

Semantic Furniture Feature Extraction

by
decorAID

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Find furnitures to realise your dream home

Click on furnitures in your image to view similar furnitures.



 FortyTwo
Valencia 3 Seater...



 FortyTwo
Cerny 4-Seater...

Breakdown of problem

How to detect and
extract furniture?

How to search for similar
furnitures?



Semantic Segmentations

Clustering & feature
extraction

Phases

Semantic Segmentations

Pre-trained models on the ADE20k dataset are sufficient and good enough

(<https://huggingface.co/spaces/shi-labs/OneFormer>)

Clustering & feature extraction

Web scraping
Data preprocessing
Model research
Model evaluation

Web scraping

Categories

Sofas	Chairs	Tables
2 Seaters	Dining Chairs	Dining Tables
3 Seaters	Office Chairs	Coffee Tables
4 Seaters & Up	Bar Stools	Side Tables
L-Shape Sofas	Dining Benches	Bedside Tables
Sofa Beds	Benches	Study Desks
Genuine Leather Sofas	Stools & Ottomans	Console Tables
Recliners	Bean Bags & Poufs	Outdoor Tables
Armchairs	Outdoor Dining Sets	Dressing Tables
Lounge Chairs	All Chairs	Bar Tables
Sofa Sets		Office Tables
Outdoor Sofas & Sets		Dining Table Sets
All Sofas	Wardrobes	
Storage	TV Consoles	
Upholstered Beds	Storage Cabinets	
Storage Beds	Bookcases & Shelves	
Bunk Beds	Sideboards & High Boards	
Metal Bed Frames	Shoe Racks & Cabinets	
Wooden Bed Frames	Kitchen Cabinets & Trolleys	
Trundle Beds	Chest of Drawers	
Bed & Mattress Packages	Office Cabinets	
Bedroom Sets	Outdoor Storage Cabinets	
Mattresses		

Product Page

fortytwo

Search furniture, mattress, home & decor...

Furniture Bed & Bath Décor Kitchen & Tabletop Lighting & Fans Kids Home Essentials Sale Trending

Home > Living Room Furniture > Sofas > 3 Seaters > Ethna 3 Seater Fabric Sofa

Ethna 3 Seater Fabric Sofa

★★★★★ 414 customer reviews
or 4 X SGD 37.48 with [Grab Info](#)

\$6229.00 **\$149.00**

To buy, select Colour Choose from options Qty: 1 Add to Cart

Add to Wishlist Email to a Friend Watch Product Video

100 Day Free Returns Free Assembly Included 300k+ Satisfied Customers 0% Instalment Plans Available

Choose your preferred product options to see the earliest delivery date available!

Description Specifications Essential Info Reviews Ask Question

This modern and functional 3 Seater sofa features comfortable fabric upholstery that is timeless and highlights the modern silhouette of the Ethna 3 Seater Sofa Brown. Crisp clean lines ensure it stands out in any space while the simplistic design ensures it works well with any interior style. Its plush design makes you feel comfortable with its thick, padded seats.

Material

- Black plastic legs
- Polyester fabric upholstery
- Solid plywood frame structure
- Hardwood internal support structure
- Black non-woven fabric lining underneath the sofa

Seat Firmness

Very Soft → Medium → Medium Firm → Extra Firm → Very Hard

Dataset features

Product title: Ethna 2 Seater Fabric Sofa



Product image
(base)



Product image
(multiple angles)



Lifestyle image

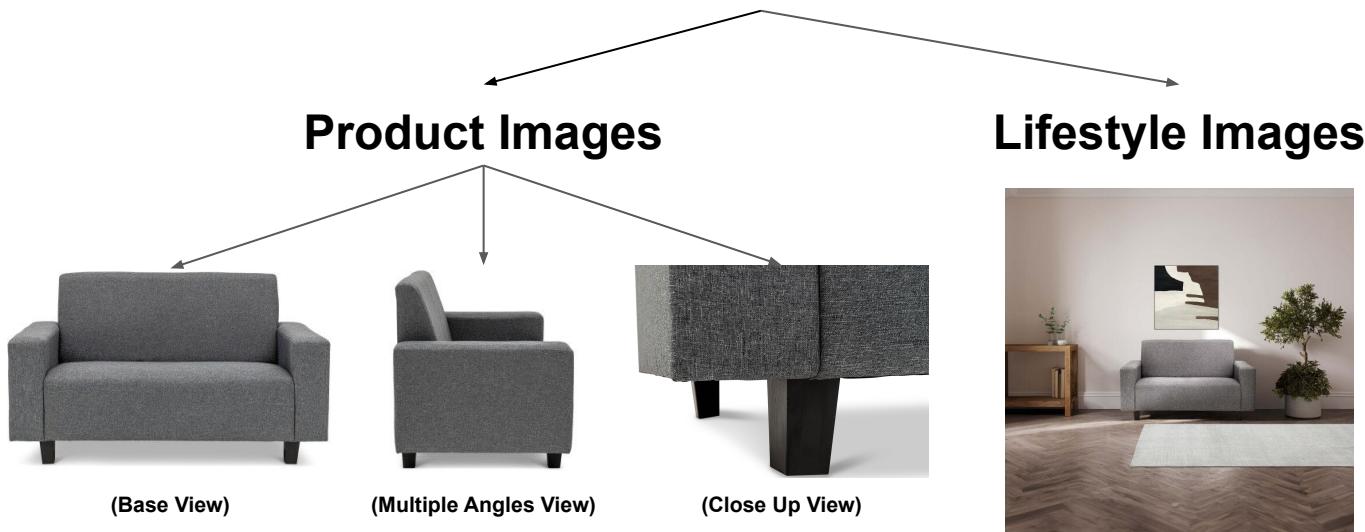


Closeup

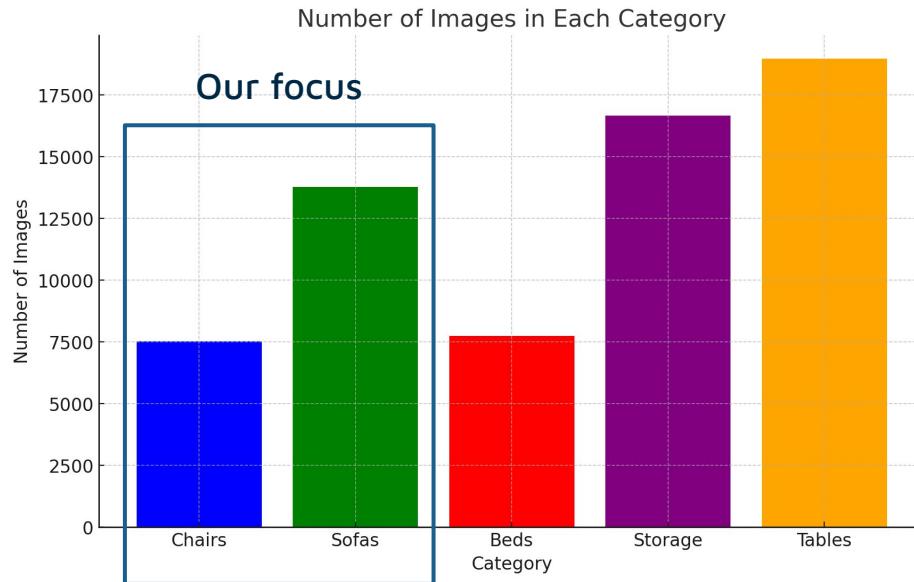
Other features extracted

Category, Subcategory, Product id, Product url, ImageUrls, Price, Colours, Description, Specifications

Types of Images



General distribution of dataset



Distribution of images more skewed towards sofas

Image Augmentation

Original



Rotated



Blurred



Noise



Image augmentation can be used to diversify our training dataset as well

Problems

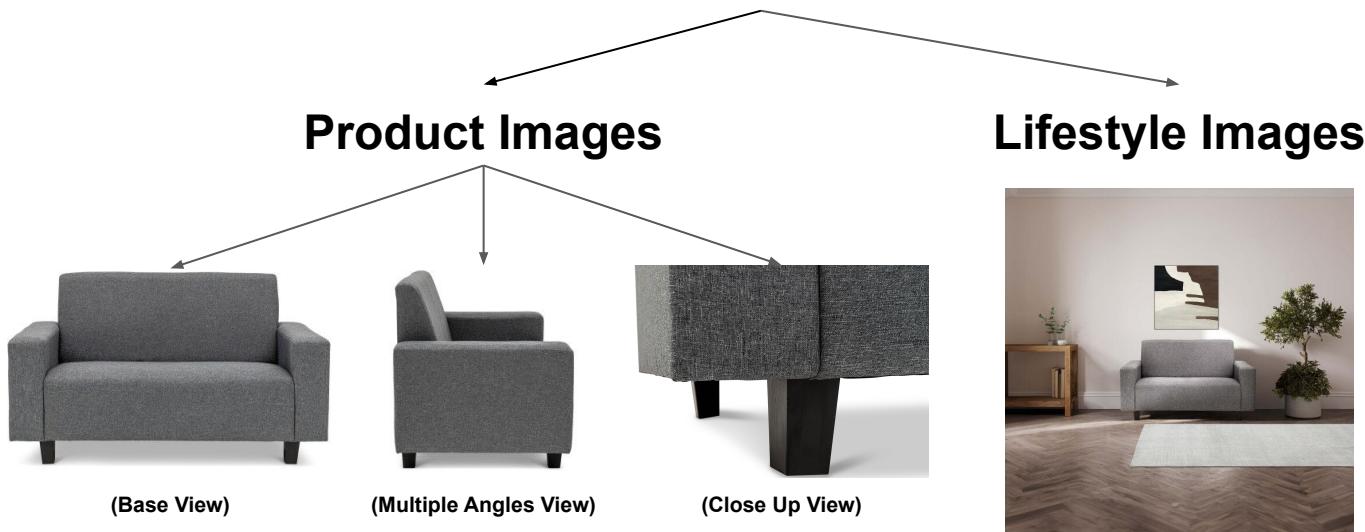


Product images
mislabeled as
lifestyle images



Text in images

Types of Images



Percent Coverage

High

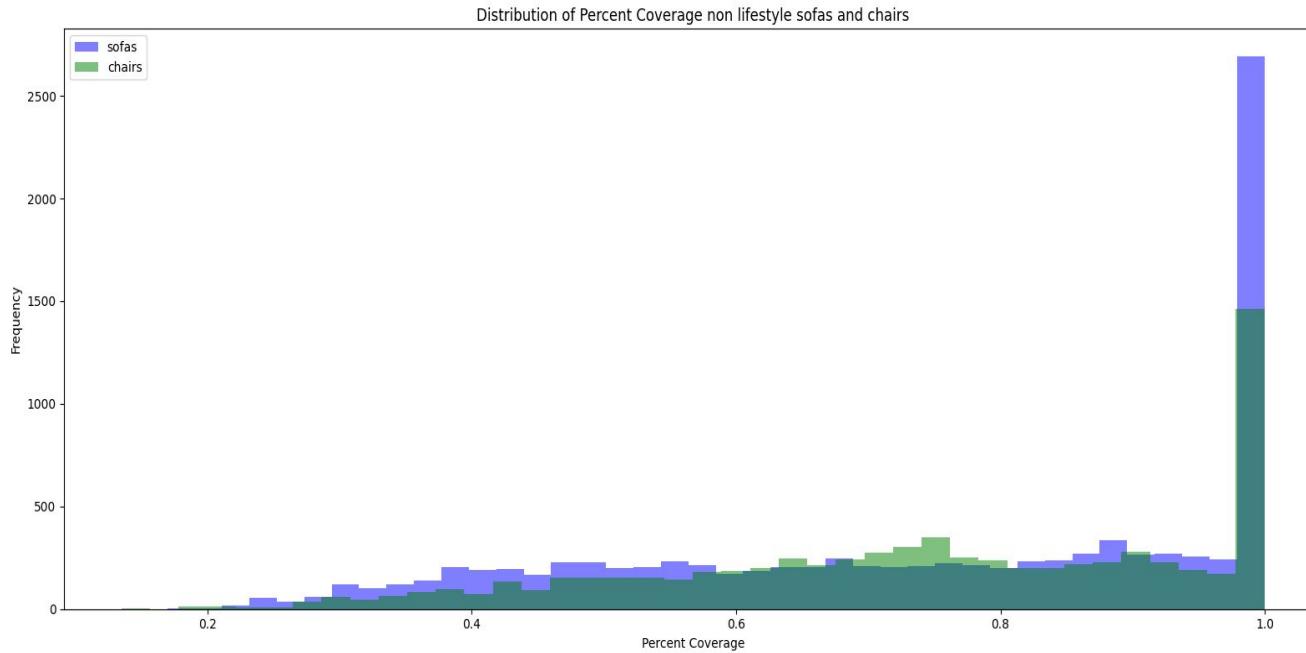


Low



- We notice product images have white background with the furniture centered
- Create bounding box covering the non-white pixels
- Coverage = bounding box area / image area

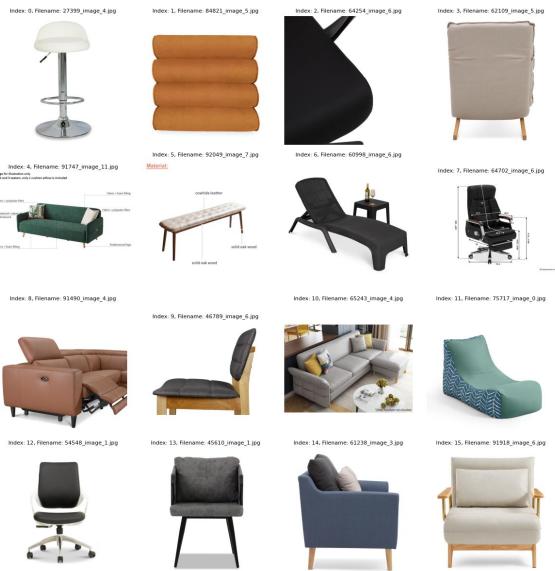
Percent Coverage



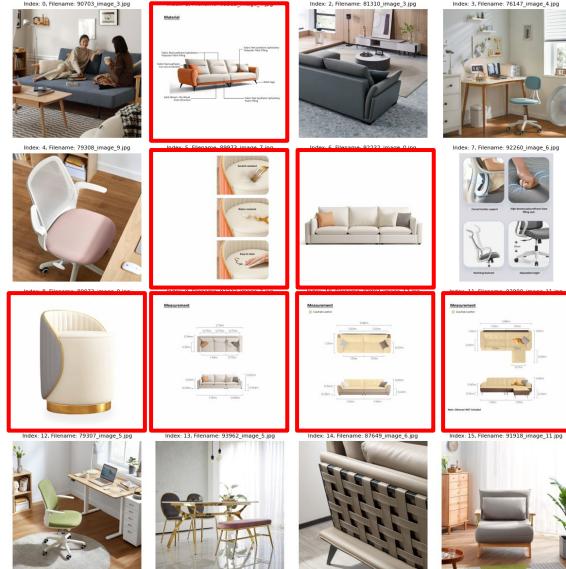
Visual identification on the distribution by displaying threshold of images in grids

Problems with Percent Coverage

< 0.99



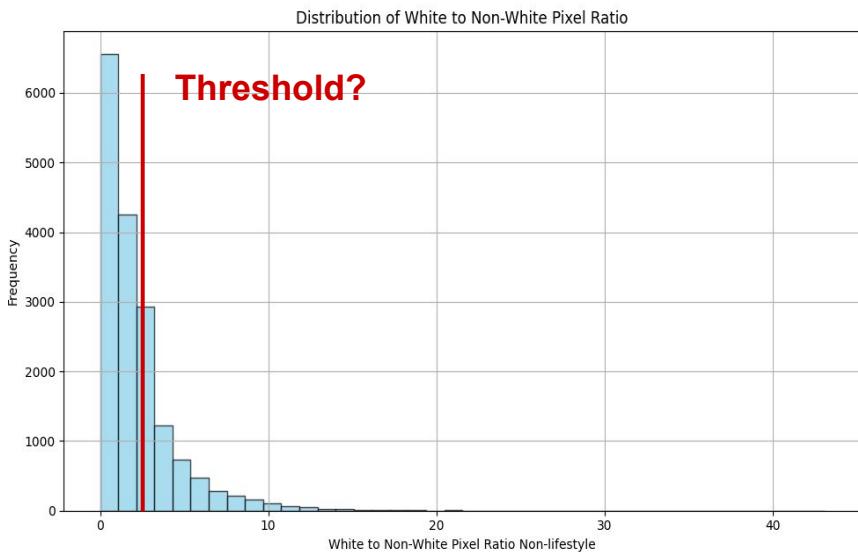
>= 0.99



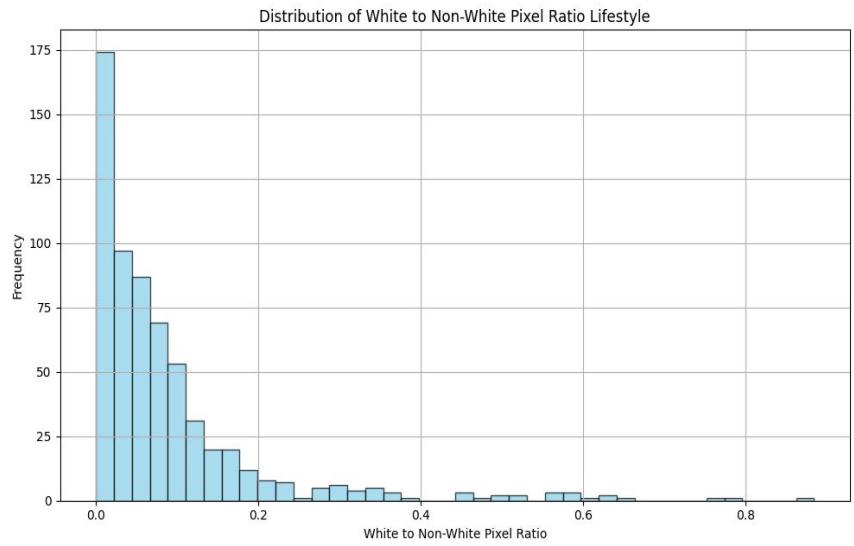
No clear distinction of lifestyle and product images

White to Non-White Pixel Ratio

Product Images



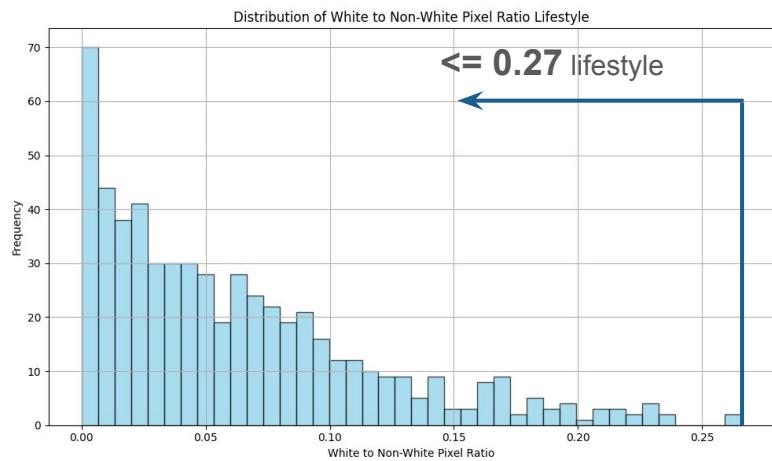
Known Lifestyle Images Only



Using correctly labelled lifestyle images from our pool as a guide to find the threshold for product images

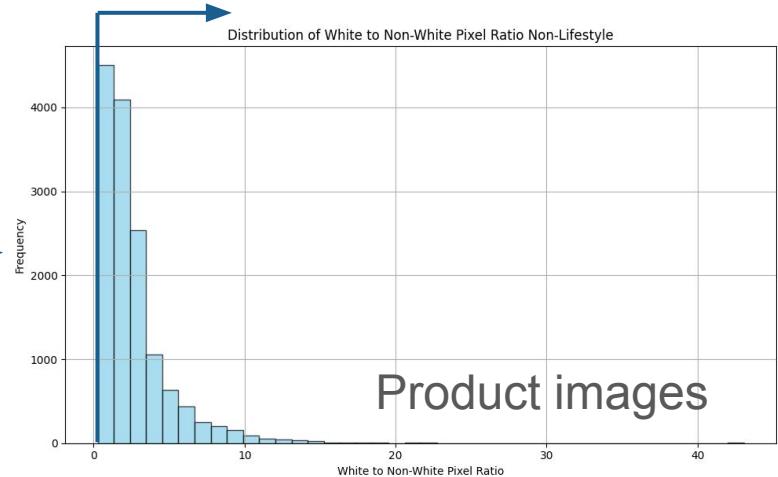
White to Non-White Pixel Ratio

Known lifestyle images



```
Q1 = lifestyle['white_to_non_white_ratio'].quantile(0.25)
Q3 = lifestyle['white_to_non_white_ratio'].quantile(0.75)
IQR = Q3 - Q1
lower_bound = Q1 - 3 * IQR
upper_bound = Q3 + 3 * IQR
# Exclude outliers
lifestyle_no_outliers = lifestyle[(lifestyle['white_to_non_white_ratio'] >= lower_bound) &
                                    (lifestyle['white_to_non_white_ratio'] <= upper_bound)]
```

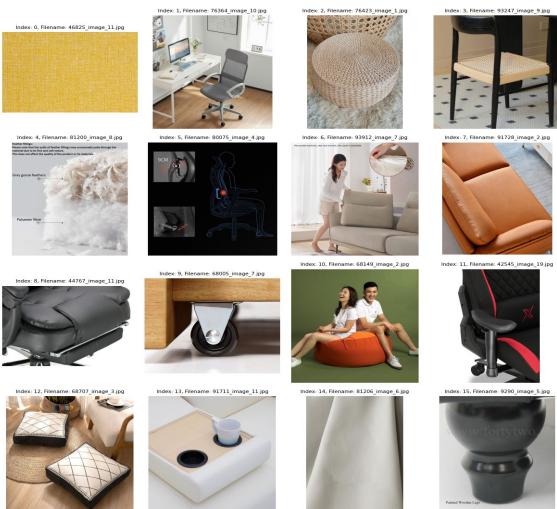
Product images with mislabelled data
>>0.27 == product image



Plotted image grids for different thresholds to visualise pattern

White to Non-White Pixel Ratio

≤ 0.27



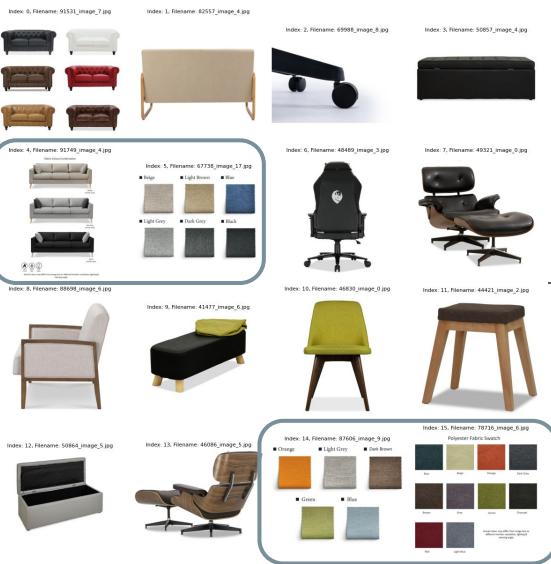
> 0.27



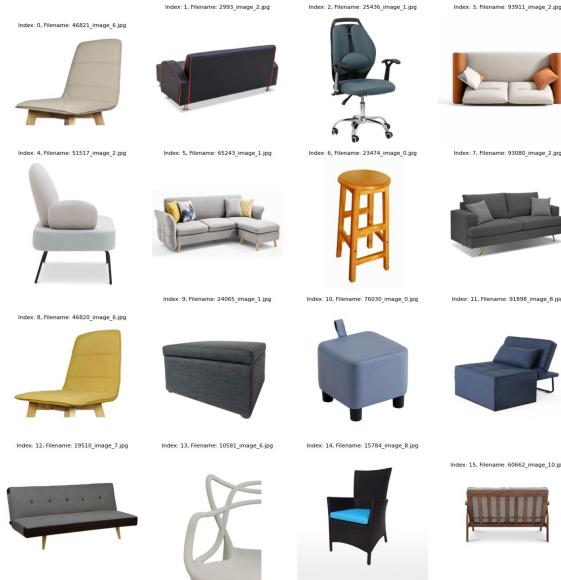
Plotted image grids for different thresholds to visualise pattern

Removing Images with Text

Using Tesseract

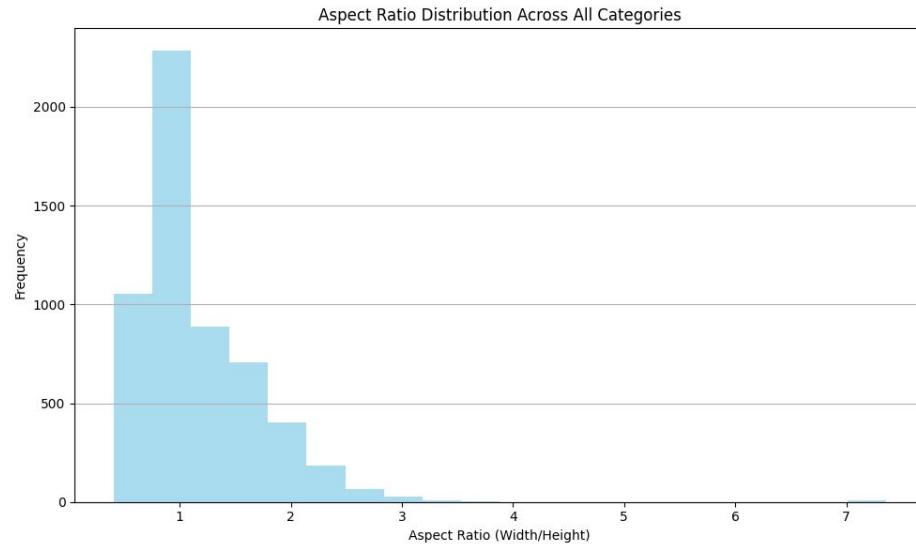


Images with text removed

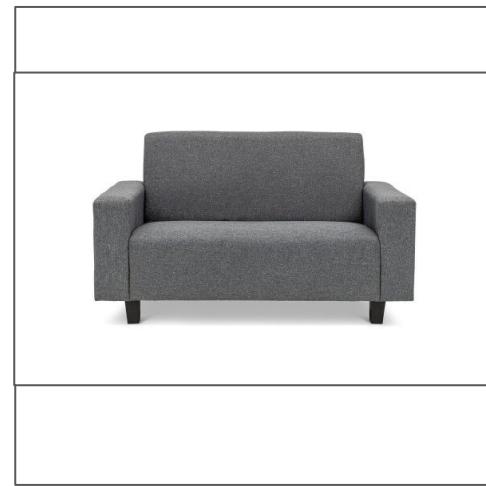


The images in our dataset are now cleaner with the removal of images with text

Aspect Ratio, Resizing and Padding



Most images used are square in shape



Resized to 512 x 512 pixels, then padded if needed

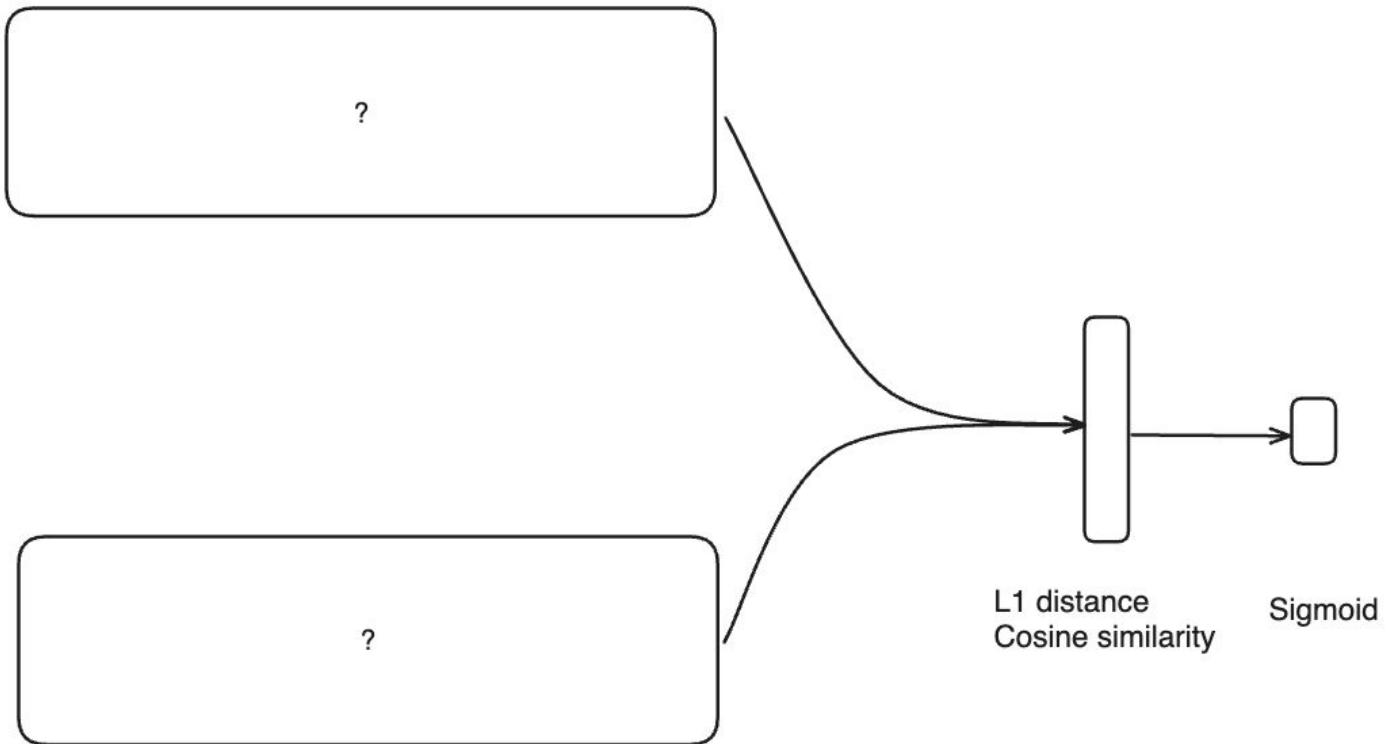
Distilling the Problem

1. Fingerprint a furniture by representing it as a feature vector
2. Cluster similar furniture and separate dissimilar furniture



Siamese Network

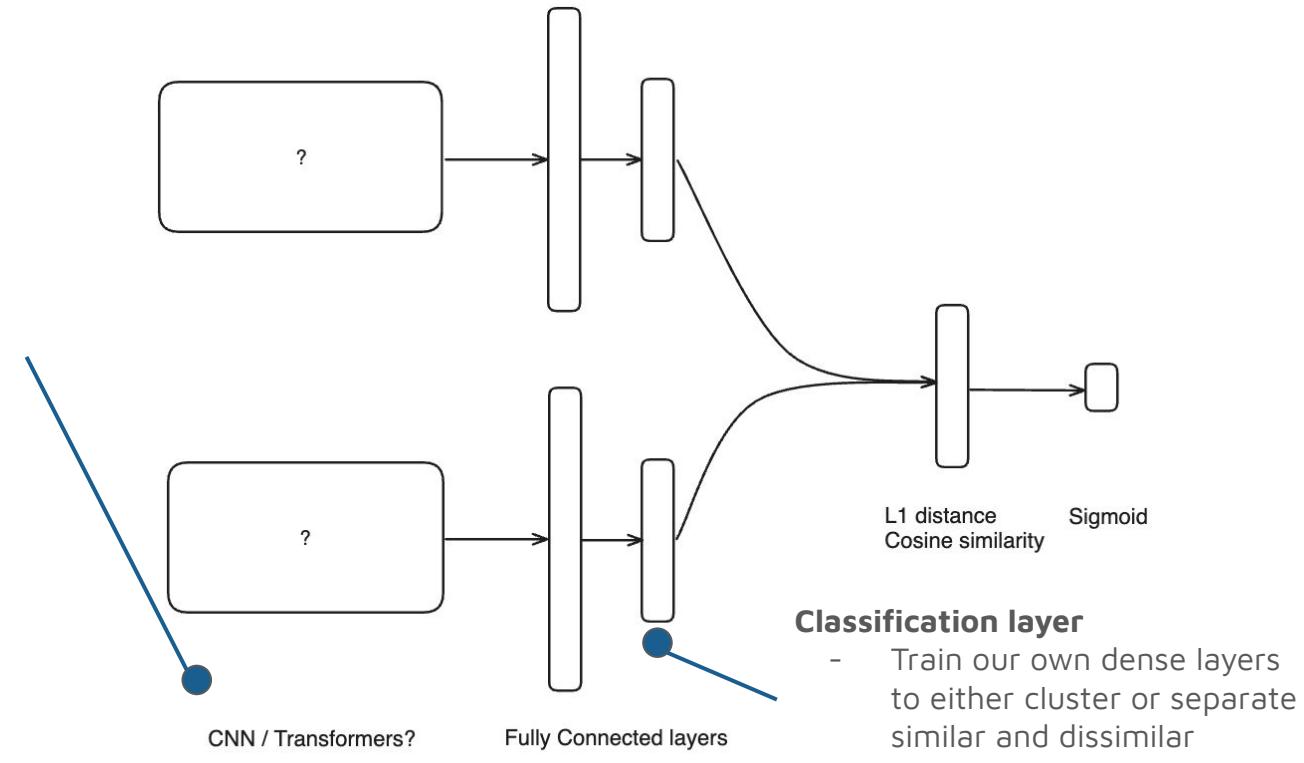
Siamese Network: Overview



Siamese Network: Gameplan

Utilise transfer learning

- Use pre-trained models without classification layers to extract feature vectors
- These feature vectors serve as a more abstract fingerprint of furnitures
- More suitable for our task that involve very vague concepts like style



Setting Up Data Pipeline: Data Generator



Given a batch size of 2 and number of pairs set as 6:

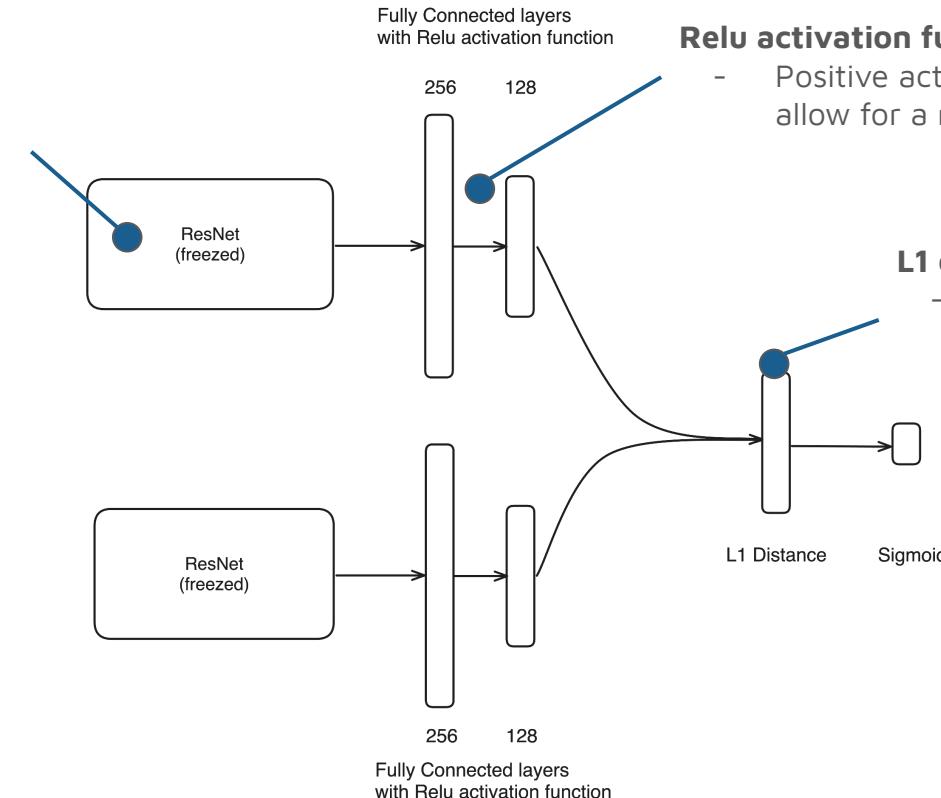
- Each batch will contain 12 images
 - 2 main images
 - Each of the 2 main images will have 3 similar and 3 dissimilar pairs
- Similarity is determined by the product's sub-category, therefore is only either 1 or 0

1 epoch = 1 full pass through the dataset

CNN: ResNet

Pre-trained ResNet without classification layer

- Take advantage of existing ResNet knowledge
- Use it to fingerprint furniture



Fully connected layer

- Train to cluster or separate feature vectors

Relu activation function

- Positive activations without bounds allow for a richer feature representation

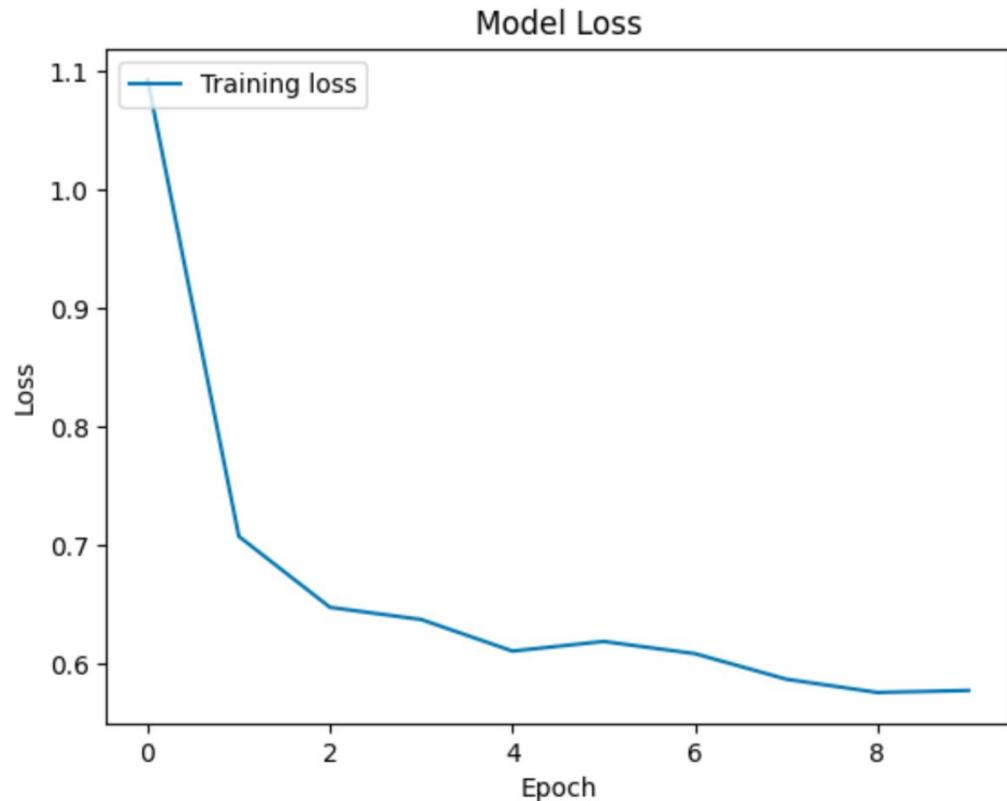
L1 distance

- Considering cosine similarity instead to capture style

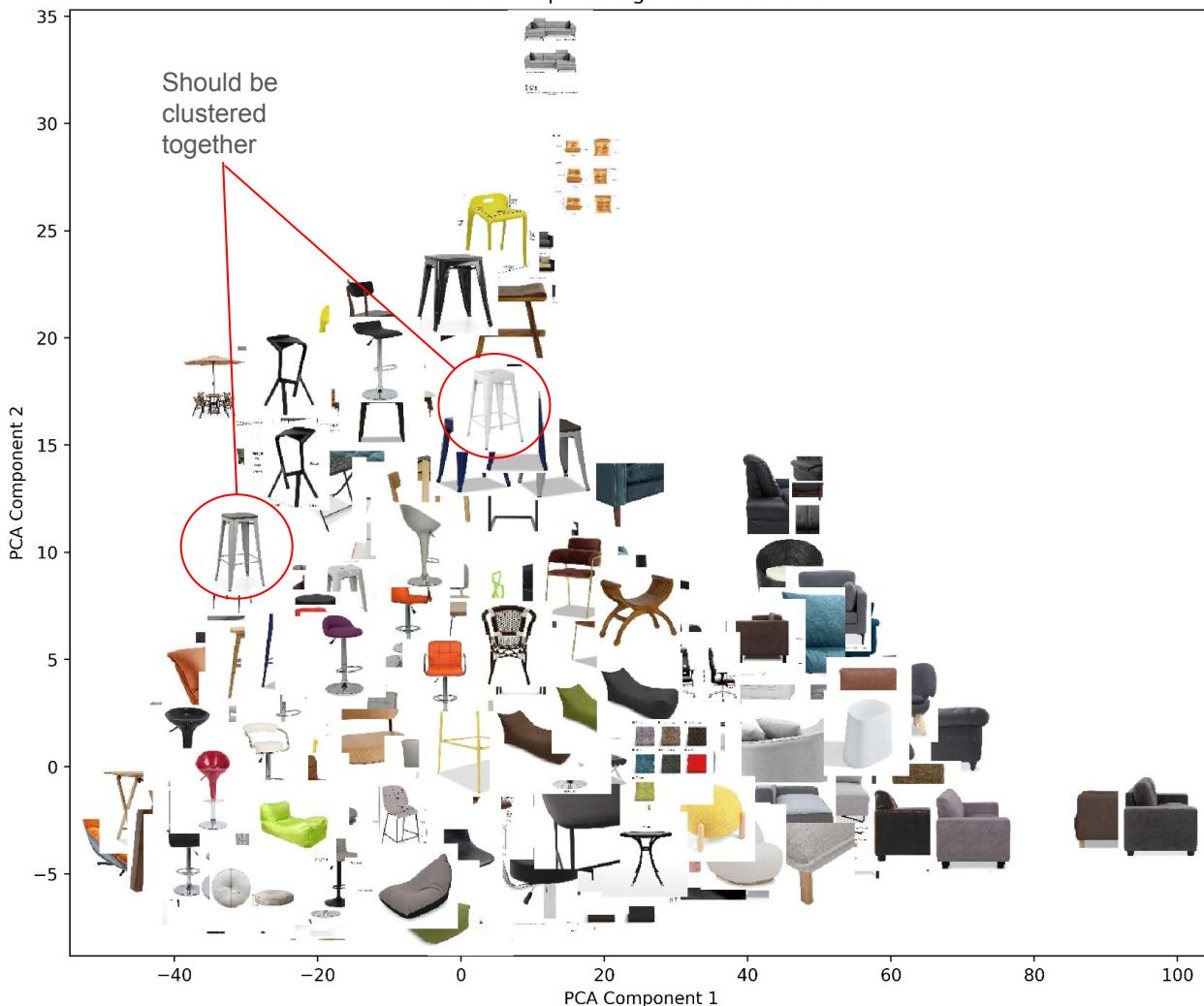
CNN: ResNet

- 10 Epochs
- Batch size of 4 with number of pairs set to 16
 - 64 pairs of images per batch
- LR = 0.0001
- LR scheduler set to lower LR by a factor of 0.2 on loss plateau

6.5 hr P100 GPU time



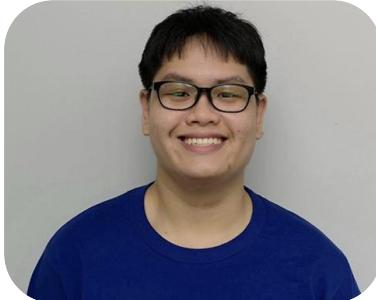
Cluster Map of Images with Thumbnails



Next Steps

1. Dataset labelling needs to be better
 - Judgement of similarity must be improved
 - Sub category do not measure the nuances of style and aesthetic
 - A pure binary similarity score also does not capture nuances of furniture
2. We could use transformer based architecture like Clip instead of ResNet

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