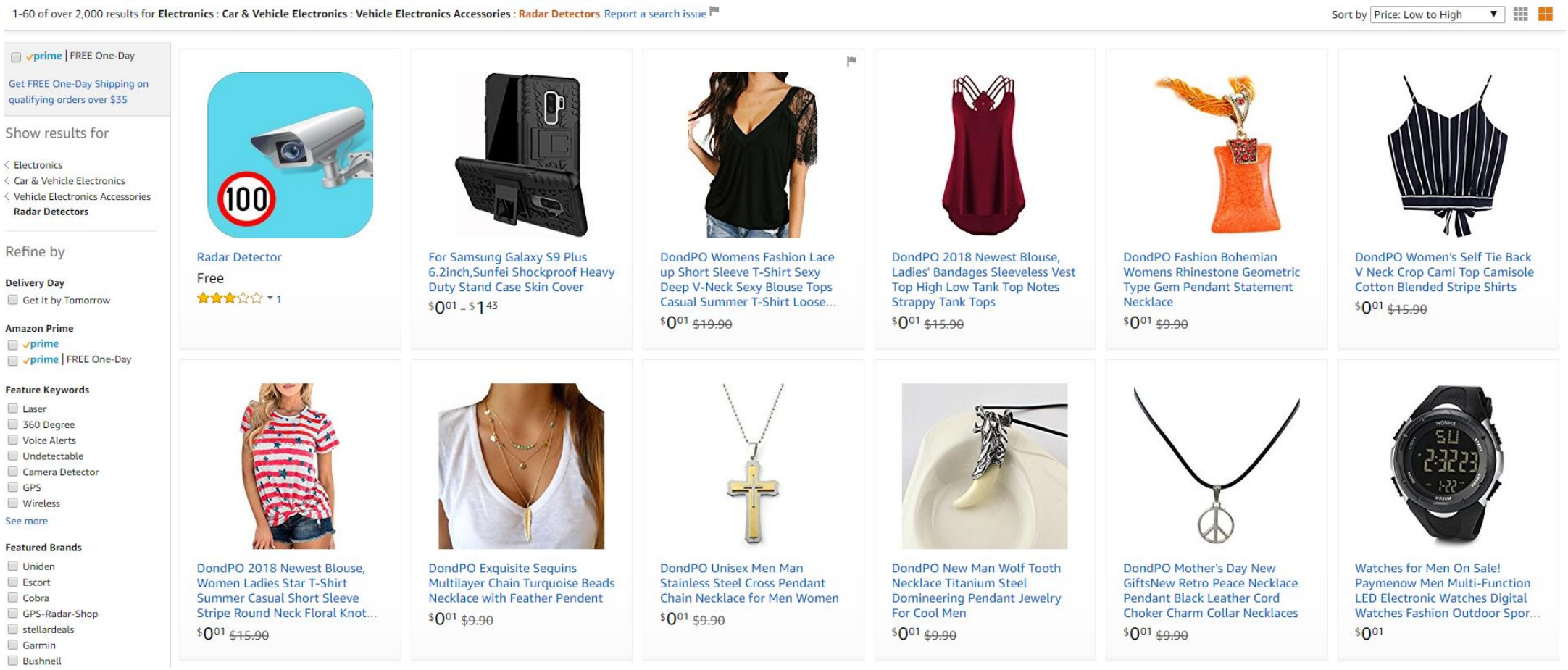
Humidifier
Sleeves

Customer Experience – Category Landing Page



Customer Experience: Sort by Price



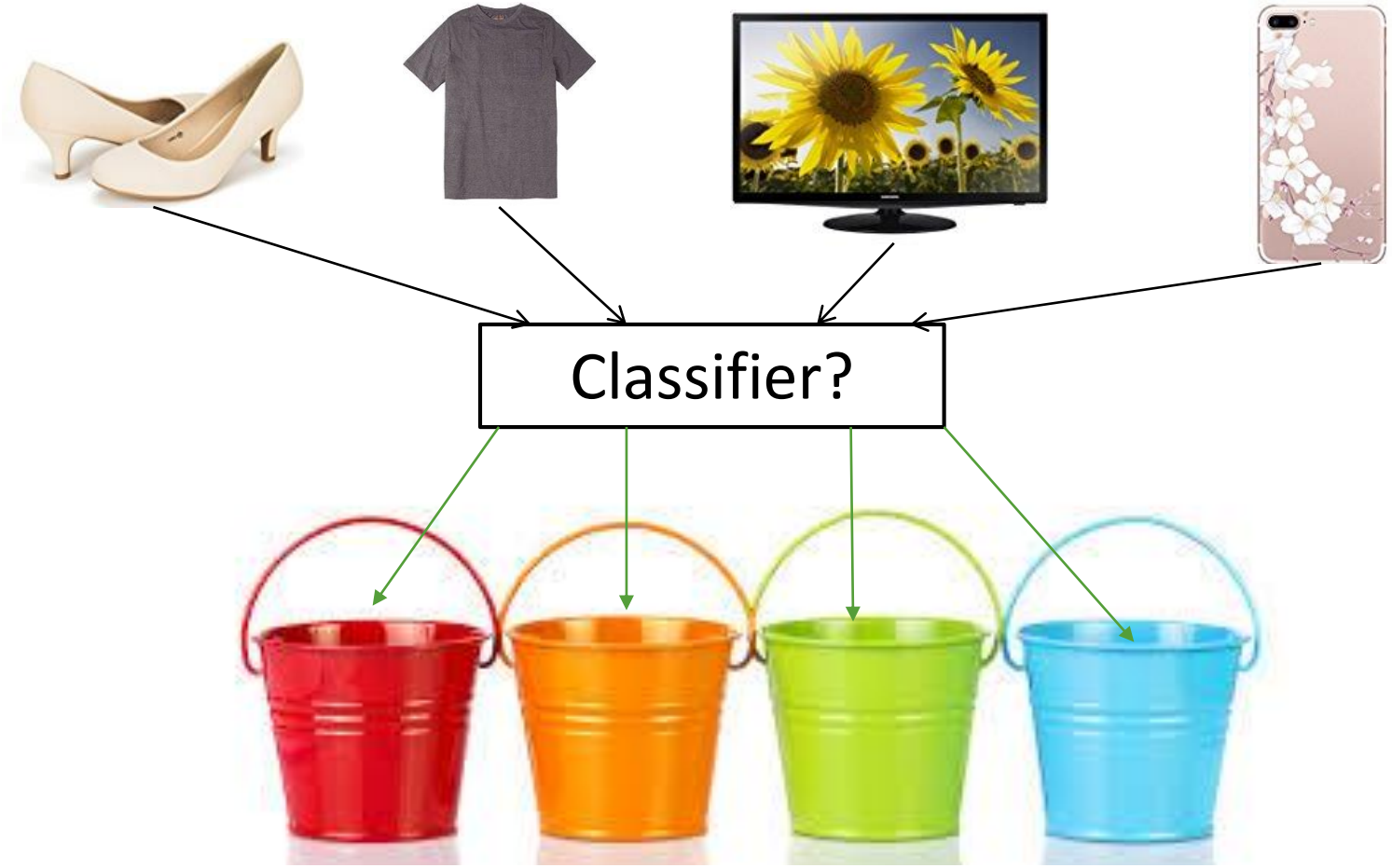
"Radar Detectors"

Product Discovery

Amazon Browse: Enabling customers' discovery experience

Without having to weed through irrelevant products

Finding Product Miscategorizations



BUT …

Product Miscategorizations as Outliers

Product Miscategorizations as Outliers

“Which of these doesn’t belong?”

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Product Miscategorizations as Outliers

"Which of these doesn't belong?"

Product Miscategorizations as Outliers

"Which of these doesn't belong?"



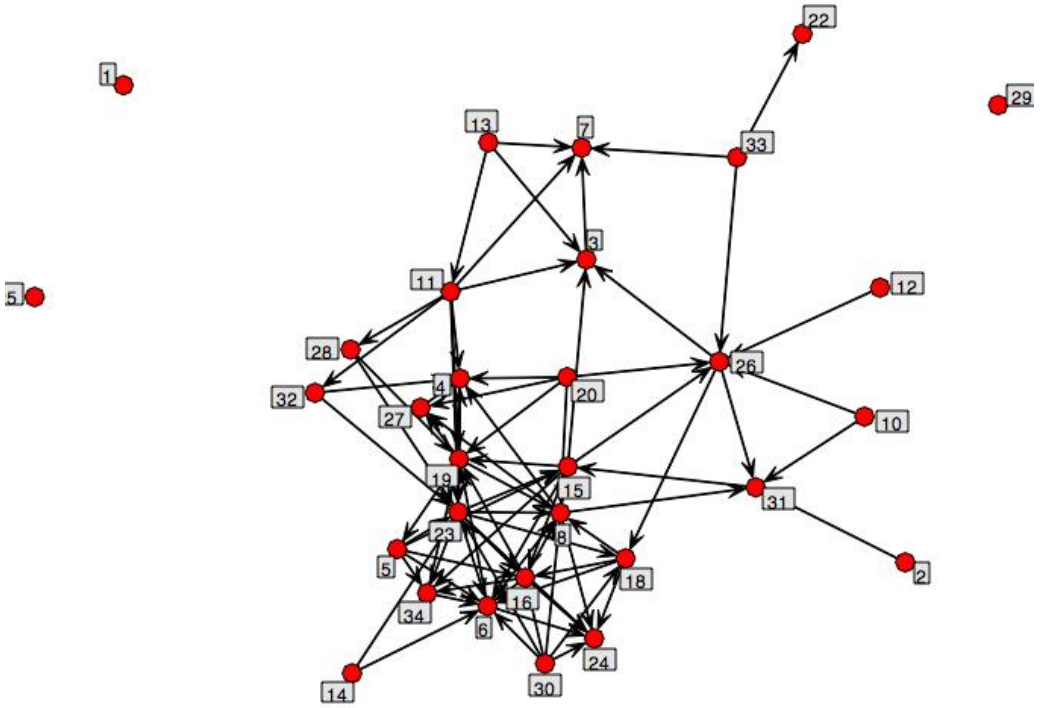




Unsupervised/Lightly supervised methods

PageRank

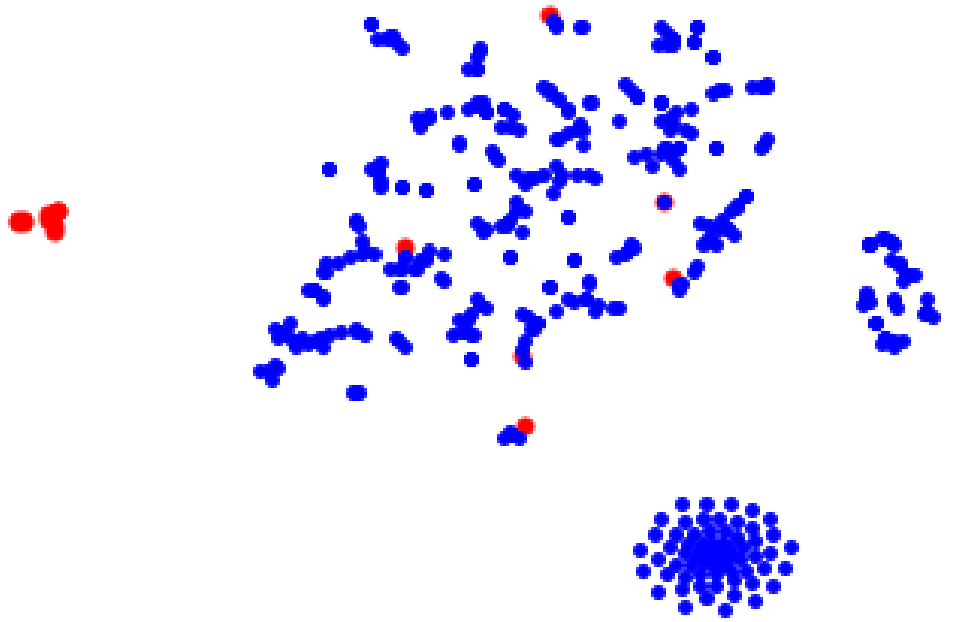
- Finds the most “central”/”important nodes
- Conversely …



Outrank – Example with ASINs

Dishwashers (dimensionally reduced)

Outrank – Example with ASINs



Dishwashers (dimensionally reduced)

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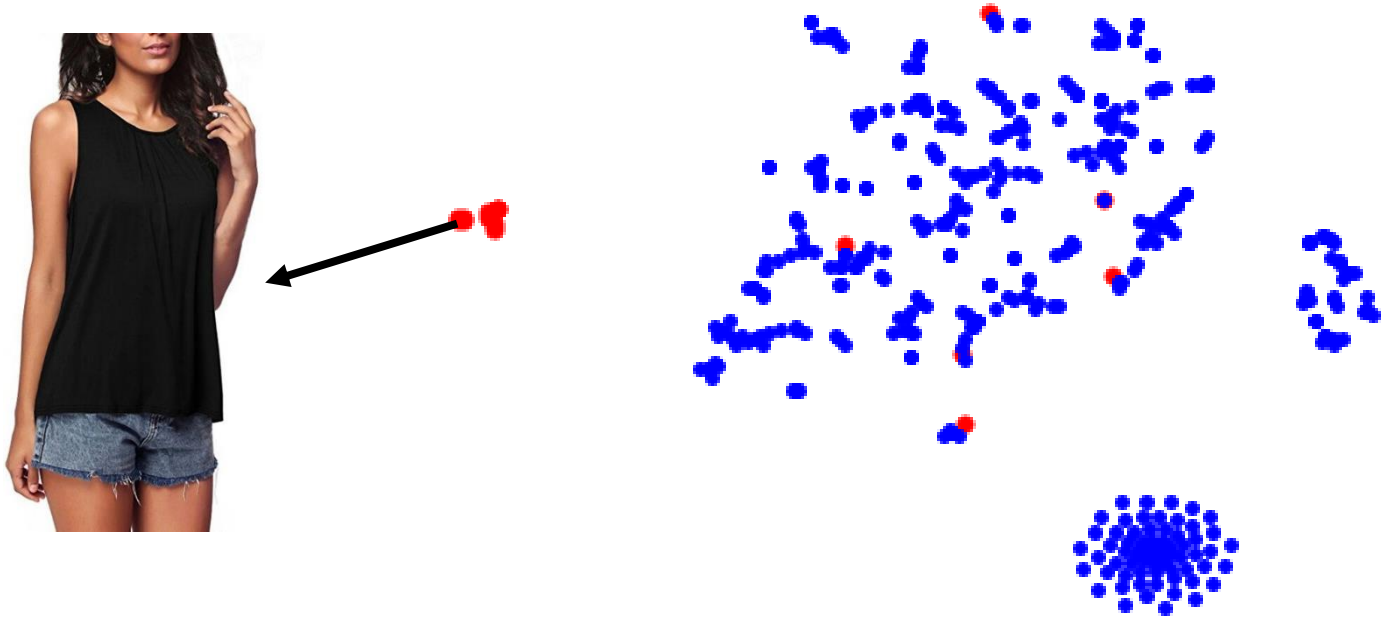
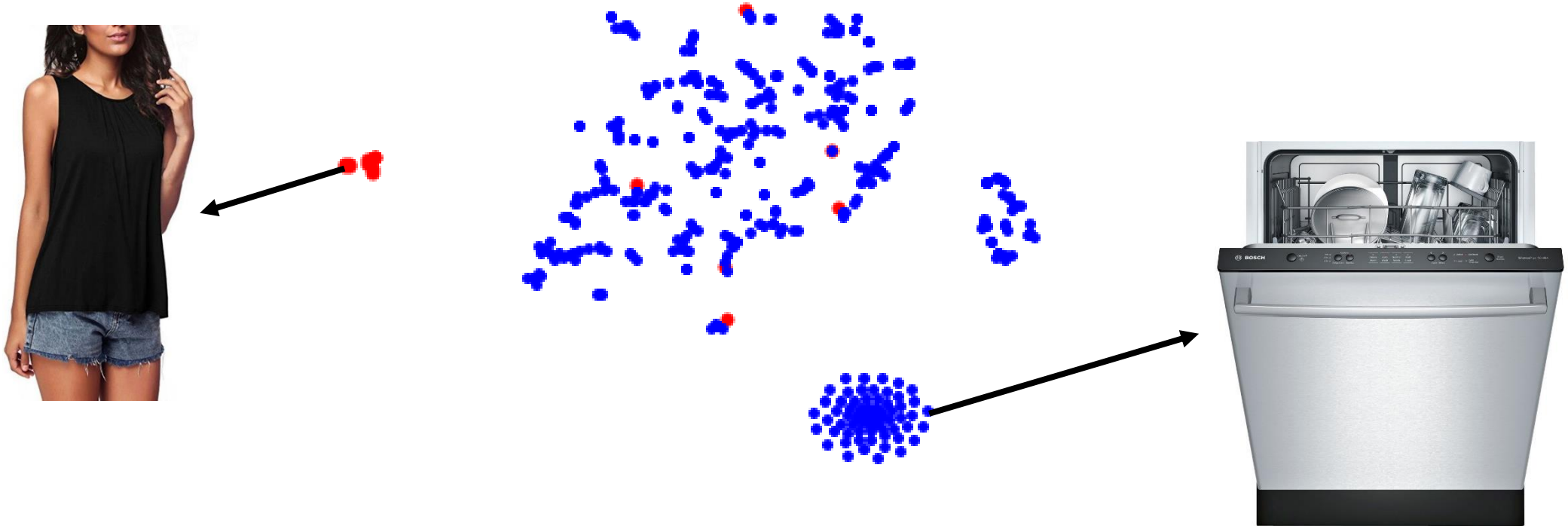


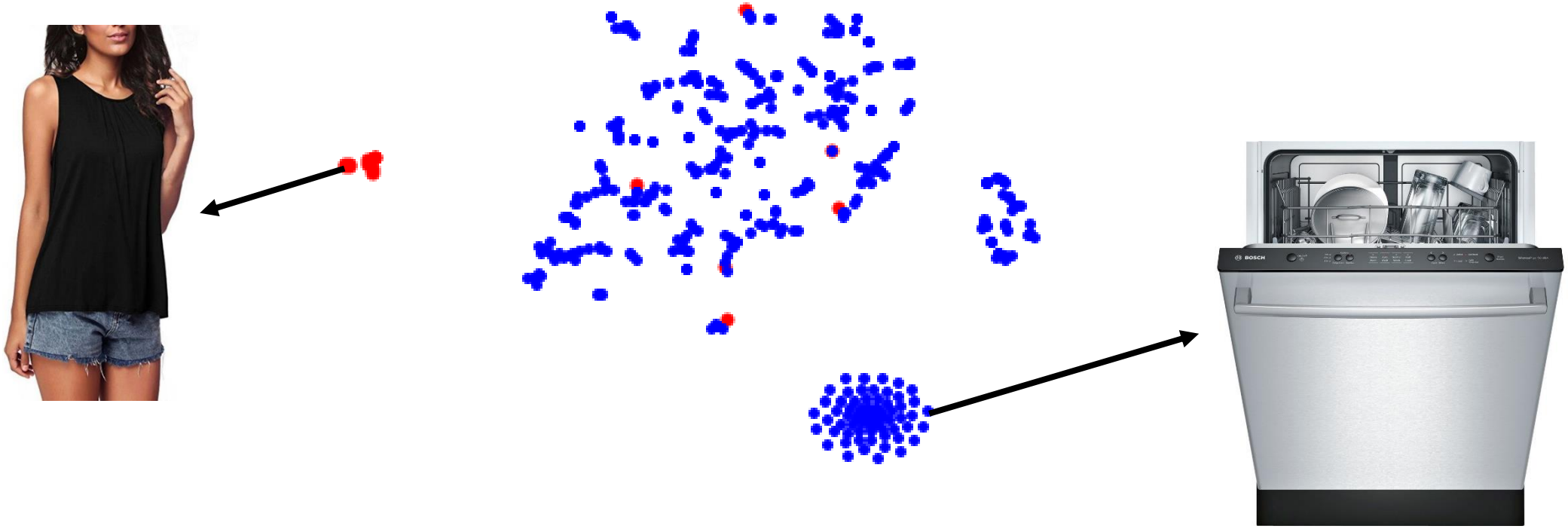
Dishwashers (dimensionally reduced)

Outrank – Example with ASINs



Dishwashers (dimensionally reduced)

Outrank – Example with ASINs



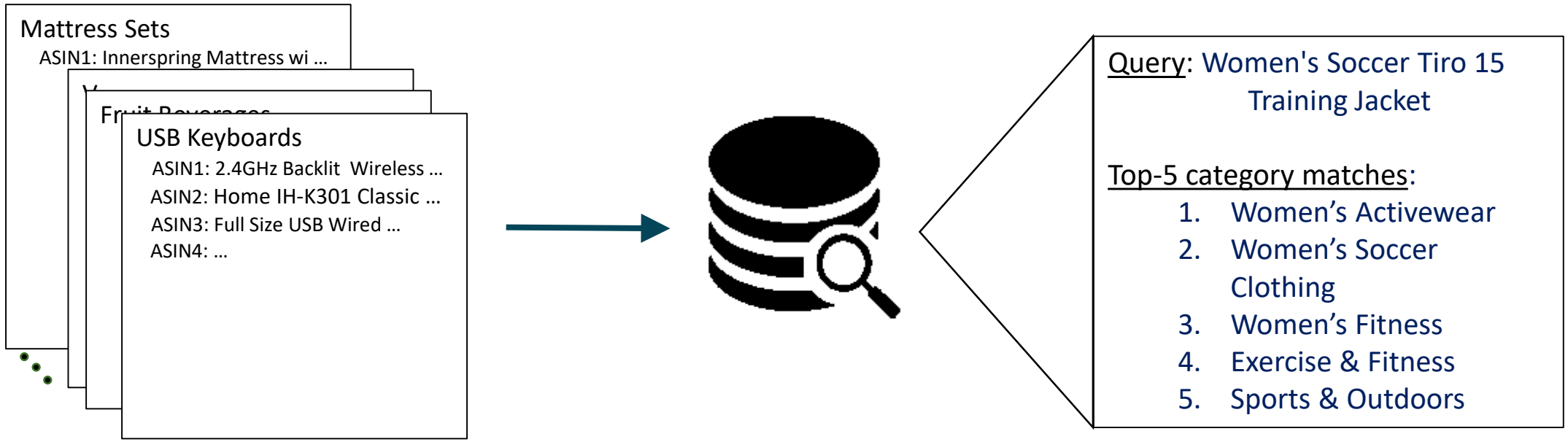
Still, Outrank has a high false positive rate

Dishwashers (dimensionally reduced)

Moonesinghe, H. D. K., and Pang-Ning Tan. "Outrank: a graph-based outlier detection framework using random walk." *International Journal on Artificial Intelligence Tools* 17.01 (2008): 19-36.

Miscategorizations – Using Search

Idea: Use a search index for product categories to find miscategorized products



Singular outliers – Results & Impact

Marketplace	Assignments removed	Audited miscat Precision	Irrelevancy Reduction	OPS impact through irrelevancy reduction
US	2,319,105	91.8%	24% → 9%	$15,925,972
UK	2,168,596	97.2%	20% → 14%	$4,886,300

Results for bestseller ASINs

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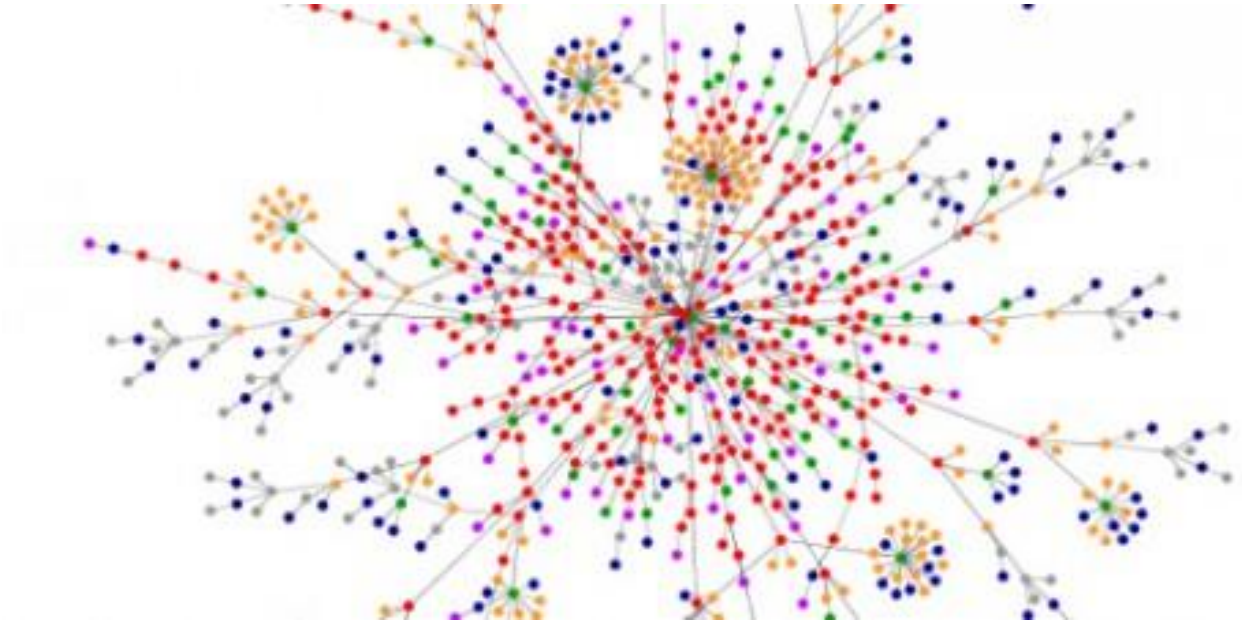
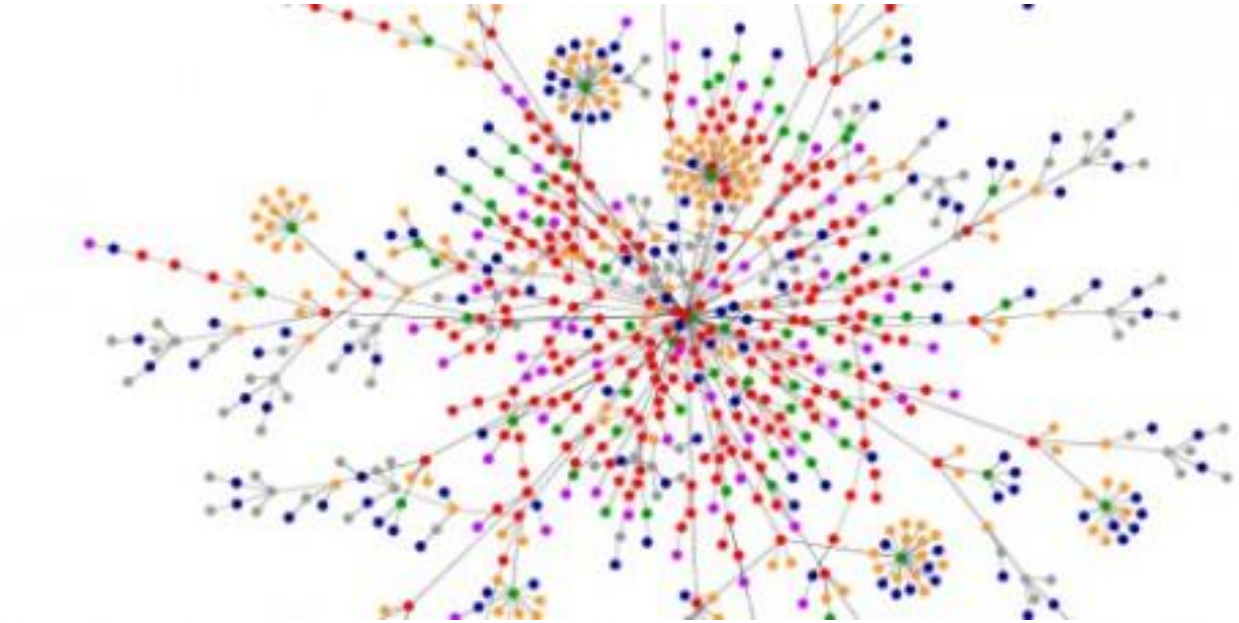
Clump outliers – Using expert input



Clump outliers – Using expert input

1. Select “exemplars”
2. Get judgments
3. Propagate judgments



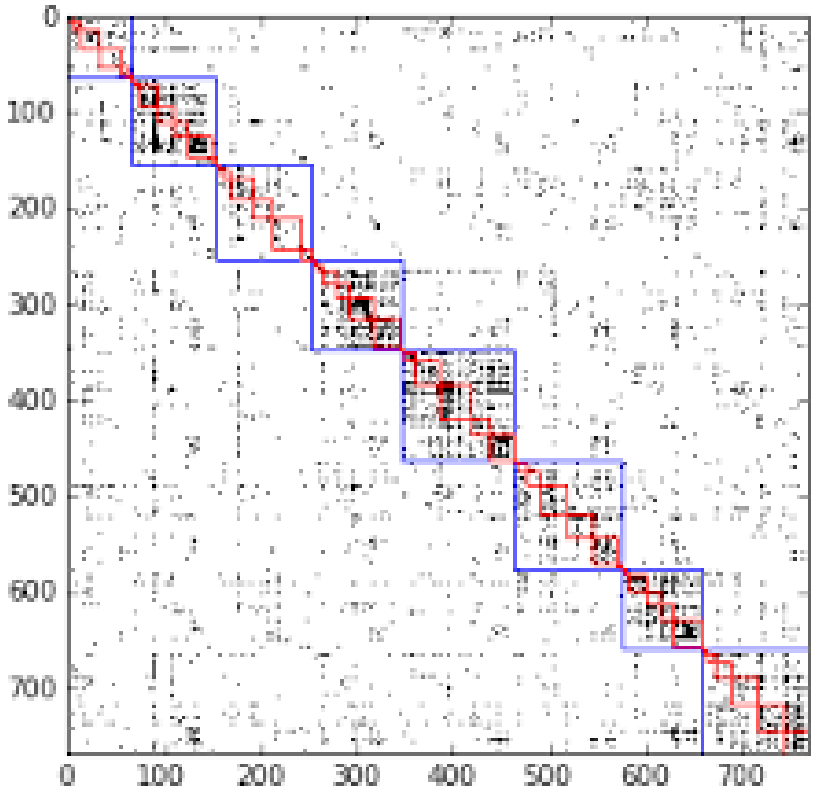
Clump outliers – Affinity Matrix

Constructing a graph adjacency/ASIN affinity matrix:

1. Vectorize ASINs using averaged GloVe
2. Find the 250 nearest neighbors of each ASIN
3. Construct matrix using (Euclidean) distances to nearest neighbors
4. Apply Gaussian kernel to each non-zero entry:

$$A_{ij} = \exp\left(\frac{-dist(\boldsymbol{x}_i, \boldsymbol{x}_j)}{2\sigma^2}\right)$$

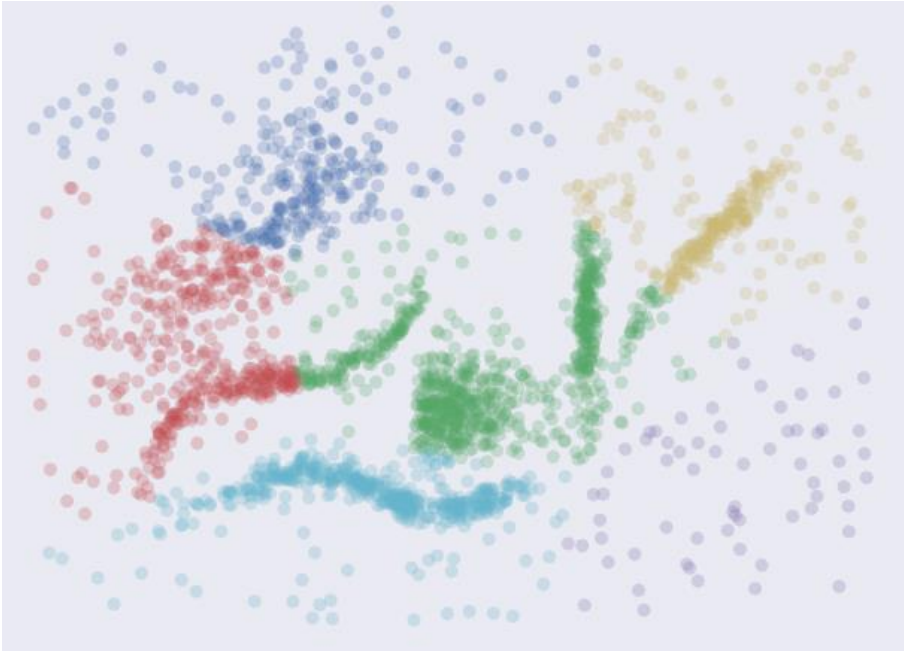
5. Symmetrize matrix



Clump outliers – Exemplar Selection

Choosing a set of “representative” ASINs:

1. Spectral clustering using affinity matrix
2. Compute the “degree vector”
3. Select ASIN with highest “degree” in each cluster



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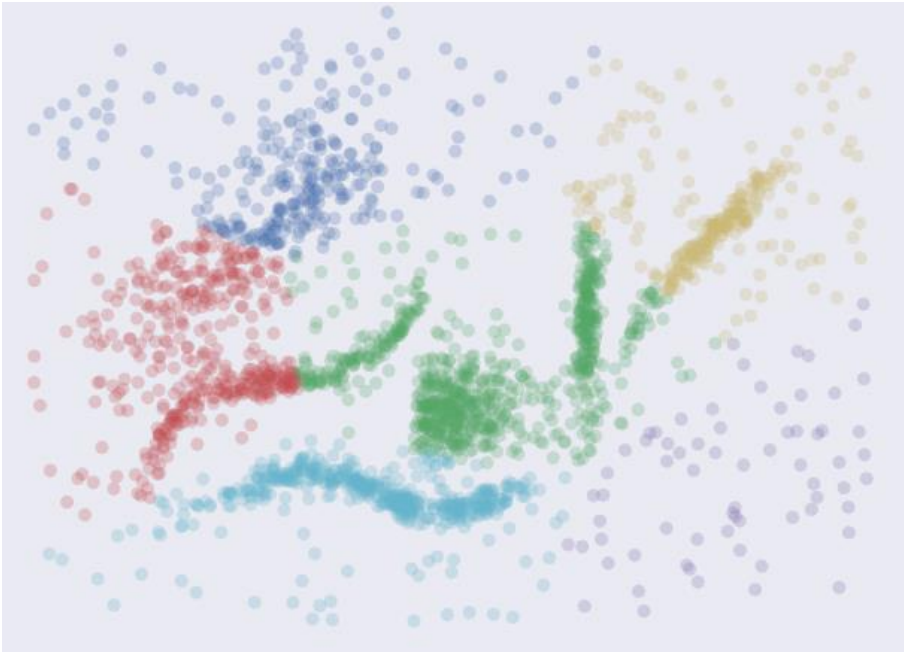

Obtain judgments for selected ASINs

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Clump outliers – Judgment Propagation

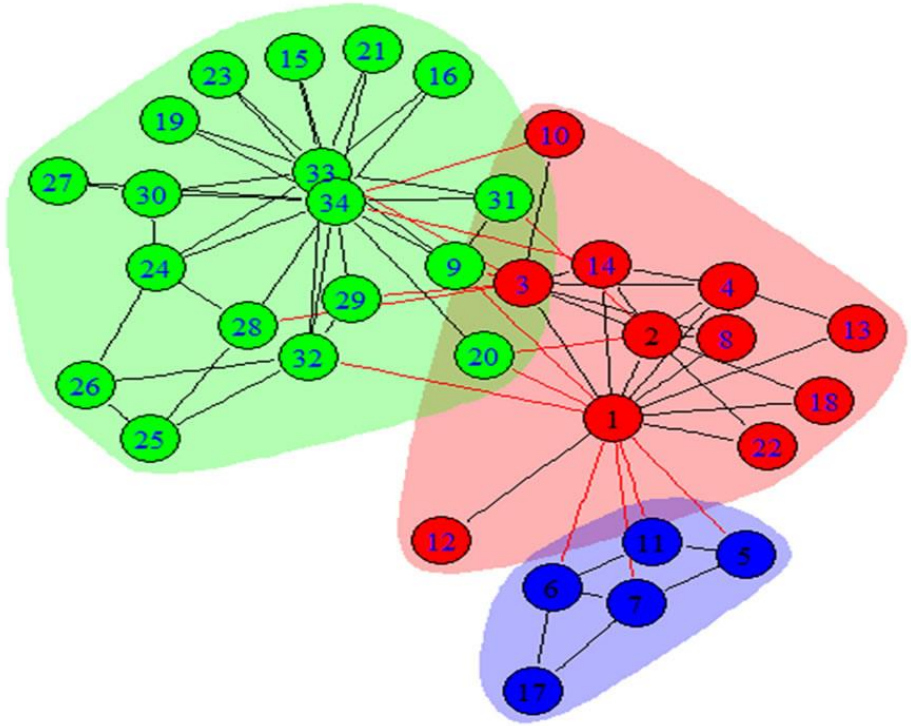
Propagating expert judgments:

1. Construct $S = D^{-\frac{1}{2}}AD^{-\frac{1}{2}}$

2. Iterate $F(t+1) = \alpha SF(t) + (1-\alpha)Y$ until convergence

   (for α between 0 and 1)

3. Obtain labels for ASINs from the limit of $F(t)$ by applying thresholds



Clump outliers – Results

Dataset	Total ASINs	Negative exemplars	Negative Propagations	Miscat Precision	Miscat Recall
TVs	19,345	20/50	5,117	98%	77%
Storage Benches	2,123	19/20	1,647	100% (est.)	-
Radar Detectors	15,225	13/19	9,427	100% (est.)	-
Cooktops	22,266	40/50	19,263	100% (est.)	-
Dart Cases & Wallets	28,992	98/100	27,151	100% (est.)	-
50 UK categories	1,748,936	2,372/5000	818,176	95.8% (audit)	-

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Towards a Pristine Catalog

Questions?