SizeNet

Weakly Supervised Learning of Visual Size and Fit in Fashion Images

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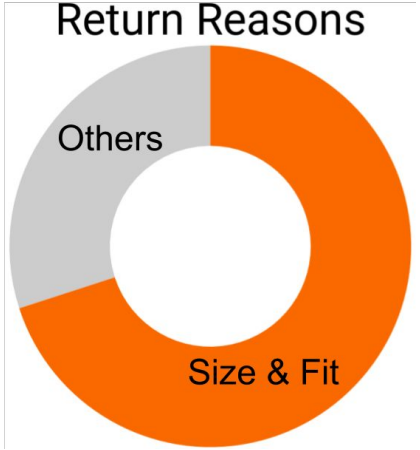
Motivation



Finding clothes that fit is the biggest problem for customers shopping online and offline

Motivation

Supporting customers on their size and fit purchase decision is a challenging problem:

- Thousands of new articles everyday with short lifetime
- Return process takes a few days to few weeks
- Zero or few sales and returns for new articles

Contributions

We present a novel teacher-student approach:

- Demonstrate the rich value of fashion images in inferring size characteristics of fashion apparel
- Effectively tackle the challenging cold start problem of providing size advice for new articles using images
- Generate large scale confidence-weighted weak annotations from crowd's subjective feedback → control weak annotations influence on the final model

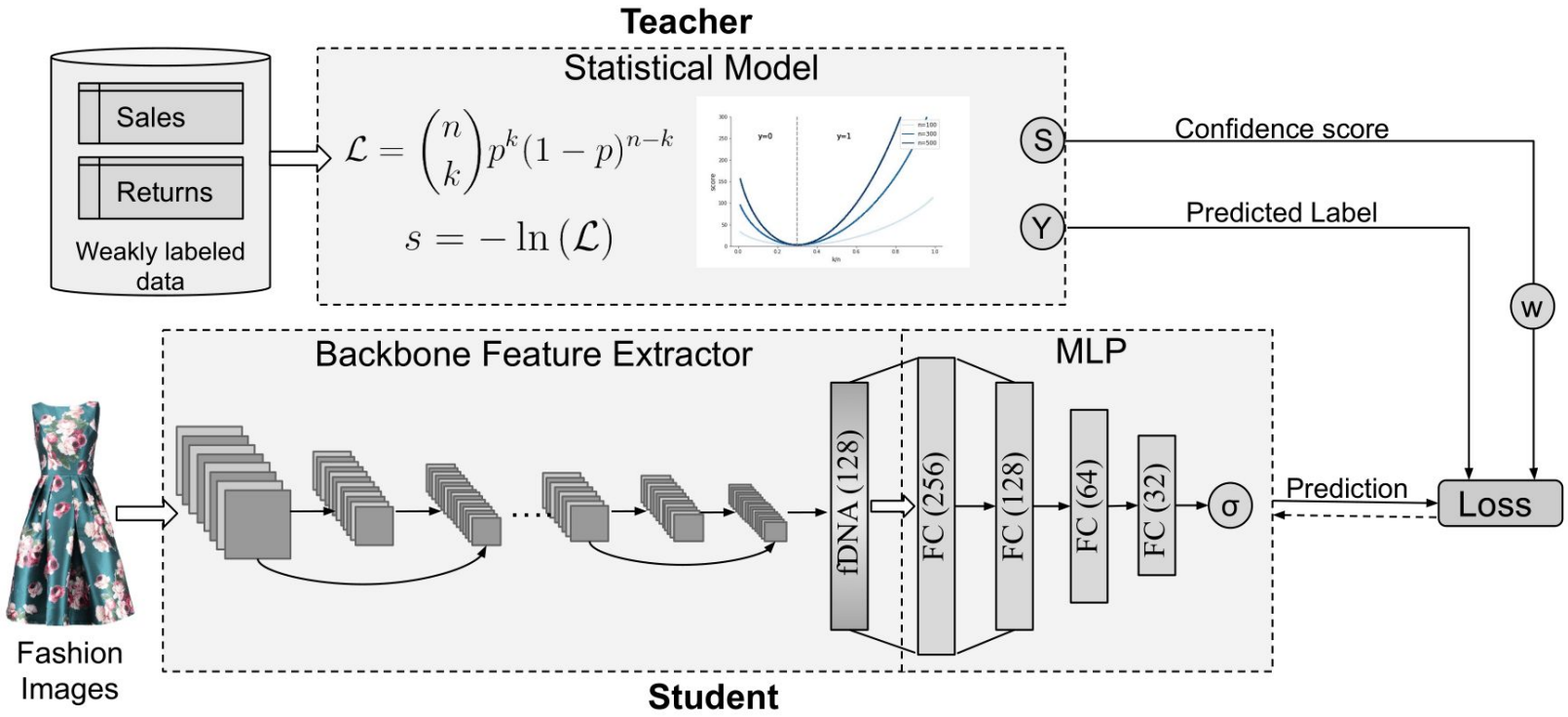
Related Work

Teacher-Student Transfer Learning

Transferring knowledge from privileged information space to decision space [Vapnik et al. JMLR15]:

- Teacher leverages privileged historical weakly annotated data of sales and returns
- Student uses this knowledge to learn from images in decision space

Approach



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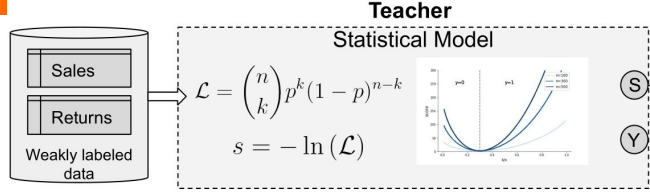
Approach - Teacher



Data

Weakly annotated data from customers subjective feedback provided in the return process

Statistical Modeling

Binomial classifier considering two factors:

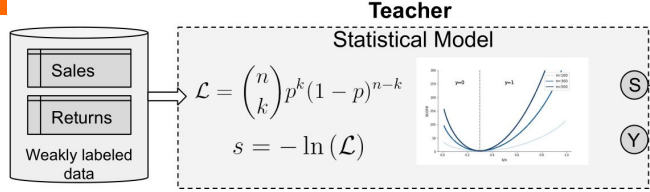
- Article category

  Different categories show different size return rate (high heels vs. sneakers)

- Article lifetime

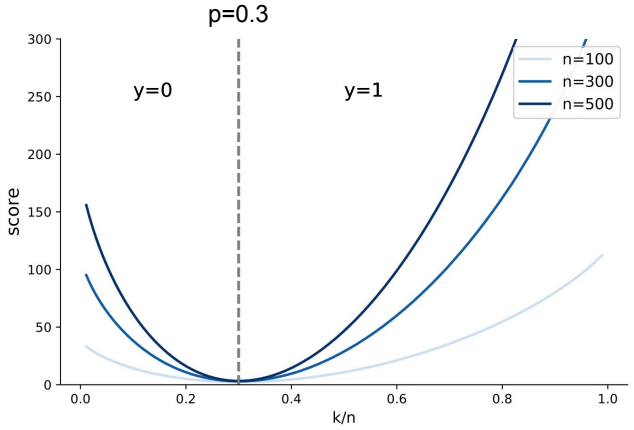
  Article sales period influence return rate (seasonality, sales, etc.)

Approach - Teacher



Binomial Likelihood $\mathcal{L} = \binom{n}{k} p^k (1-p)^{n-k}$

p: expected size return rate of article category over the sales period
k: size returns of the item
n: sales of the item



Estimator Score

Based on negative logarithm of likelihood

$$s = -\ln(\mathcal{L})$$

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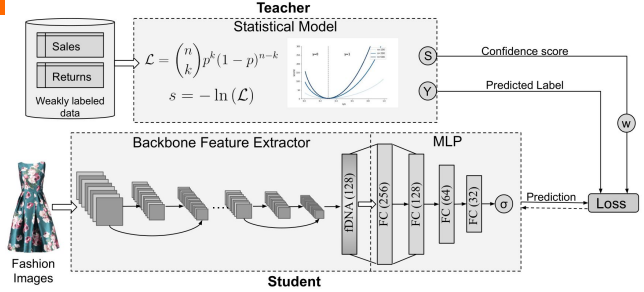
Student - SizeNet

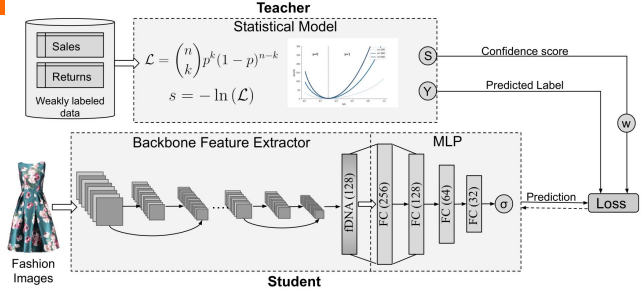


CNN Backbone Feature Extractor

Transfer knowledge using bottleneck features of pre-trained network

- Resnet [He et al. CVPR16] pre-trained on ImageNet dataset [Deng et al. CVPR09]
- FashionDNA [Bracher et al. KDD16] pre-trained on in-house rich fashion dataset of 1.3 million articles

Student - SizeNet



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Multi-Layer Perceptron

4 fully connected layers with nonlinear activations

Use binary cross entropy loss weighted based on estimator confidence score

$$w = \ln(1 + s)$$

logarithmic transformation of score allows us to reduce the skewness

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Dataset

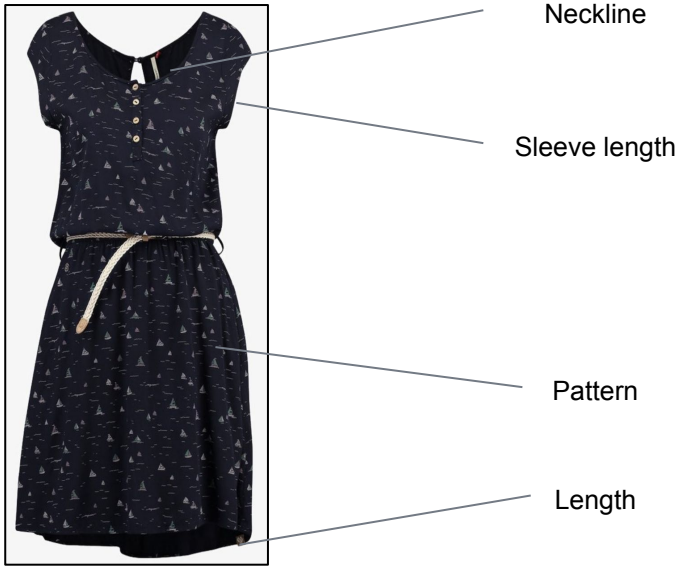
- 127K articles of women textile including 12 categories such as: dresses, blouses, jeans, skirts, jackets, etc.
- Config SKU level
  - Manufacturers use different fabrics depending on the dying technique
  - Customers don’t perceive size and fit the same way depending on the color of clothes

Class	#Articles	# Images
size issue	68,892	69,064
no size issue	58,152	58,321
total	127,044	127,385

Evaluation - Baseline

Attributes

Replace article images with sparse k-hot encoding of *human annotated* binary fashion attributes



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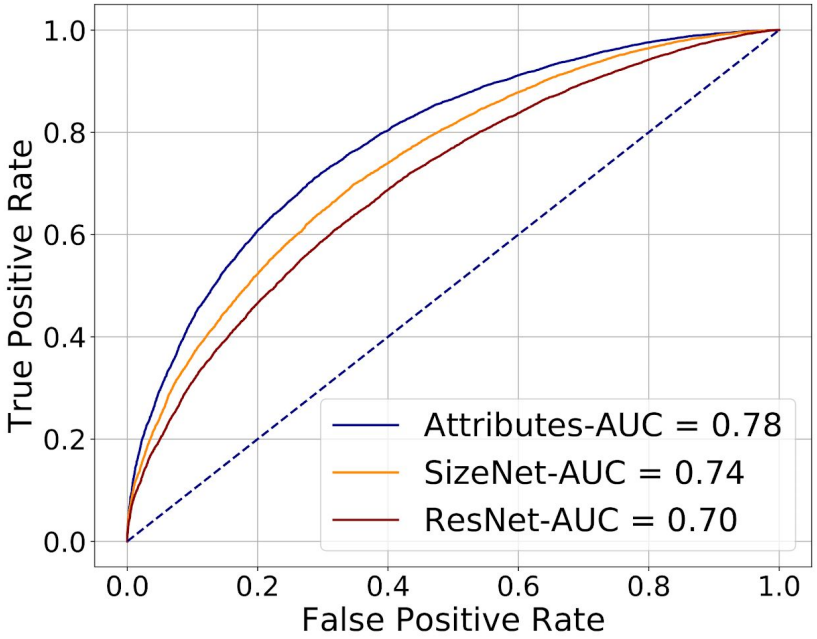
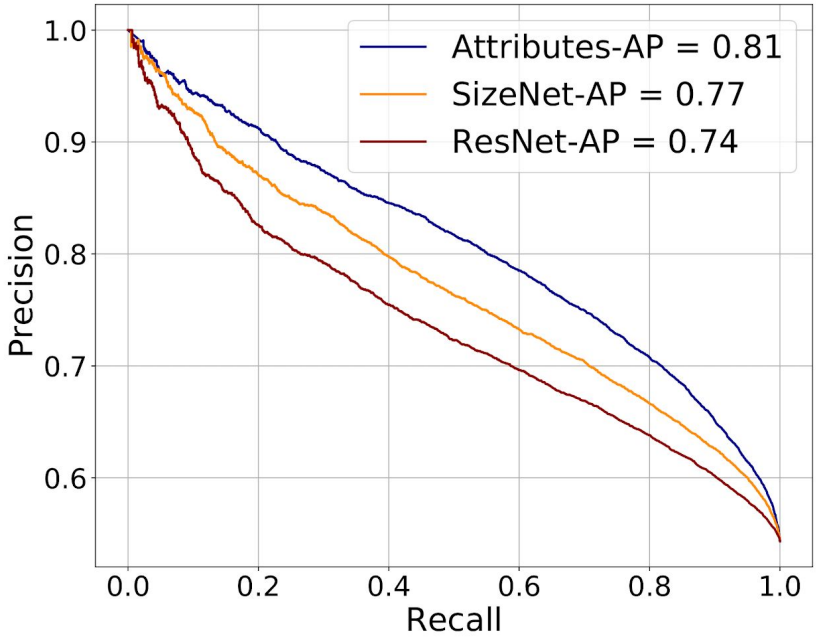
Evaluation - Baseline





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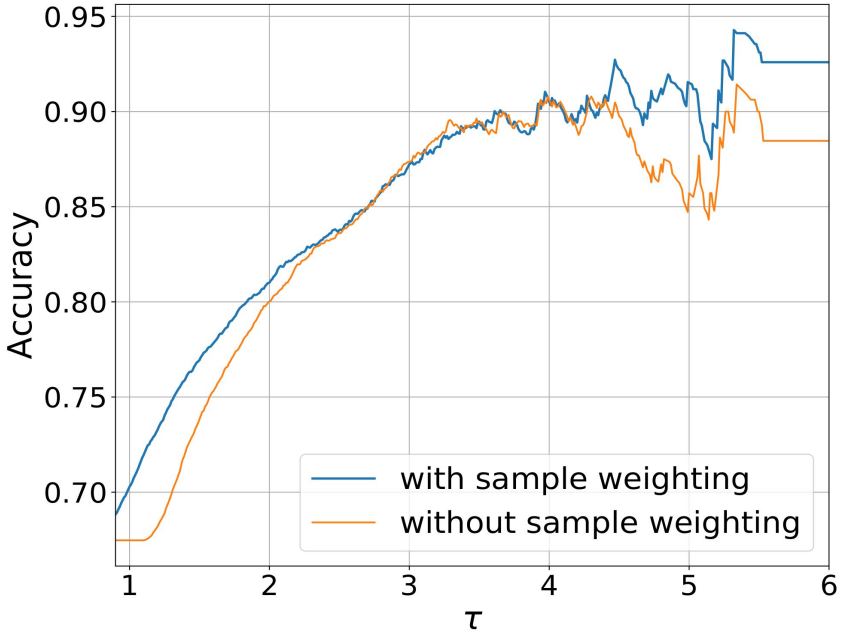
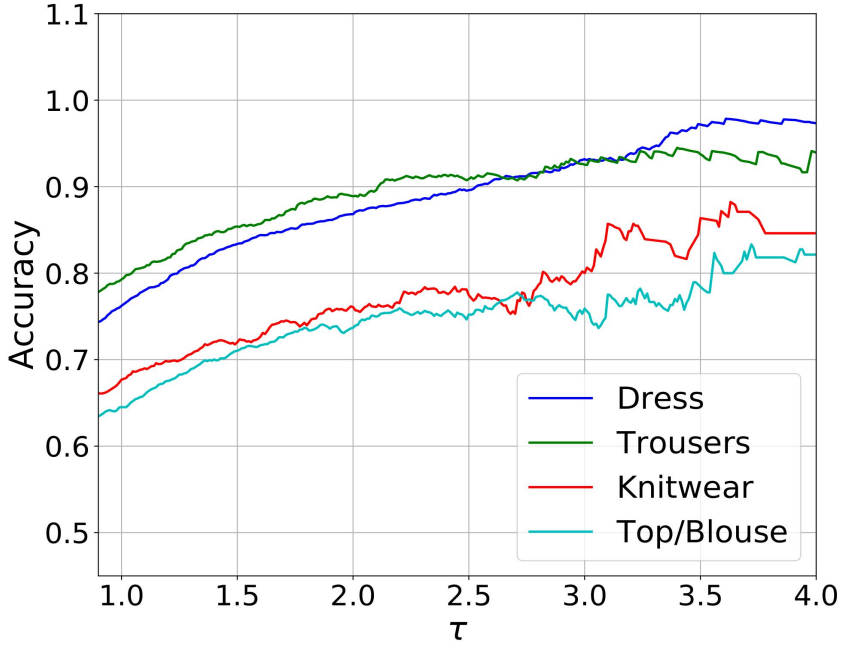
Evaluation - Weights Importance





τ threshold applied on weights

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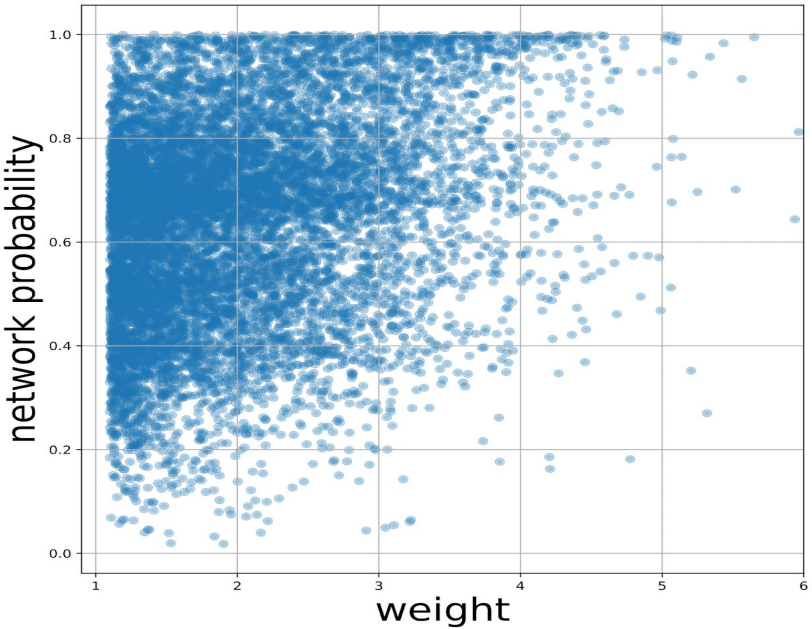
Evaluation - Size Issue Probability vs. Weights

- **Bottom right**
  almost no samples are misclassified by SizeNet when Teacher is certain of no size issue;
- **Top left**
  high density of correctly predicted samples by SizeNet where Teacher is unsure
- **Top right**
  samples show that SizeNet has learned accurately from Teacher
- **Bottom left**
  SizeNet misclassifies fewer samples where Teacher is unsure



Class Size Issue

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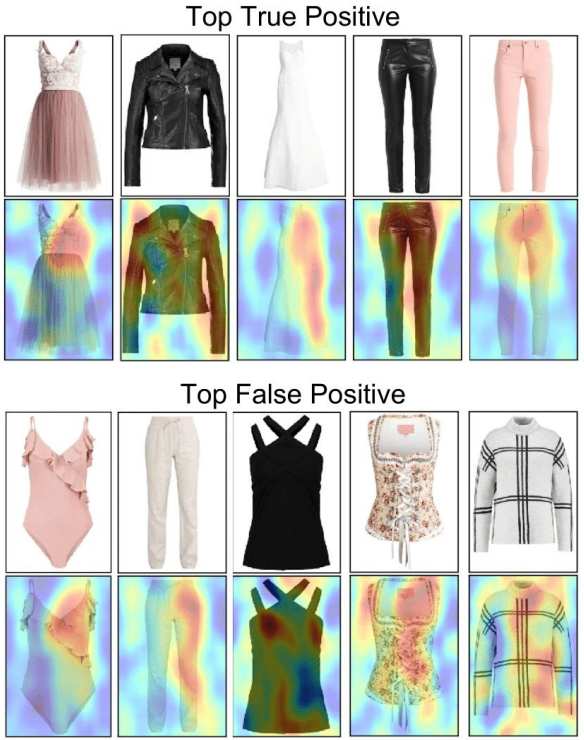
Evaluation - Size Issue Explanations

Generate Explanations using RISE [Petsiuk et al. BMCV19]

- Randomly generate masked input
- Use the corresponding outputs to assess region saliency

Insights

- True positives show more localized heatmaps
- False positives show more expanded maps
- False positives are affected by article design



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Conclusion

- Fashion images in fact contain information about article size and fit issues
- Fashion images are valuable assets in tackling the challenging cold start problem

Future Work

- Include expert-labeled data
- Explore generalization capacity to fashion images in the wild
- Evaluate SizeNet explanations to understand if they correspond to actual customer problems

Thanks!

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