



Deep Product Search

Jonas Dahl, Ayush Chopra | Precise vertical specific visual search

TS
19
ESCAPE
VELOCITY





★★★★★ 3 REVIEWS

CLASSIC PETITE TALL

CHF 173.77

SIZE:
All sizes are US sizes.

[SIZE CHARTS](#)

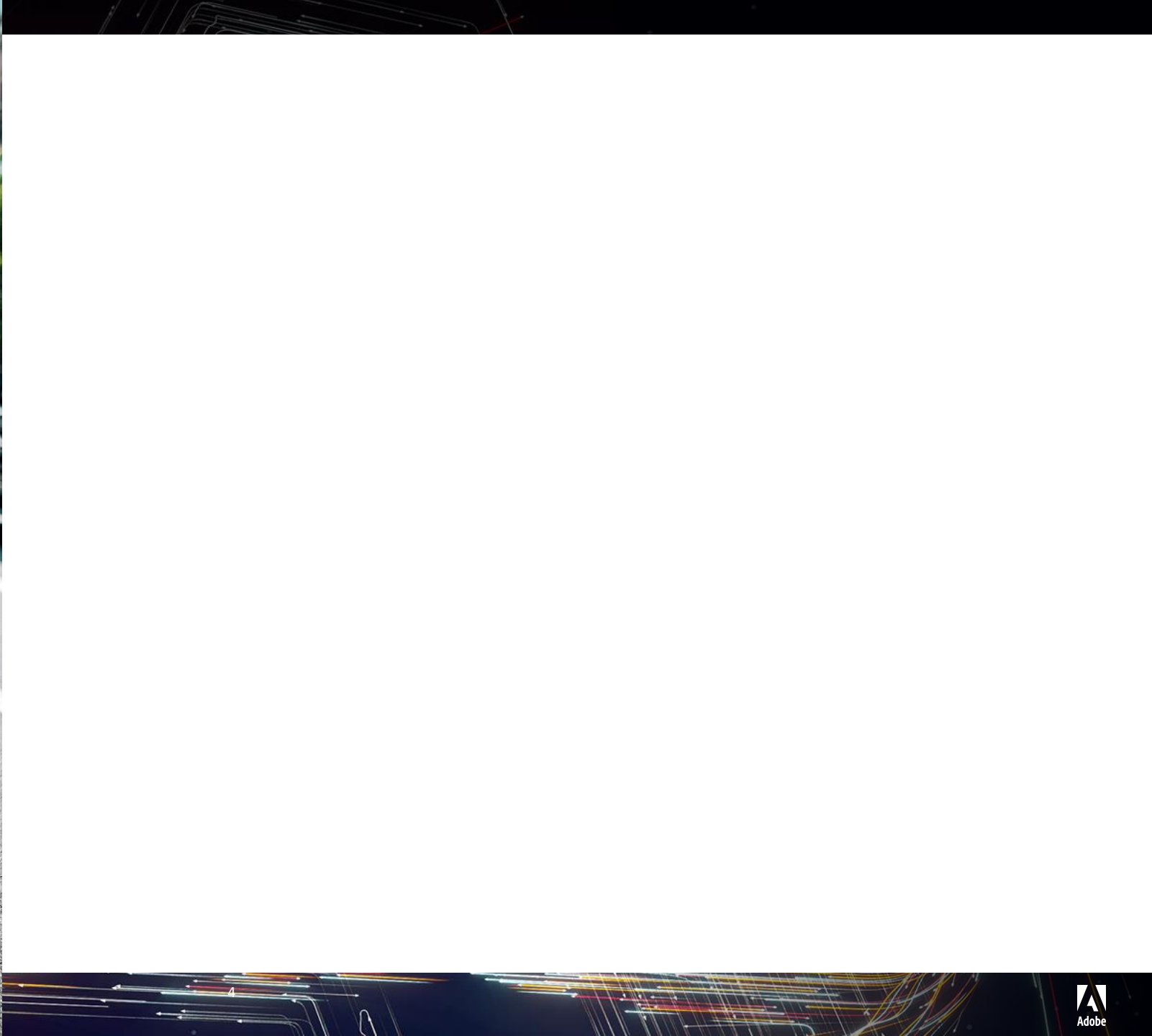
00	0	2	4	6	8	10
12	14	16				

QUANTITY: 1

Prices do not include taxes.

Add to Bag

ADD TO WISHLIST





Céline



“Contrasting
CHECKS with
stripes is a thoroughly
modern move”





Céline



“Contrasting
CHECKS with
stripes is a thoroughly
modern move”

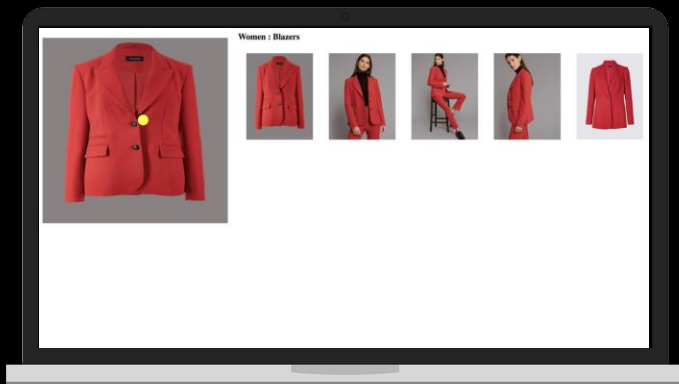


Search





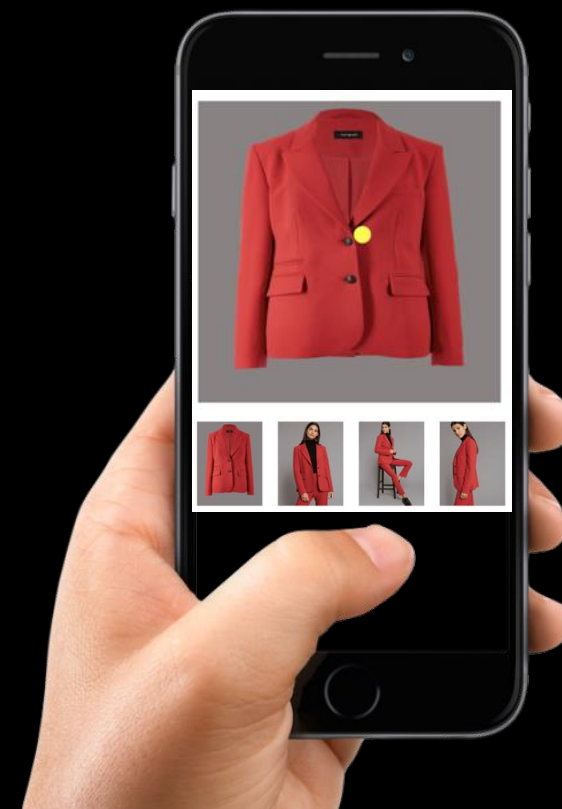
Deep Product Search – Apparel API



Web site Deep Product Search
and find-similar functionality



Find similar products in-store



Search for apparel using in-
the-wild images

Exploration

Recommendations

ENGAGEMENT



Leverages Adobe Sensei to accomplish
best-in-class accuracy



Great support for non-exact matches

QUERY IMAGE



Upper

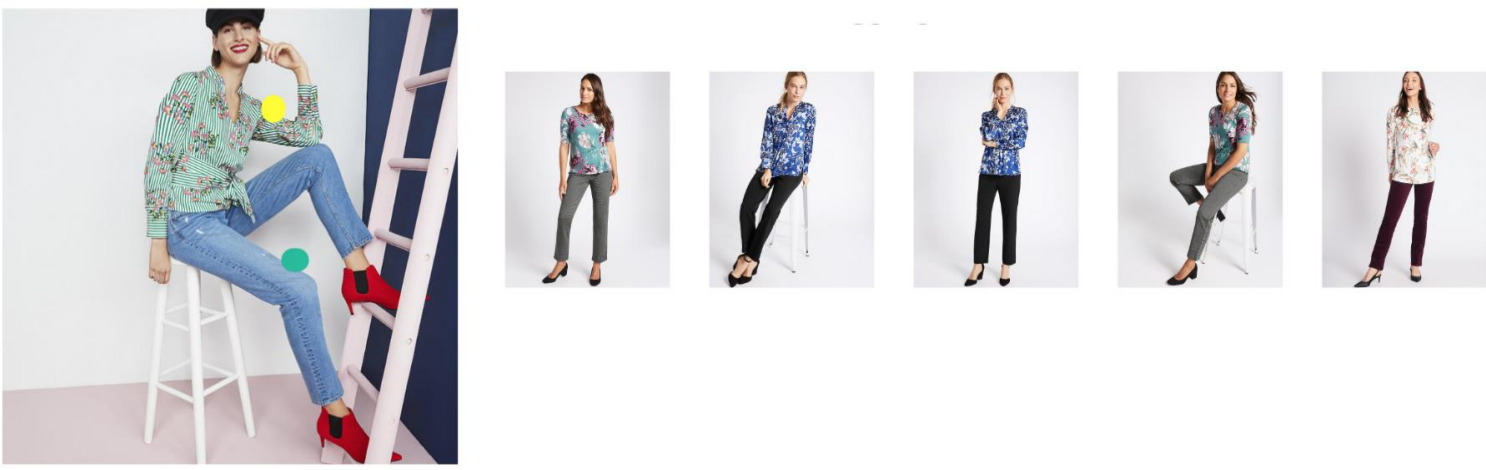
SEARCH RESULTS



EXACT MATCHES

Matches can be found in challenging pictures including apparel that's displayed on a model as well as isolated on a plain background, which are visually very different.

Choose file



SIMILAR RESULTS

The product catalog doesn't necessarily include an exact match. Therefore, it's very important that the algorithm is able to also suggest similar items.

Visual dissimilar exploration



Aviator™



Original Wayfarer®



New Wayfarer®



Clubmaster



Justin



Erika



Round Metal



RB2180



RB2447

DEMO

ALGORITHMIC OVERVIEW

Workflow Components

Workflow Components

1. Hotspot Detection

Workflow Components

1. Hotspot Detection
2. Feature Vector Extraction

Workflow Components

1. Hotspot Detection
2. Feature Vector Extraction
3. Recommendation

Workflow Components

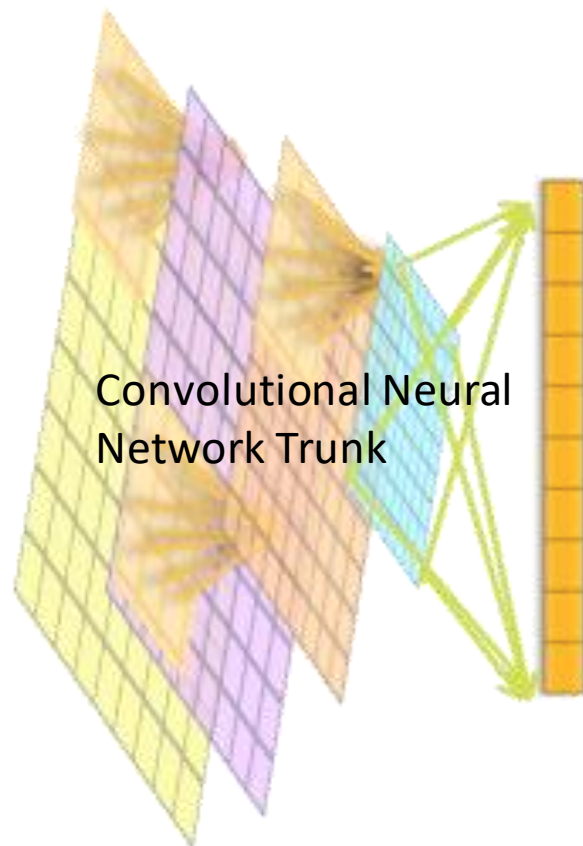
1. Hotspot Detection

2. Feature Vector Extraction

3. Recommendation

Hotspot Detection

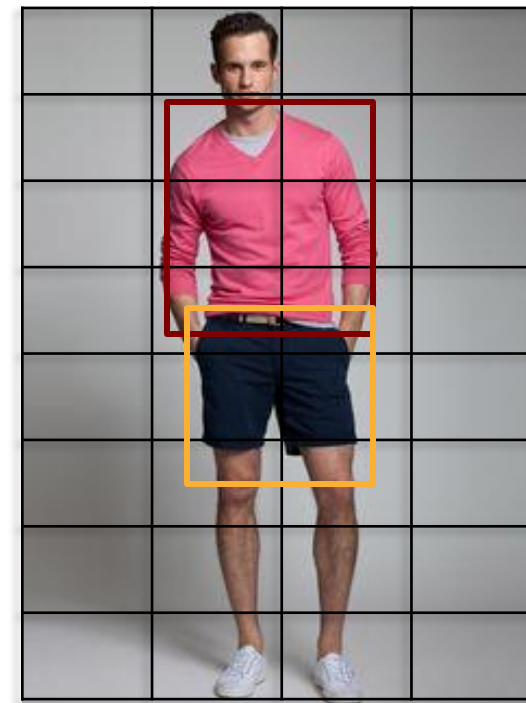
Bounding Box Segmentation



bbox regression

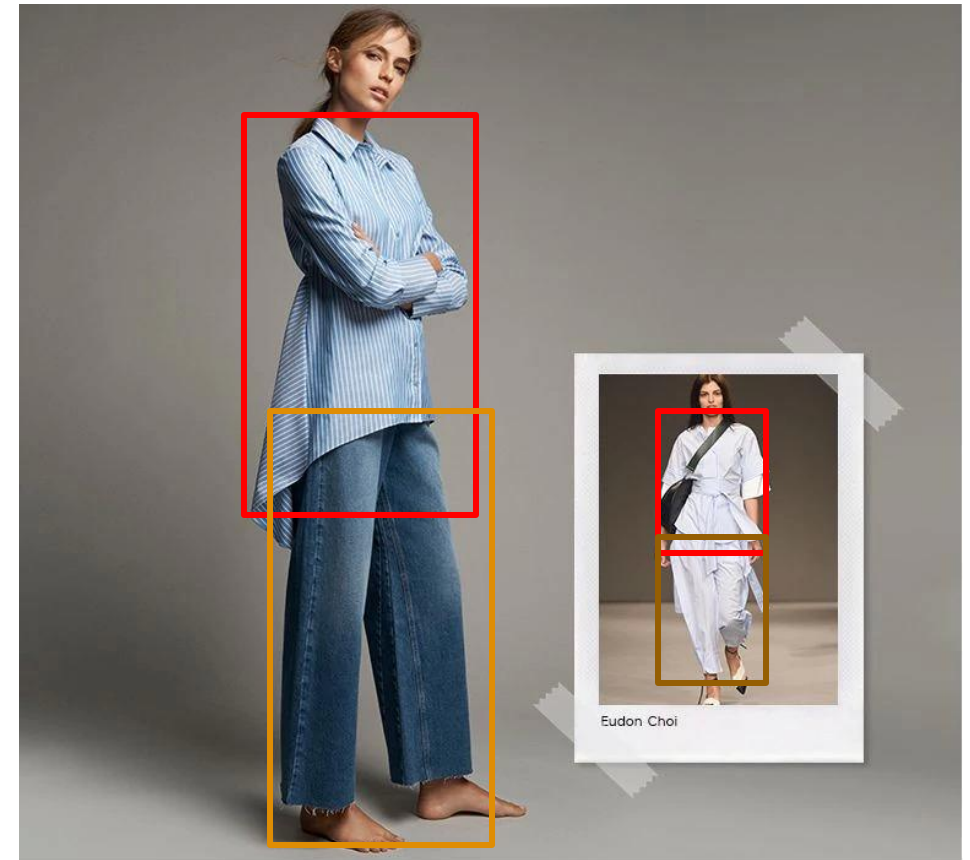
(x, y, w, h)

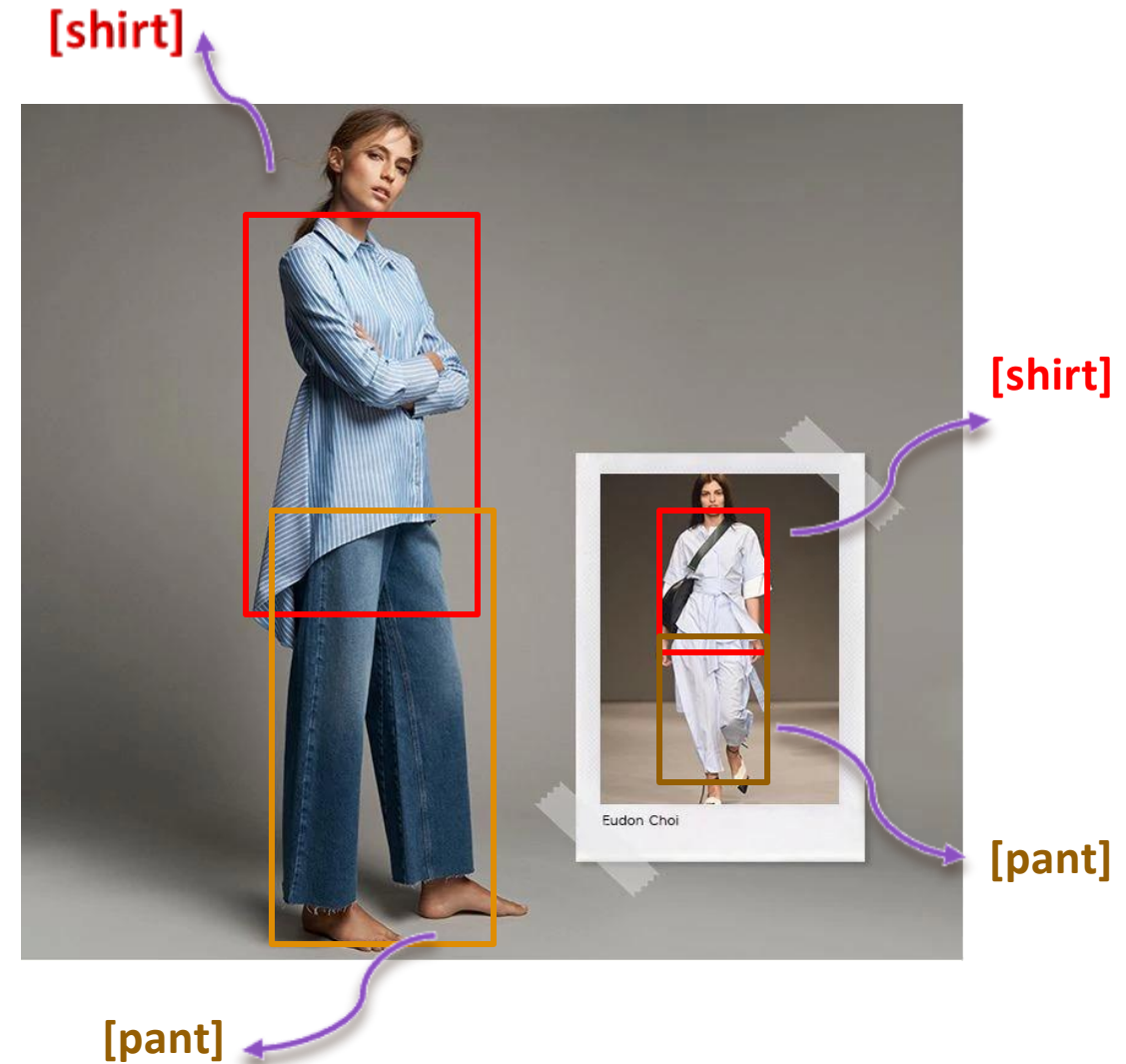
classification



[shirt, shorts]







Workflow Components

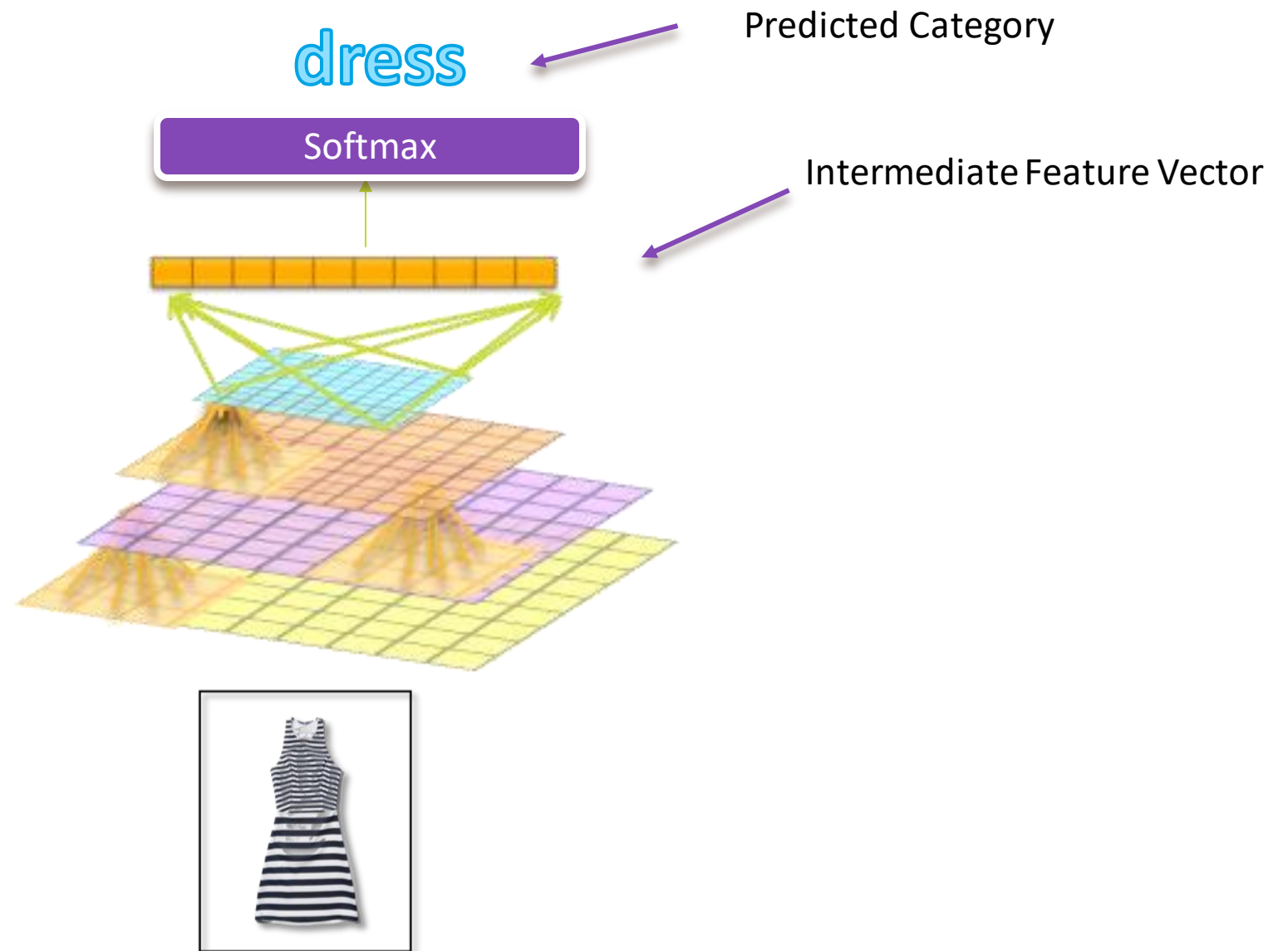
1. Hotspot Detection

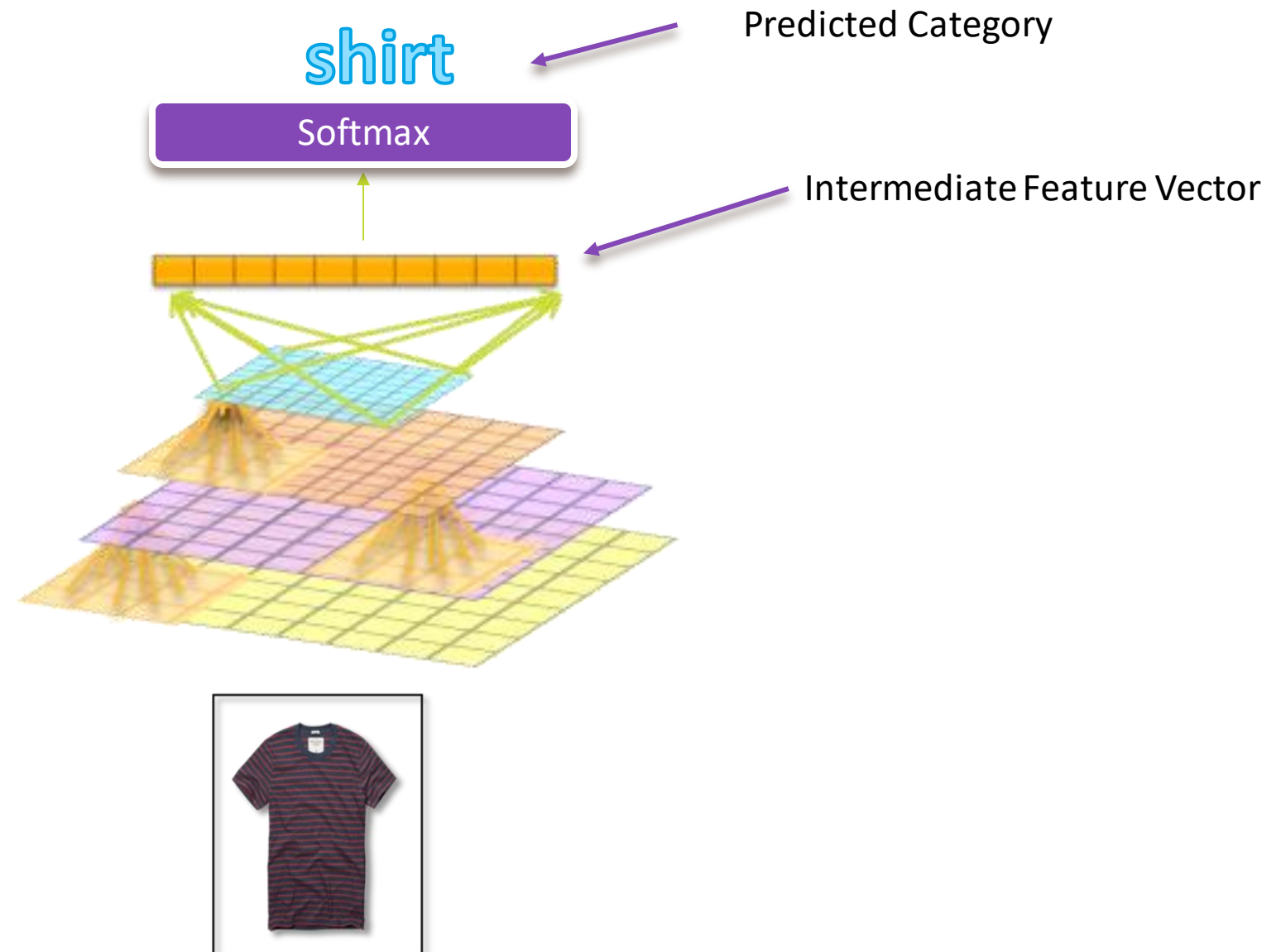
2. Feature Vector Extraction

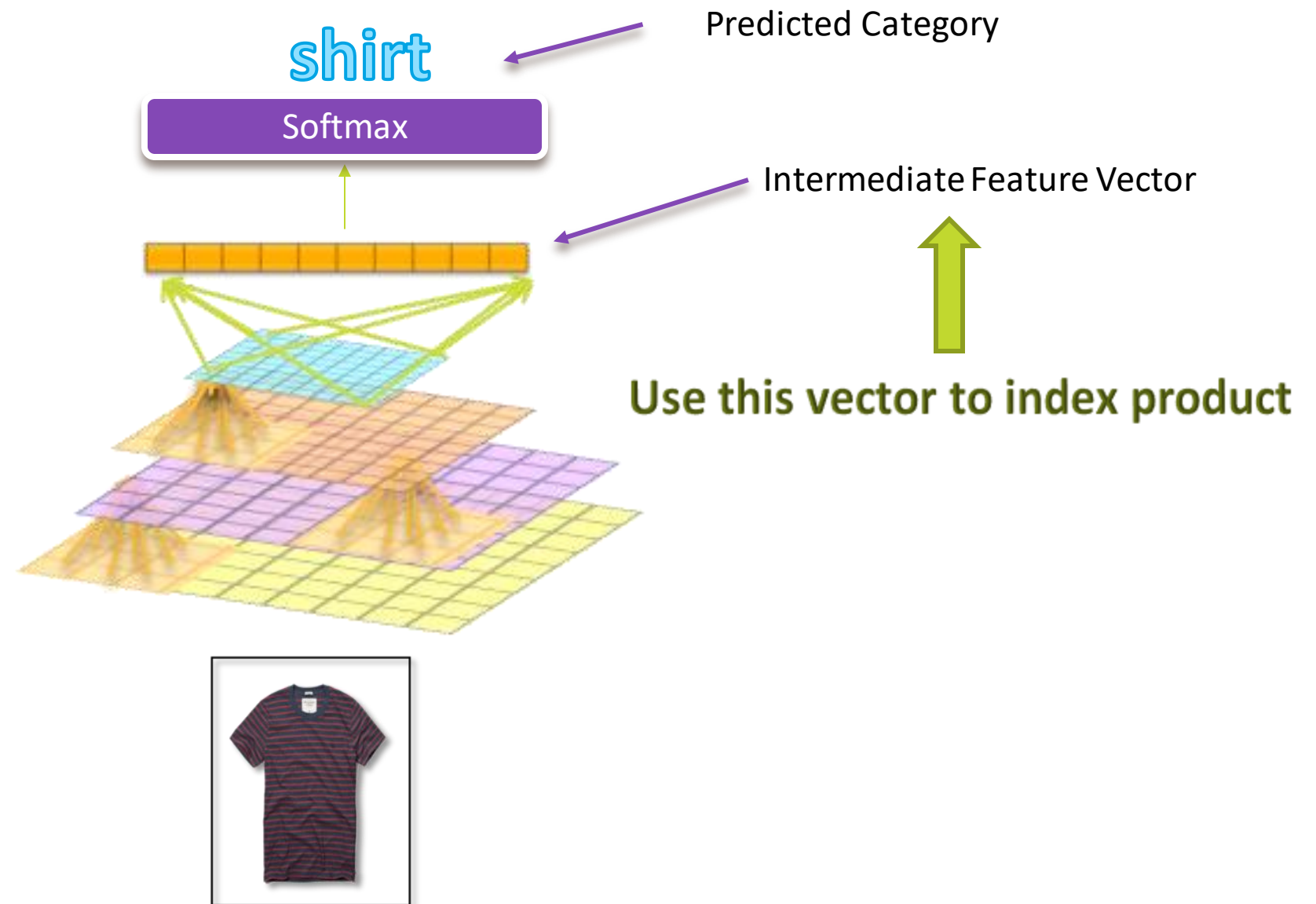
3. Recommendation

How to generate robust feature vectors?

Approach 1: Classification Network







Problem: Feature Vector biased by product category

Query



B



C



Query



B

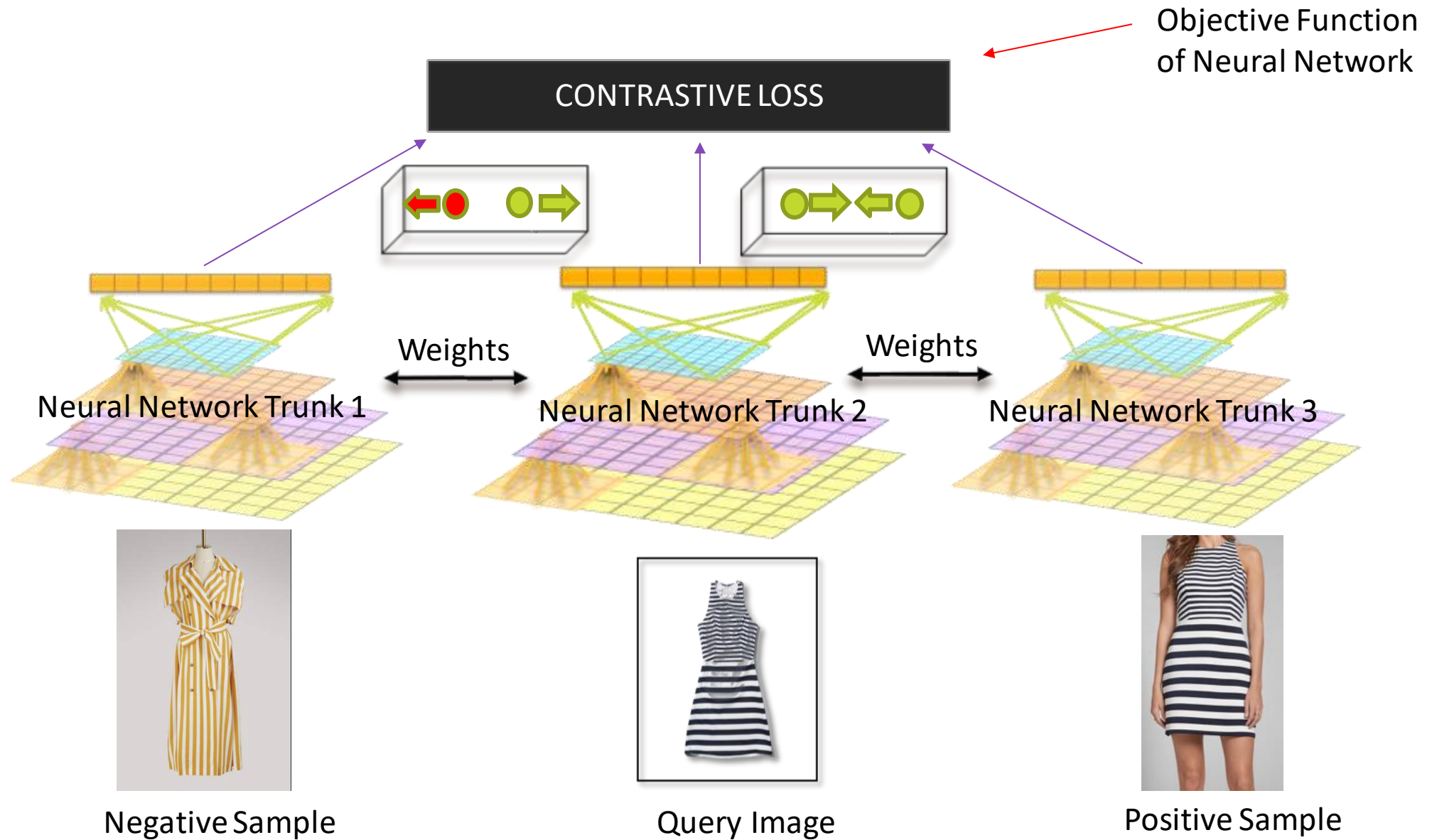


D



Solution: Need some measure of fine-grained similarity

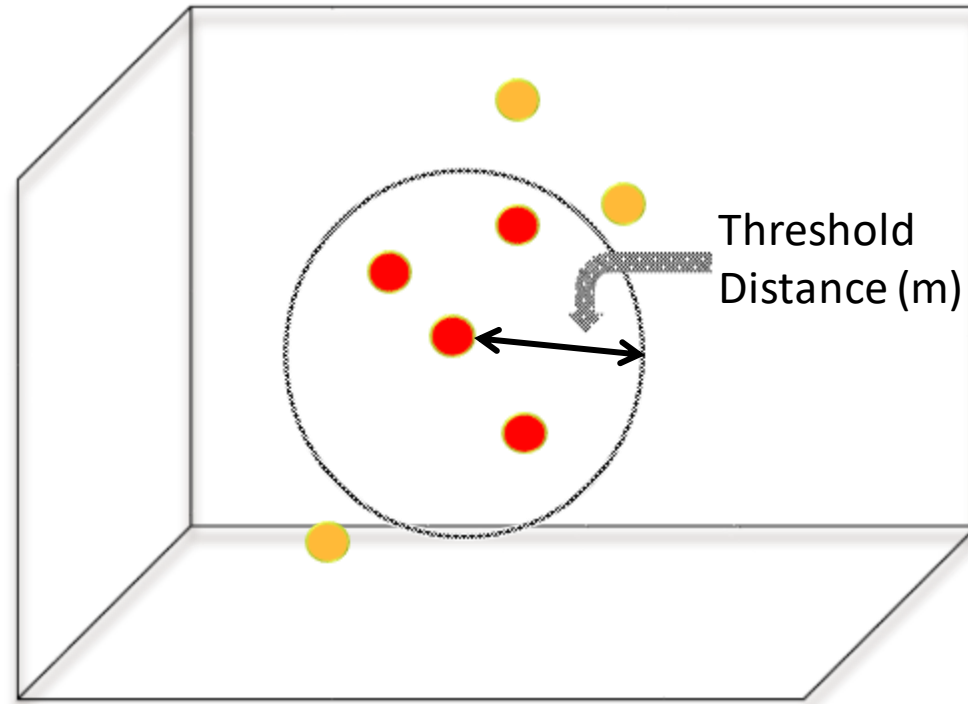
Approach 2: Siamese Neural Networks



CONTRASTIVE LOSS

$$(1 - Y) \frac{1}{2} (D_W)^2 + (Y) \frac{1}{2} \{ \max(0, m - D_W) \}^2$$

$$D_W = \sqrt{\{G_W(X_1) - G_W(X_2)\}^2}$$



Problem: Feature Vectors not robust to hard negatives.

Query



B



D



Query



B



D

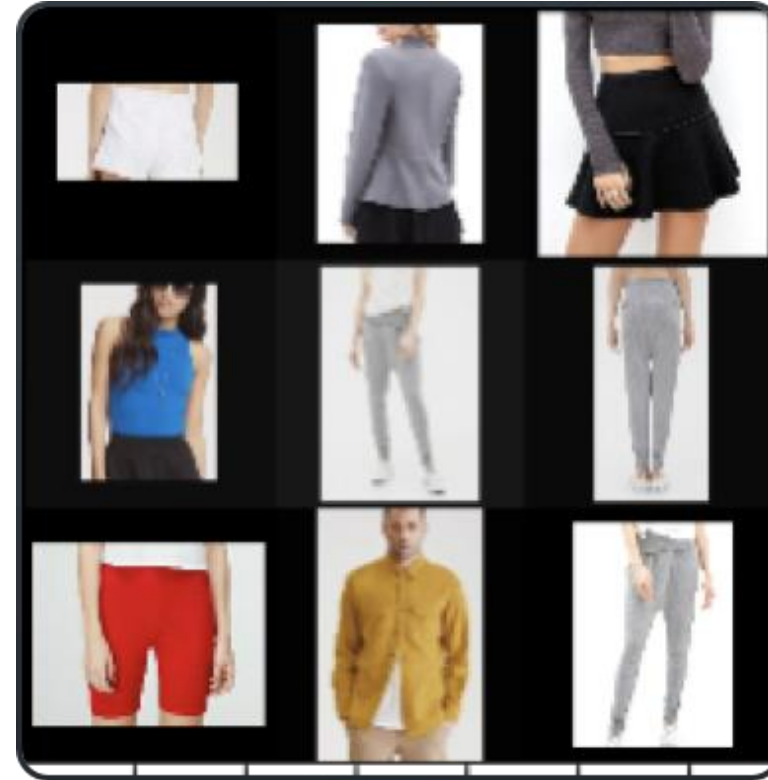


Solution: Jointly compare query against multiple negative and positive samples.

Approach 3 : Grid Search Network



QUERY IMAGE



TARGET GRID

Locate all instances of query in target

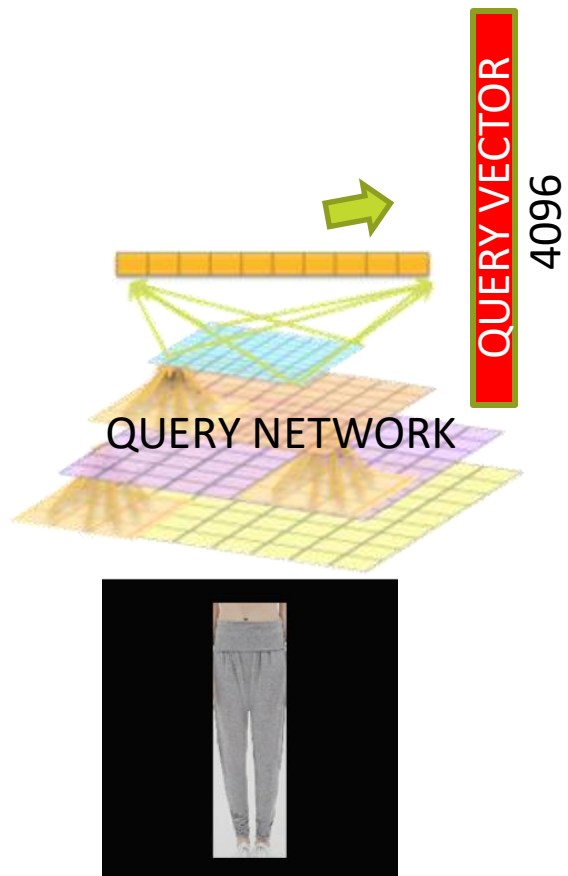


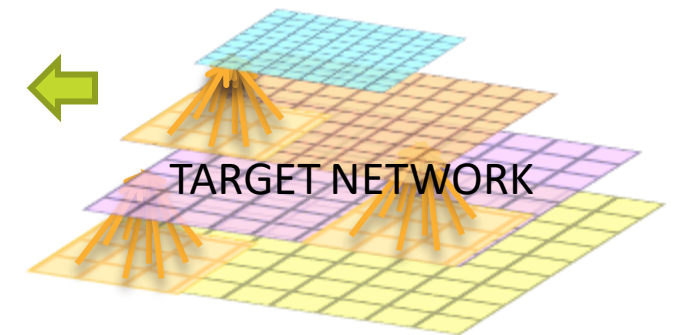
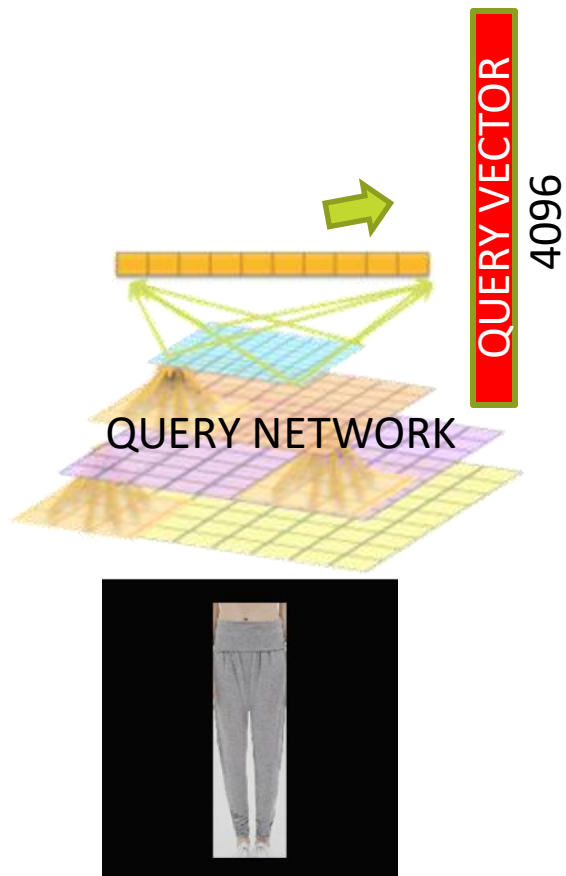
QUERY IMAGE



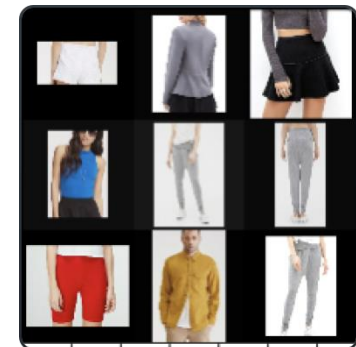
TARGET GRID

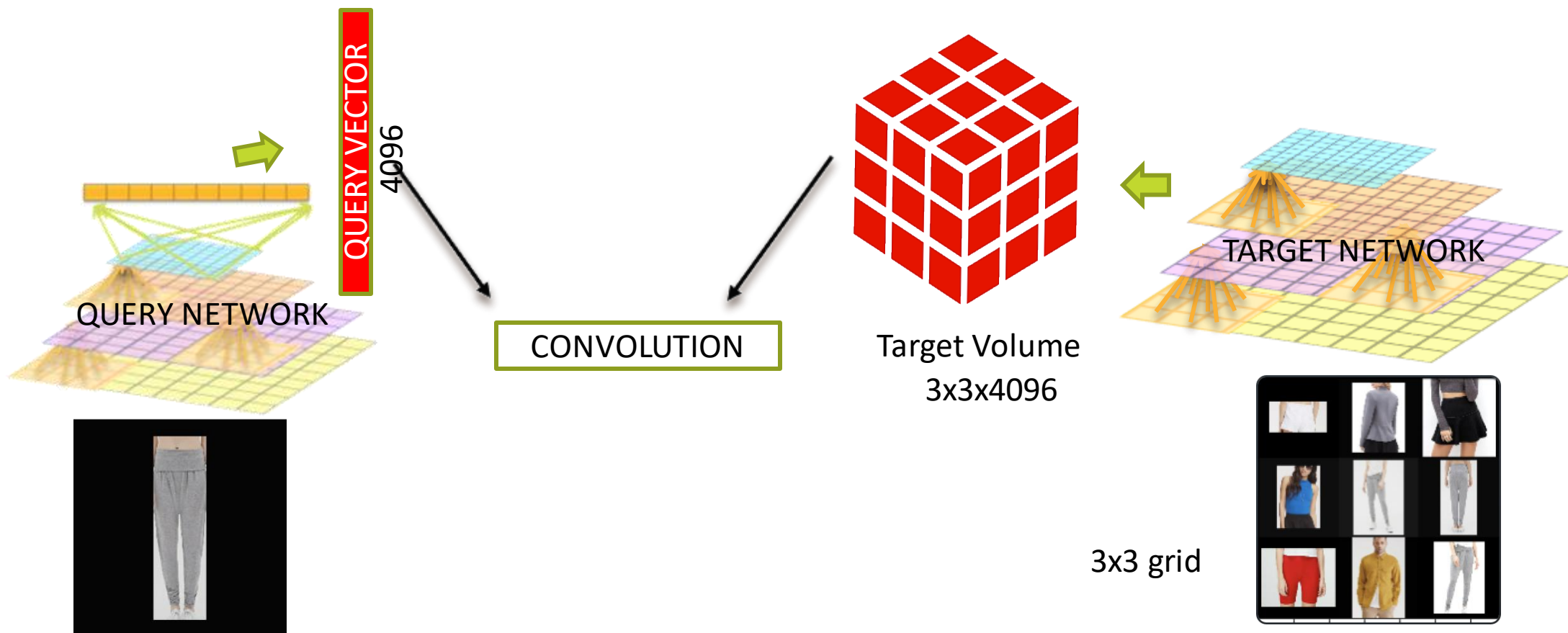




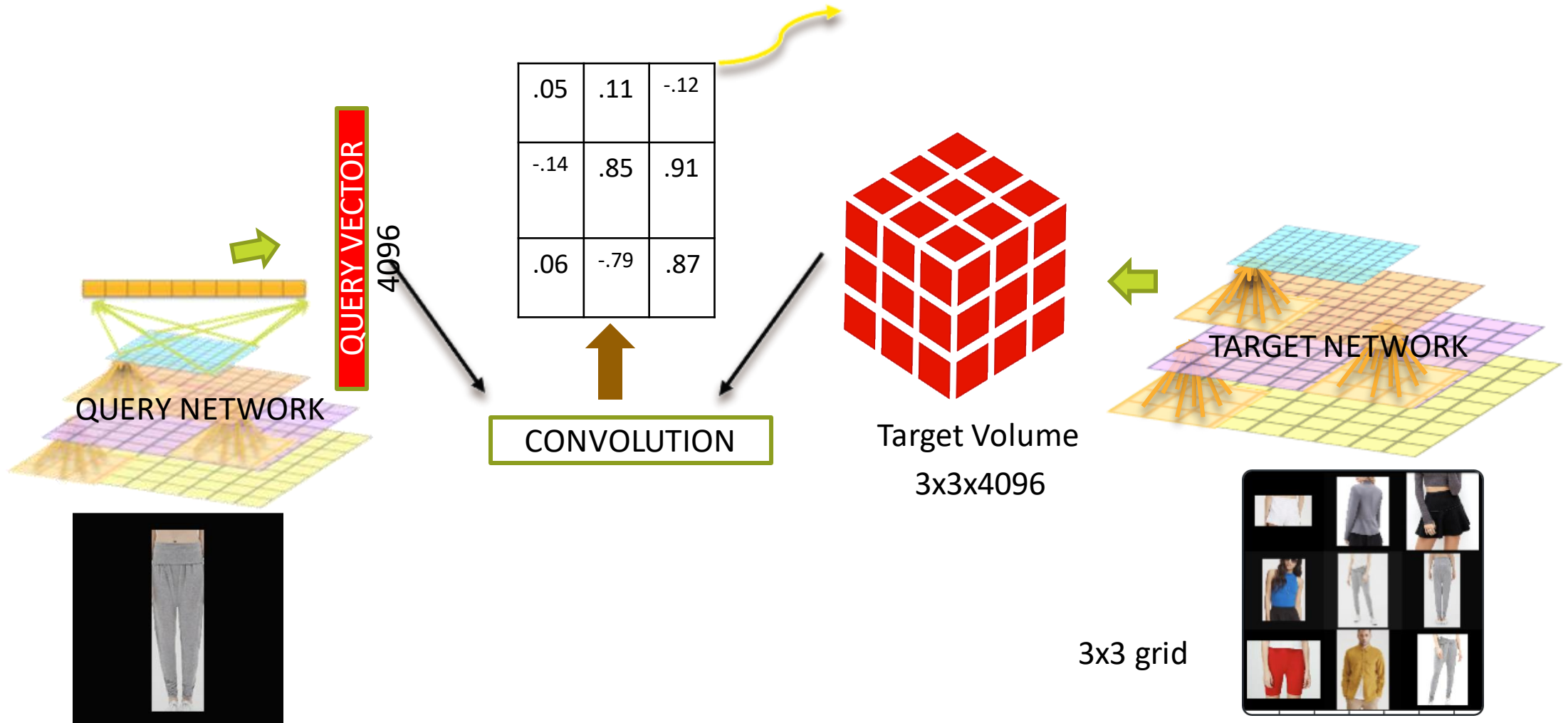


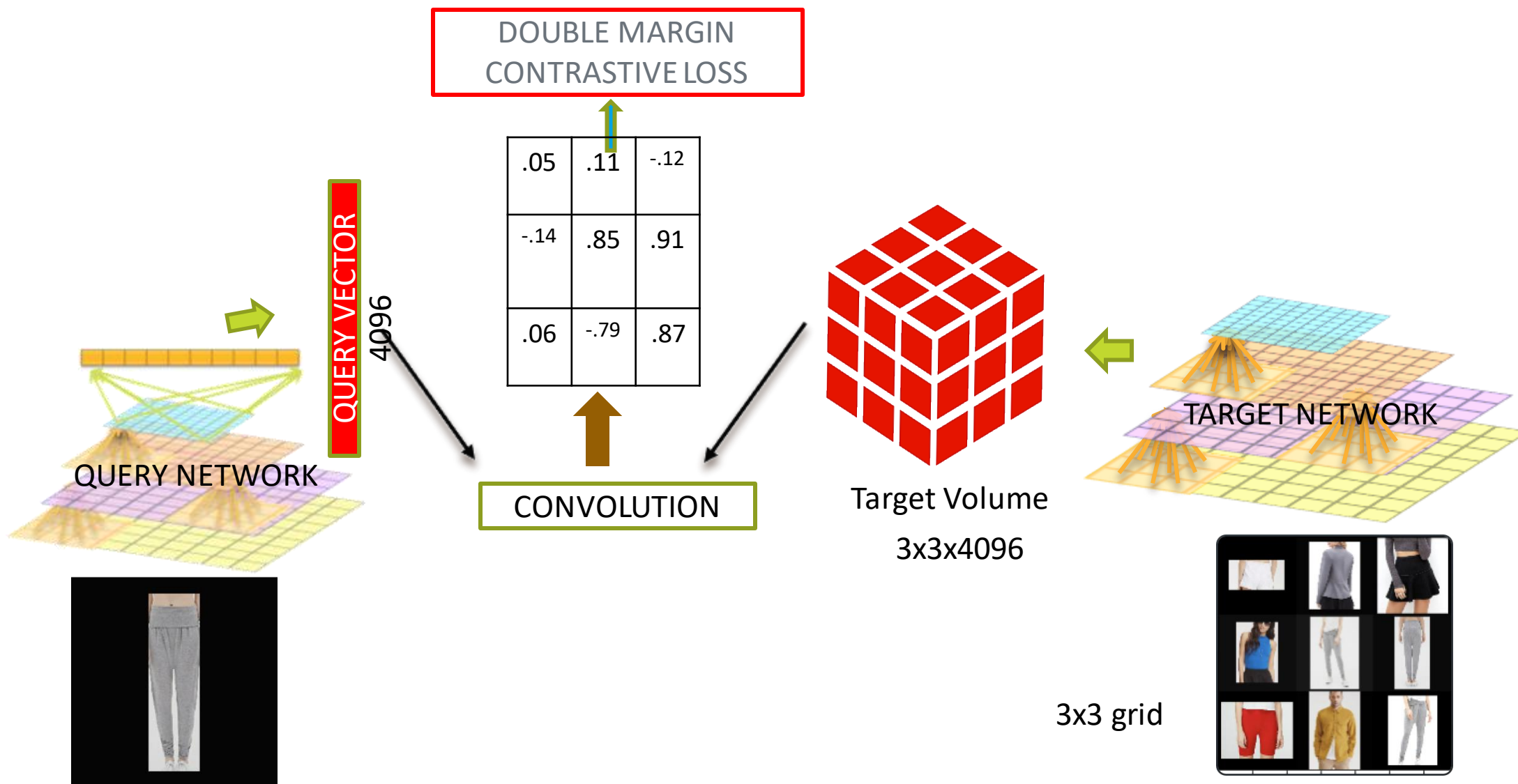
3x3 grid





3x3 cosine similarity map





LOW THRESHOLD

-1	-1	-1
-1	.9	.9
-1	-1	.9

HIGH THRESHOLD

0	0	0
0	1	1
0	0	1

DOUBLE MARGIN
CONTRASTIVE LOSS

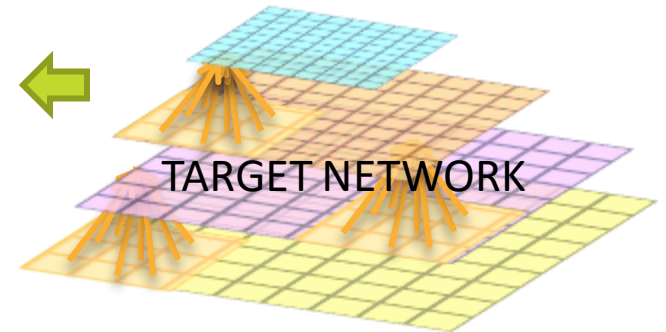
.05	.11	-.12
-.14	.85	.91
.06	-.79	.87

CONVOLUTION

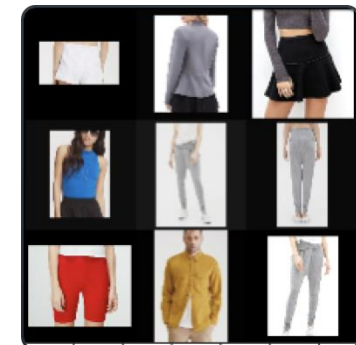


Target Volume
3x3x4096

TARGET NETWORK



3x3 grid



QUERY VECTOR

4096

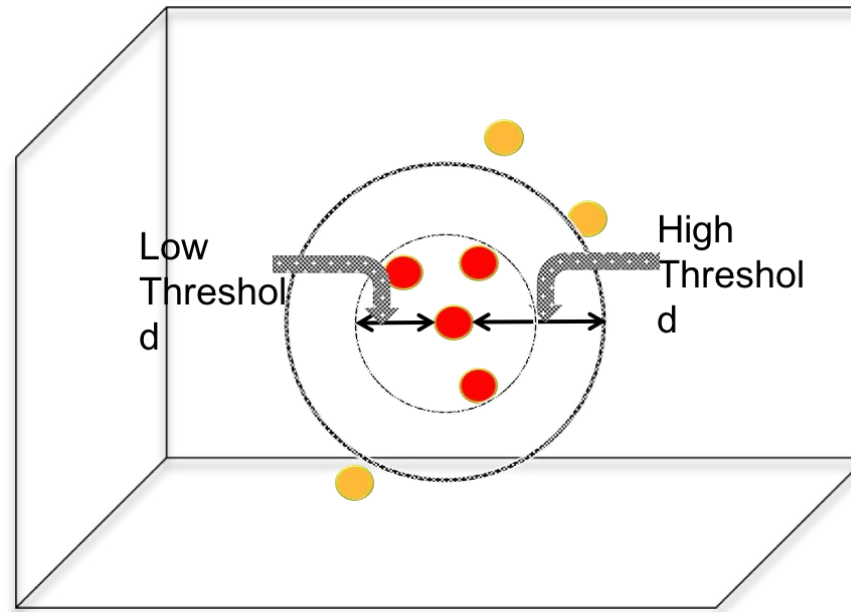
QUERY NETWORK



OBJECTIVE FUNCTION

Double Hinge Contrastive Loss

$$loss = \sum_{j=0}^{j<H} \sum_{i=0}^{i<W} y[i,j] * \max(H[i,j] - d[i,j], 0)^2 + (1 - y[i,j]) * \max(d[i,j] - L[i,j], 0)^2$$

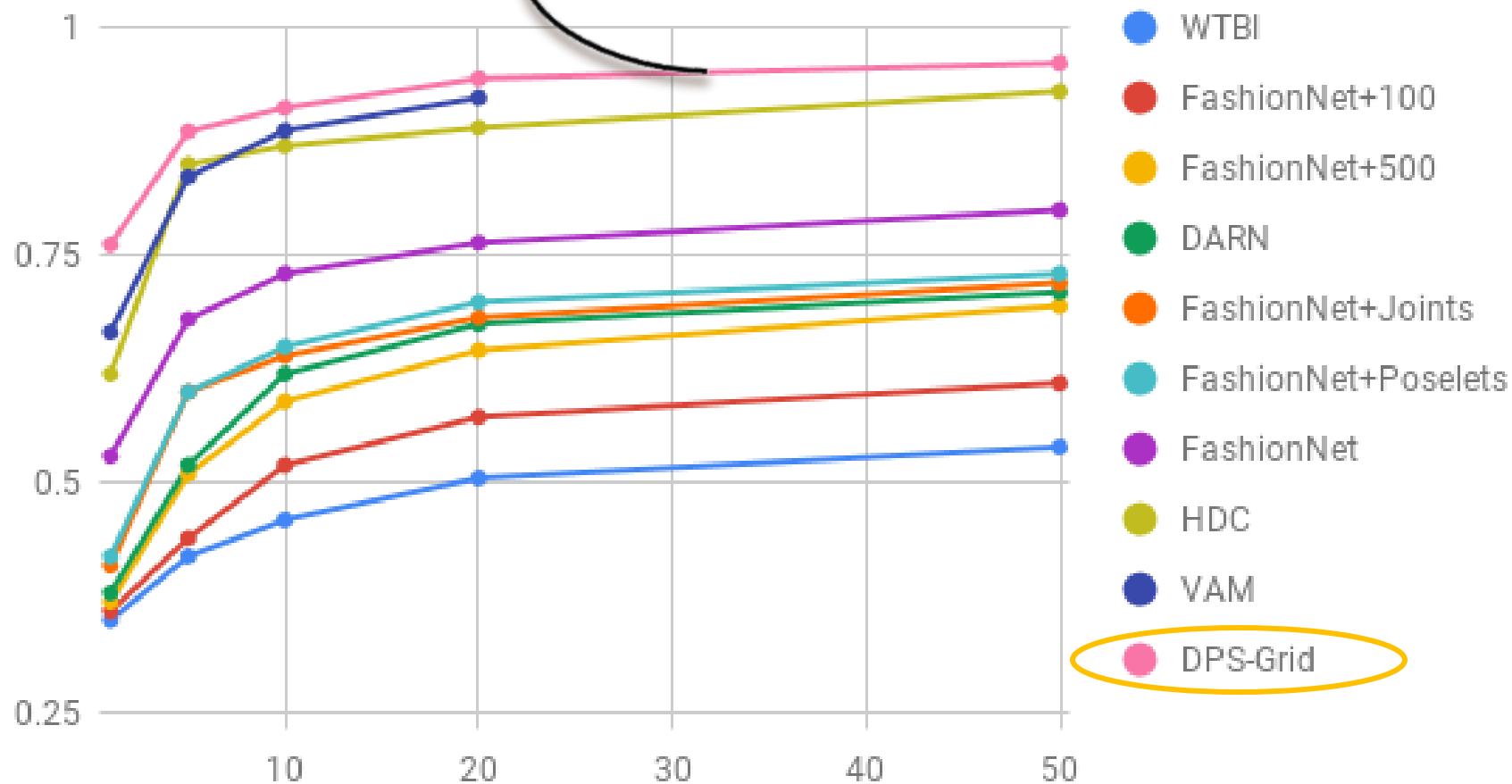


QUANTITATIVE PERFORMANCE

State of Art on Visual Retrieval

Our result

Recall Rate comparison on Inshop Retrieval Dataset

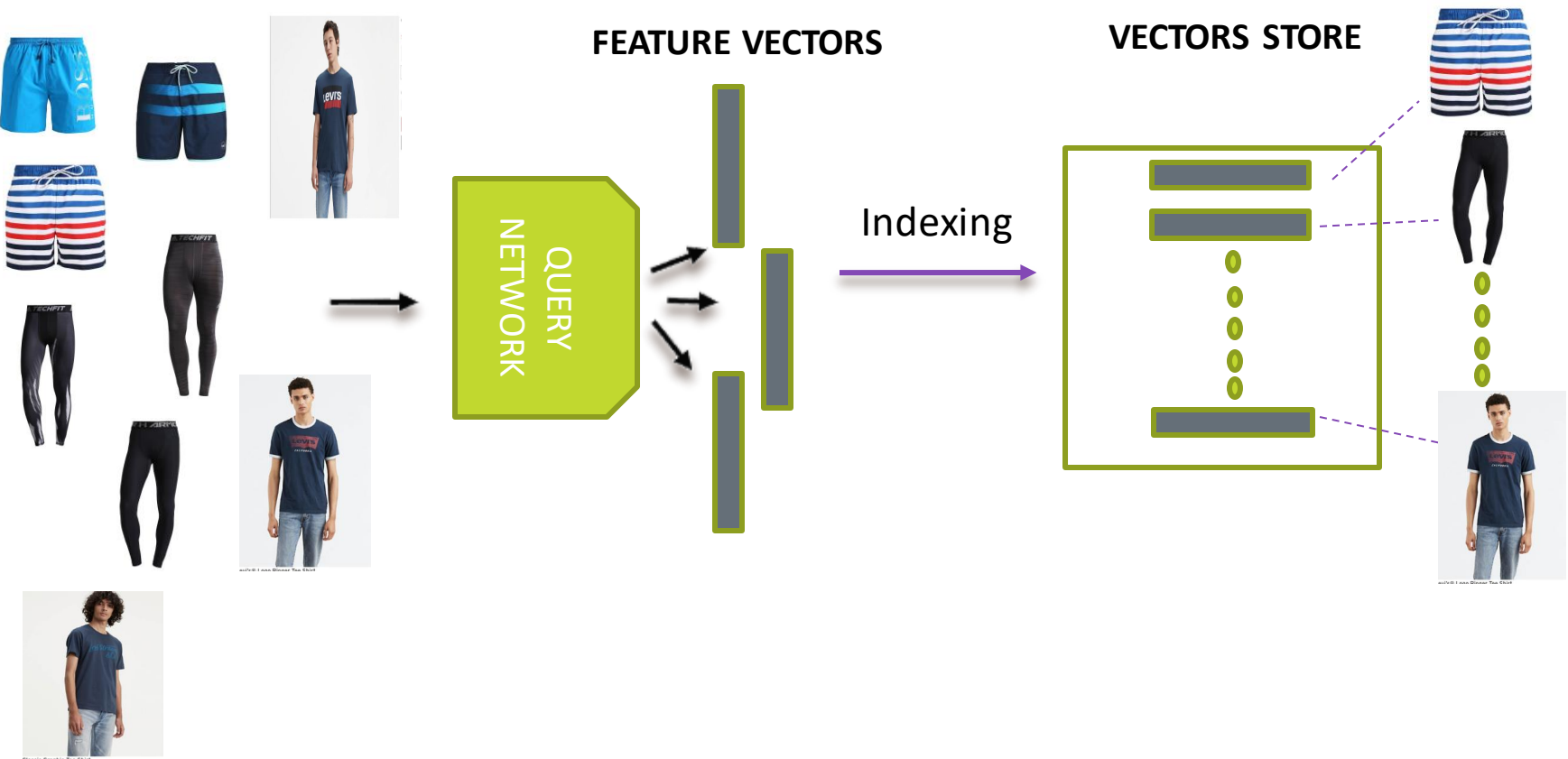


PUTTING IT ALL TOGETHER

Case Study: Visual Recommendations

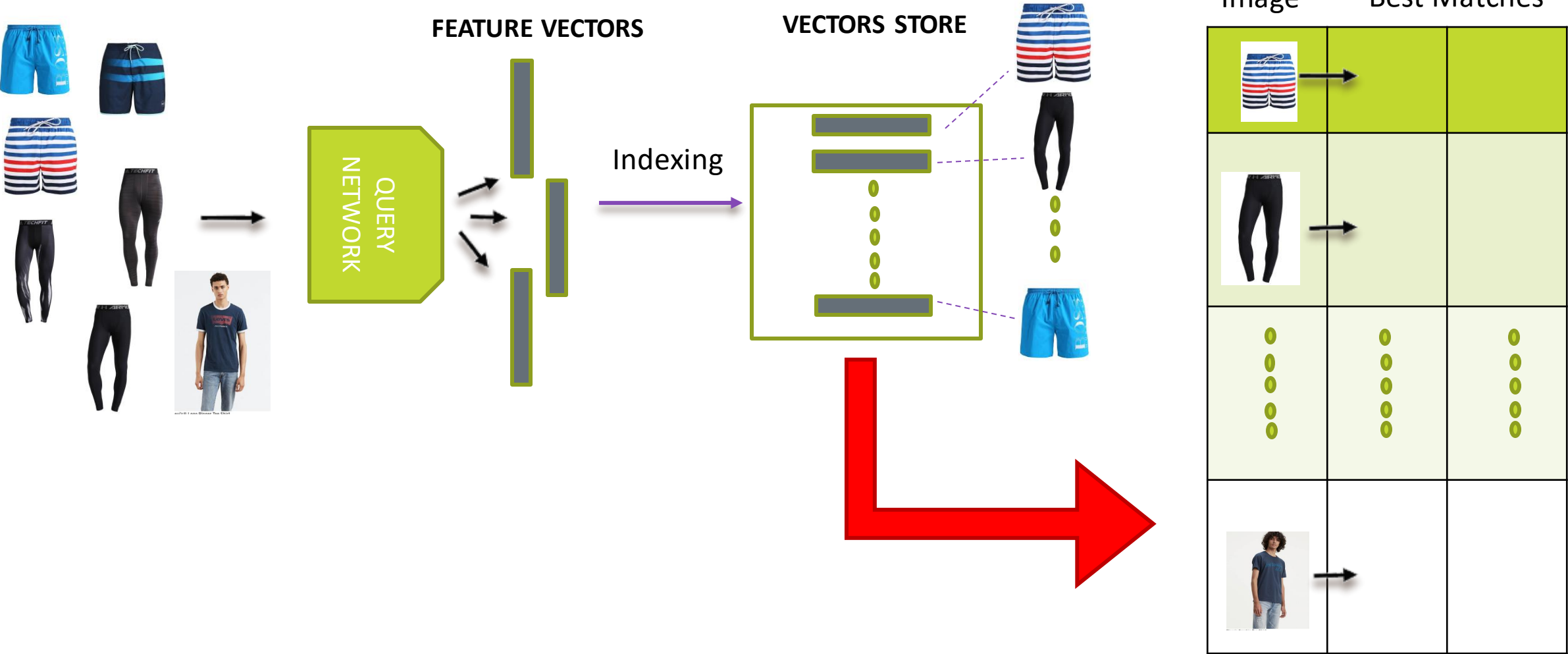
CATALOG

VISUAL RECOMMENDATIONS: INDEXING



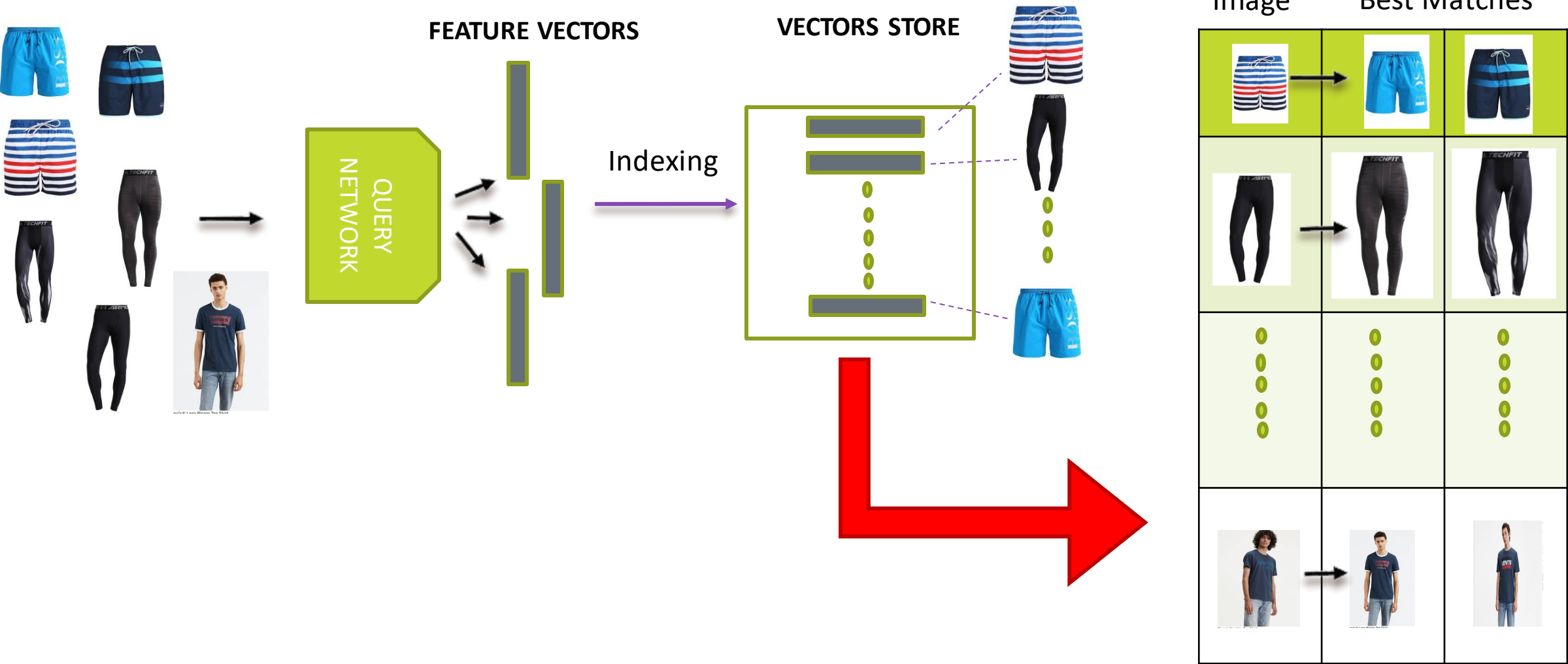
CATALOG

VISUAL RECOMMENDATIONS: INDEXING



CATALOG

VISUAL RECOMMENDATIONS: INDEXING



VISUAL RECOMMENDATIONS: INFERENCE

BROWSED CATALOG PRODUCT



Search

Image

Best Matches



Retrieval



Best Matches

Levi's


MEN WOMEN KIDS CUSTOMIZE STORIES SALE

Search

Shopping Cart

FREE SHIPPING ON ORDERS OF \$100+ Details

Clothing / Unisex / Shirts / Classic Graphic Tee Shirt



Classic Graphic Tee Shirt

\$19.98

~~\$26.00~~

Select a Size

Qty 1

WHAT'S MY SIZE?




Size Guide

Color

DRESS BLUES SPORTSWEAR LOGO

ADD TO BAG

FIND IN STORE



DETAILS

Levi's® graphic tees are designed for comfort, casual style and versatility. Style # 396360003


MATERIALS

100% Cotton
Non-Stretch Jersey
Crewneck
Short sleeves
Screen-printed graphic
Wash And Dry inside Out With Like Colors. Liquid Detergent Is Recommended. Do Not Iron
Decoration Imported


FIT & SIZING

Regular fit


VISUALLY SIMILAR ITEMS



Levi's® Logo Ringer Tee Shirt
29.50



Classic Graphic Tee Shirt
20.00




Levi's® Classic Logo Tee Shirt
20.00


REVIEWS

Be the first to review this product


CUSTOMERS WHO VIEWED THIS ALSO VIEWED




Levi's® Classic Logo Tee Shirt
\$19.98 ~~\$26.00~~




Levi's® Classic Logo Tee Shirt
\$19.98 ~~\$26.00~~




Levi's® Classic Logo Tee Shirt
\$19.98 ~~\$26.00~~



Classic Graphic Tee Shirt
\$19.98 ~~\$26.00~~



Classic Graphic Tee Shirt
\$19.98 ~~\$26.00~~



Classic Graphic Tee Shirt
\$25.00

VISUAL
RECOMMENDATIONS IN
ACTION

Levi's


MEN WOMEN KIDS CUSTOMIZE STORIES SALE

Search

Shopping Cart

FREE SHIPPING ON ORDERS OF \$100+ Details

Clothing / Unisex / Shirts / Radio Short Sleeve Women



Radio Short Sleeve Women

\$49.50

~~\$65.00~~

Select a Size



Qty 1

WHAT'S MY SIZE?

Size Guide

ADD TO BAG

FIND IN STORE



DETAILS

For the extra-fitting shirt with plenty of room for both comfort and style, we've designed this shirt with a relaxed fit and a classic plaid pattern.


MATERIALS

Soft Cotton
With Liquid
Non-Stretch Fabric Blend
Imported


FIT & SIZING

Standard/Regular


VISUALLY SIMILAR ITEMS



Summer Western Shirt
\$4.50



Classic One Pocket Shirt
\$8.97




Levi's® 688® Flared Western Shirt
\$8.00


REVIEWS

Be the first to review this product


SHOPPERS WHO VIEWED THIS ALSO VIEWED




Levi's® Original Fit Jeans
\$49.50




Levi's® Original Fit Jeans
\$49.50



Levi's® Original Fit Jeans
\$49.50



Levi's® Original Fit Jeans
\$49.50



Levi's® Original Fit Jeans
\$49.50

NEXT STEPS

Deep Product Search on Furniture

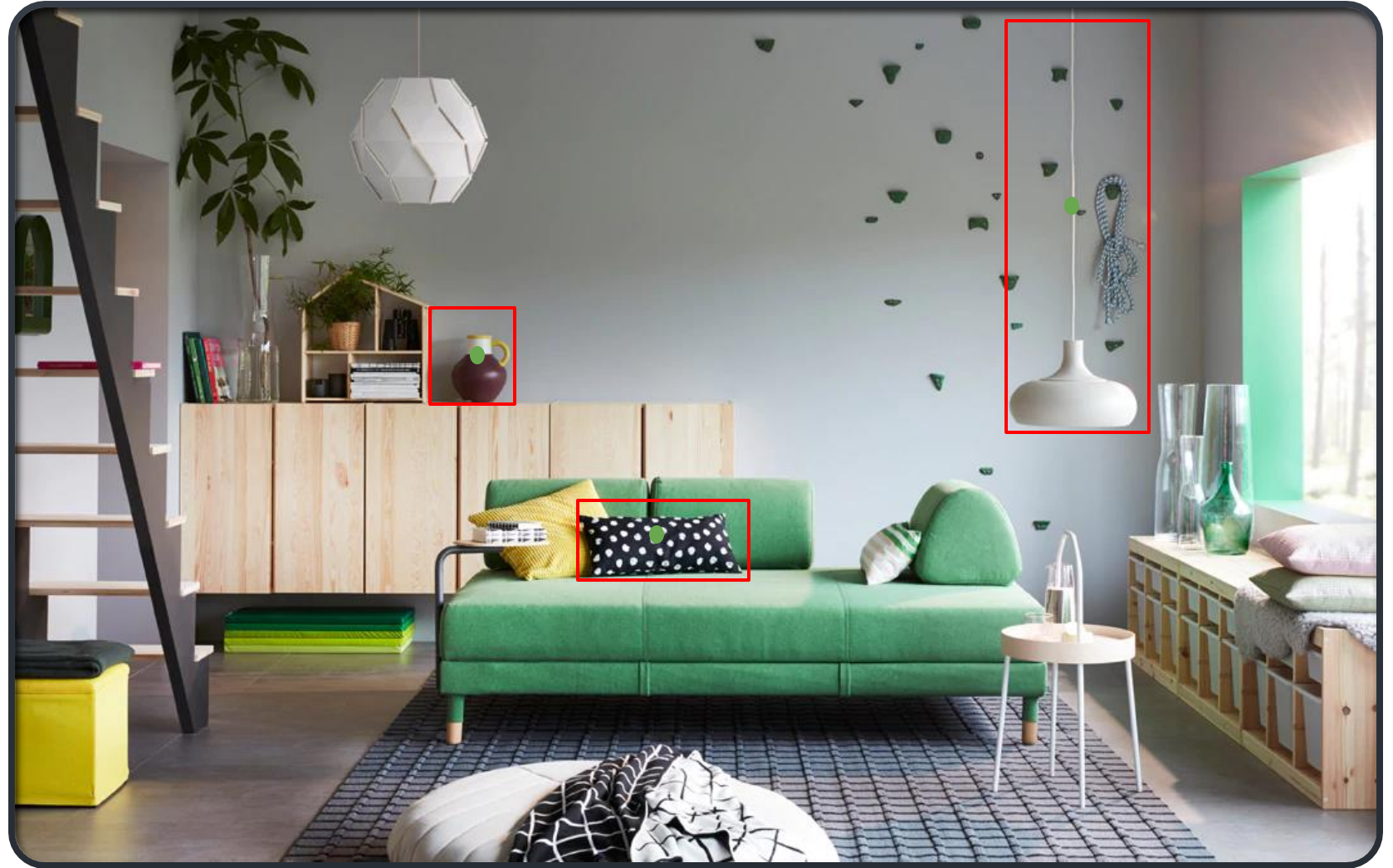
DPS ON FURNITURE

QUERY IMAGE

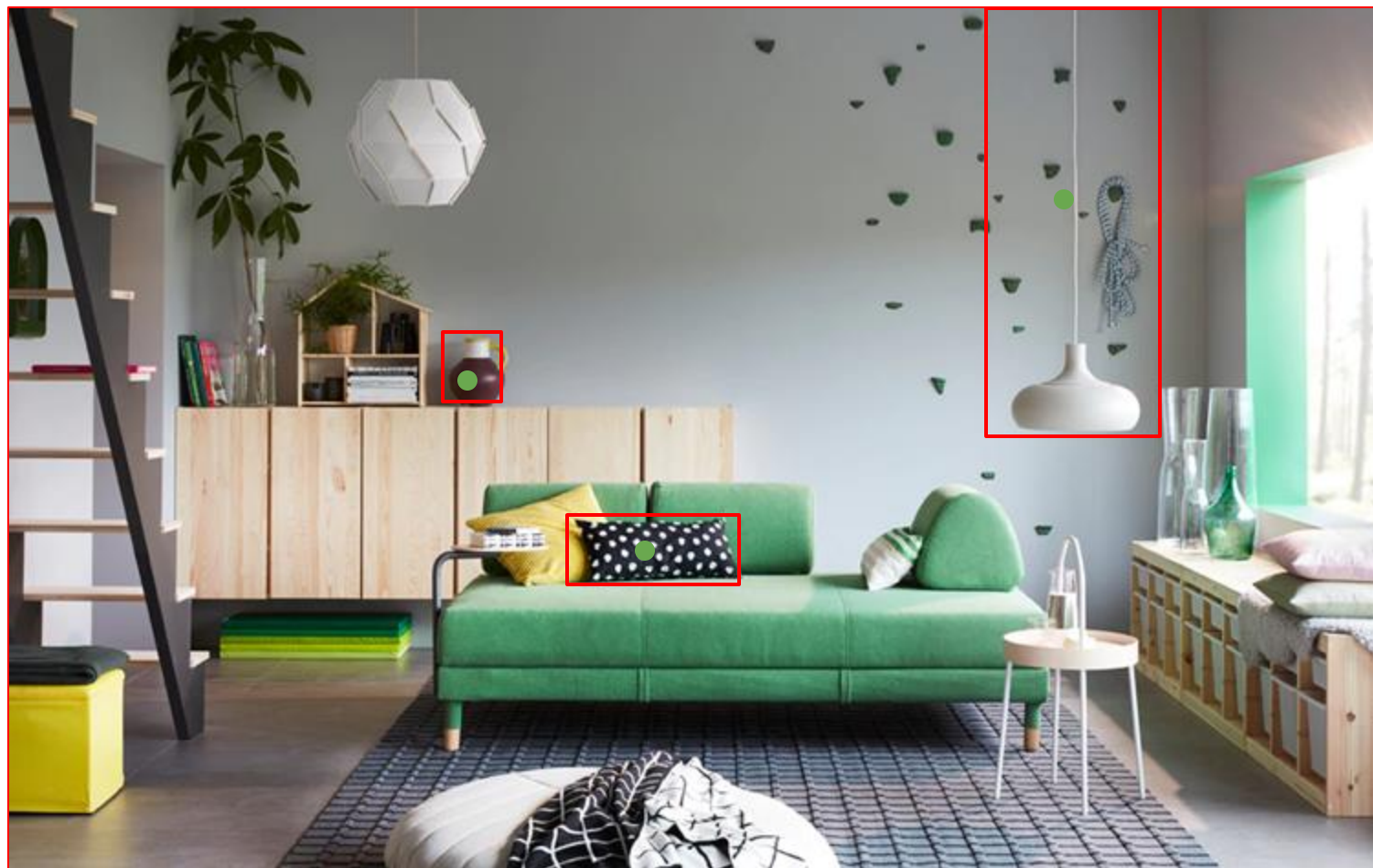


DPS ON FURNITURE

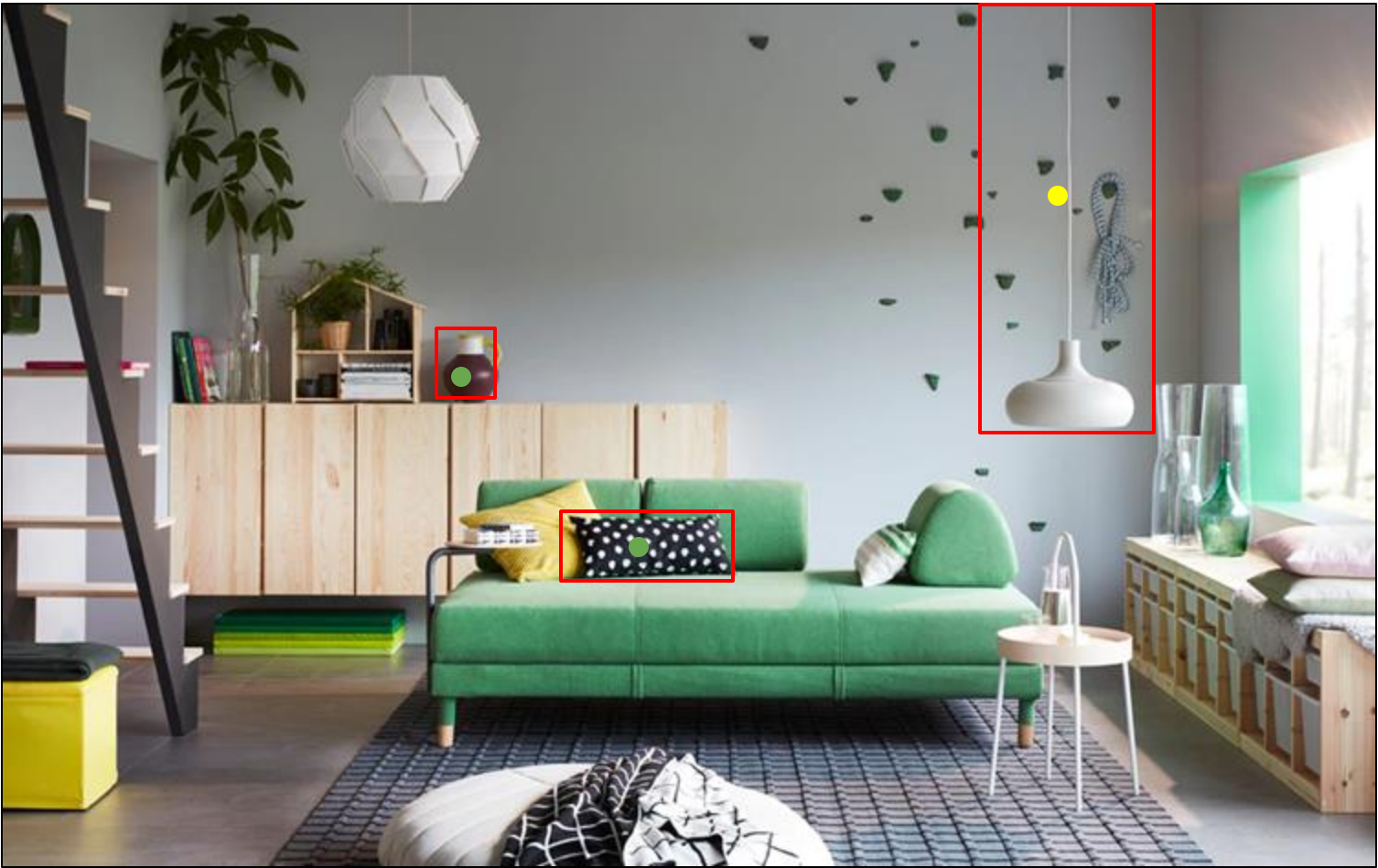
HOTSPOTS DETECTED



Query Image with detected product bounding boxes



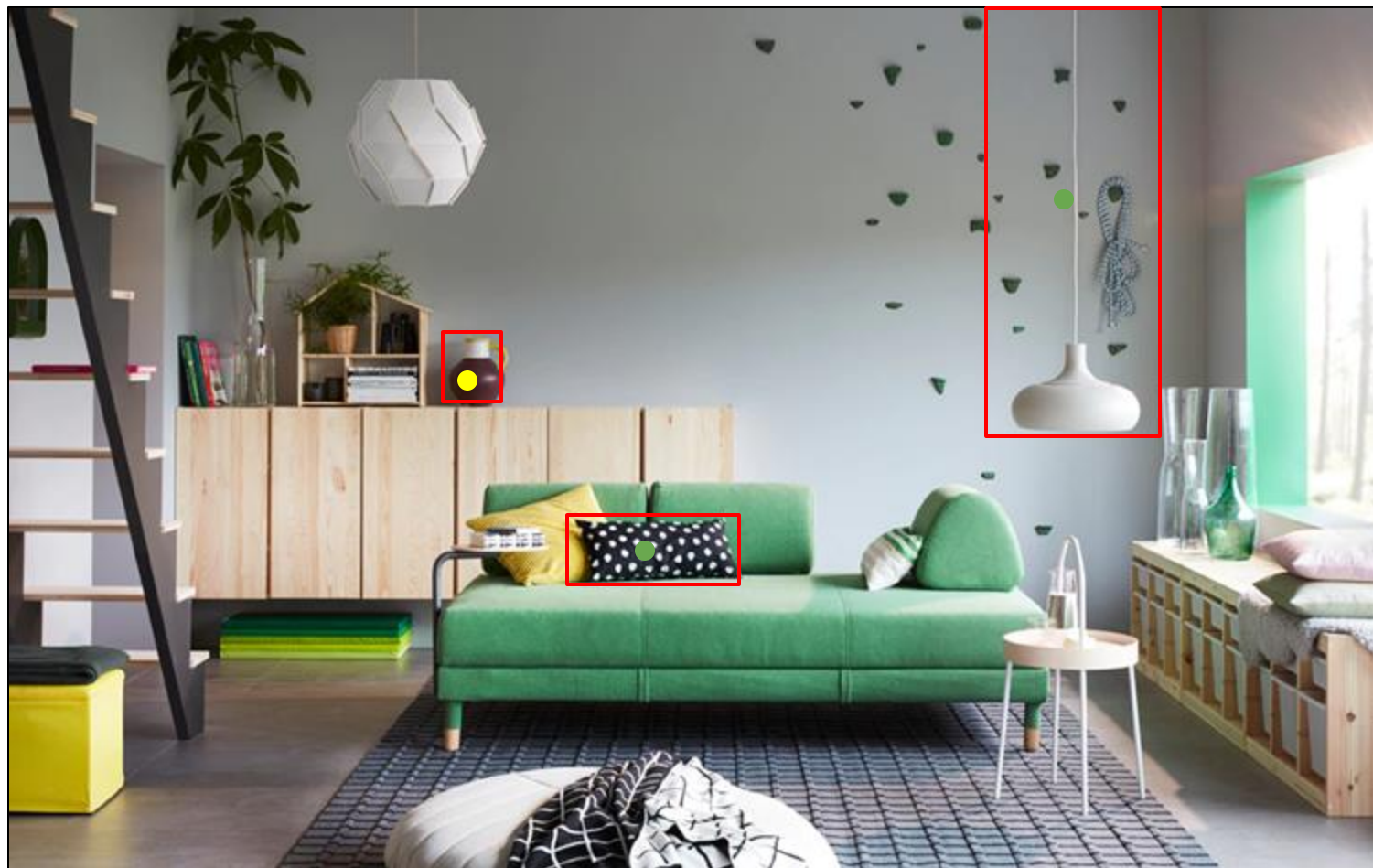
Query Image with detected product bounding boxes



Retrieved Images



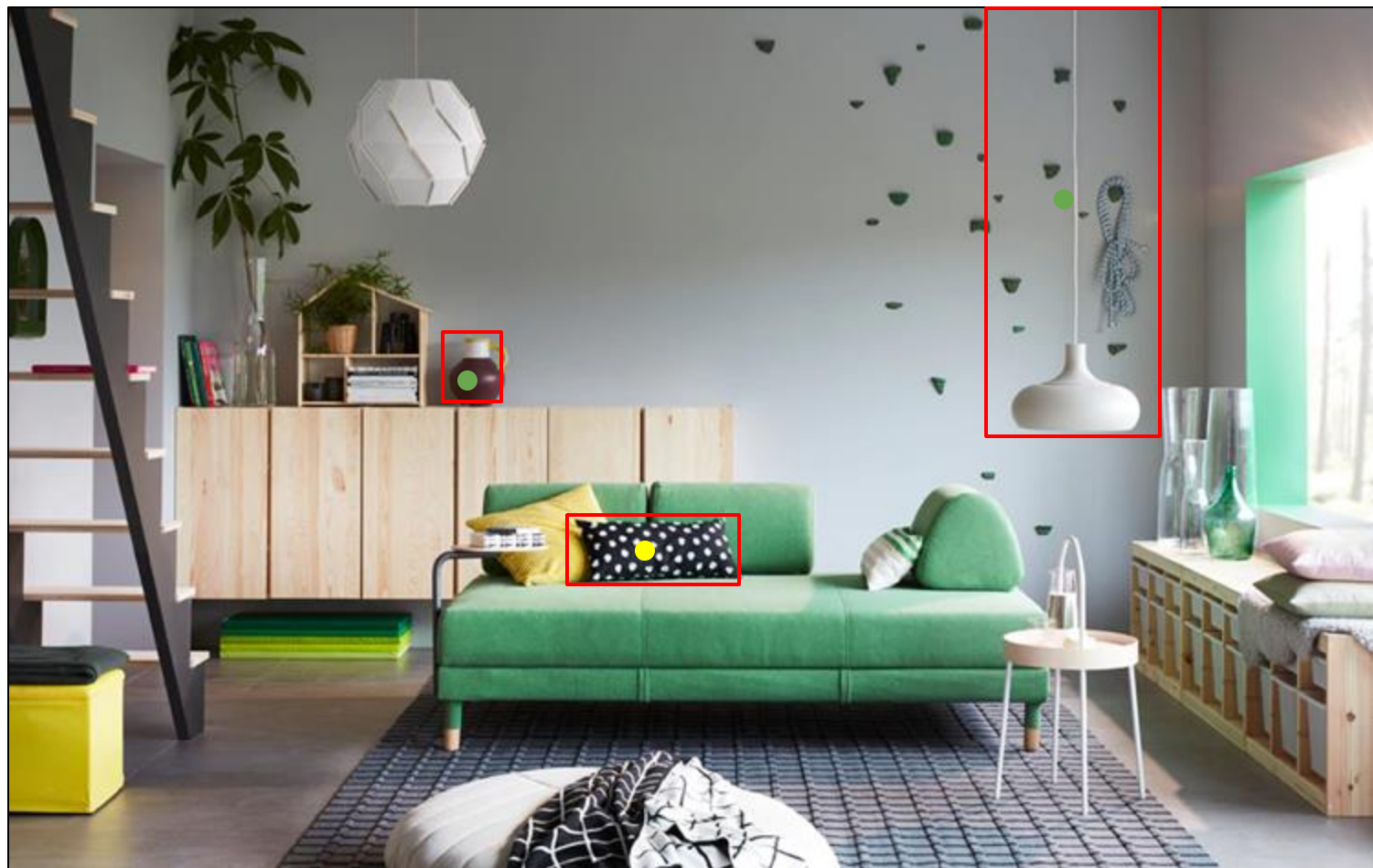
Query Image with detected product bounding boxes



Retrieved Images



Query Image with detected product bounding boxes



Retrieved Images



KNOW MORE

1. Wiki – <https://wiki.corp.adobe.com/display/DMSArchitecture/Deep+Product+Search+Overview>
2. Demo – https://git.corp.adobe.com/mdsr/DPS_demo
3. API - <https://wiki.corp.adobe.com/display/DMSArchitecture/DPS-API>

REACH US

1. DPS @ Tech Fair – 5th Feb, 6 – 9 PM
2. Team Leads – Balaji K (kbalaji), Mausoom Sarkar (msarkar)



Adobe



Adobe