

Fashion Image Classification Using Convolutional Neural Networks (CNNs)

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Introduction

- Implemented and evaluated CNN-based models (ResNet18, EfficientNetB0) for fashion image classification.
- Performed multi-class classification to categorize fashion items into broad categories (such as Apparel, Footwear, Accessories, etc.) with high accuracy, improving the overall product categorization process.

Motivation

- The fashion industry relies on efficient product categorization for inventory management and e-commerce.
- E-commerce platforms need accurate and efficient product categorization for better search, filtering, and personalized recommendations.
- Manual classification is time-consuming/inefficient, error-prone, and inconsistent.
- Automating classification using deep learning increases accuracy, reduces human error and operational costs, and improves search functionality and user experience.

Machine Learning Models Used

Convolutional Neural Networks (CNNs):

- Used to extract visual features and patterns from fashion product images.
- **ResNet18** :
 - Uses residual learning to train deep networks efficiently without vanishing gradients.
- **EfficientNetB0** :
 - Uses compound scaling to balance network depth, width, and resolution for optimal performance

Dataset

- Fashion Product Images Dataset:
 - <https://www.kaggle.com/datasets/paramaggarwal/fashion-product-images-dataset>
- Fashion Product Images Dataset (Small):
 - <https://www.kaggle.com/datasets/paramaggarwal/fashion-product-images-small>
- 44,000 products with multiple category labels, descriptions and images



Fashion Product Images Dataset

Updated 6 years ago

Usability **10.0** · 25 GB



Fashion Product Images (Small)

Updated 6 years ago

Usability **10.0** · 1 File (UNSPECIFIED, CSV) · 593 MB

Data Explorer

15.71 GB

▼  fashion-dataset

▶  images

▶  styles


 images.csv

 styles.csv

Data Explorer

572.13 MB

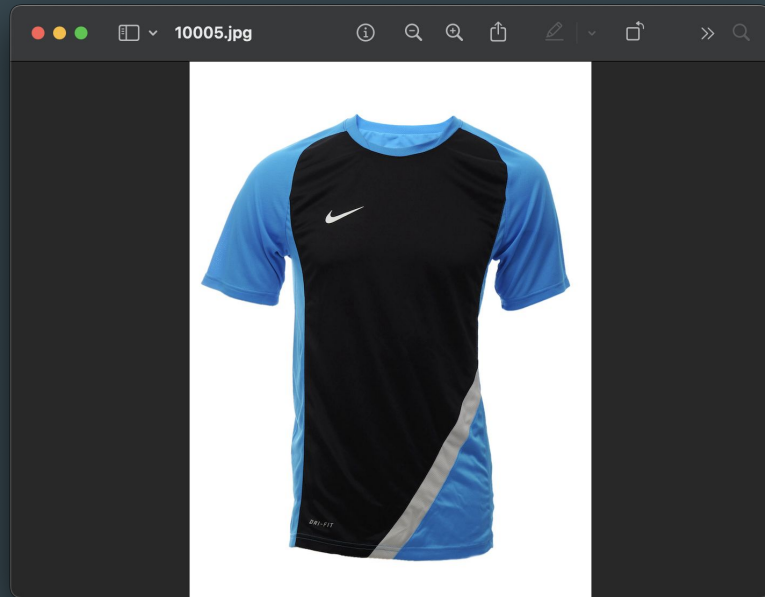
▶  images

 styles.csv

Dataset (Continued)

- ▼ fashion-dataset
 - ▼ images
 - 10000.jpg
 - 10001.jpg
 - 10002.jpg
 - 10003.jpg
 - 10004.jpg
 - 10005.jpg

- ▼ fashion-dataset
 - images
 - ▼ styles
 - {i} 10000.json
 - {i} 10001.json
 - {i} 10002.json
 - {i} 10003.json
 - {i} 10004.json
 - {i} 10005.json

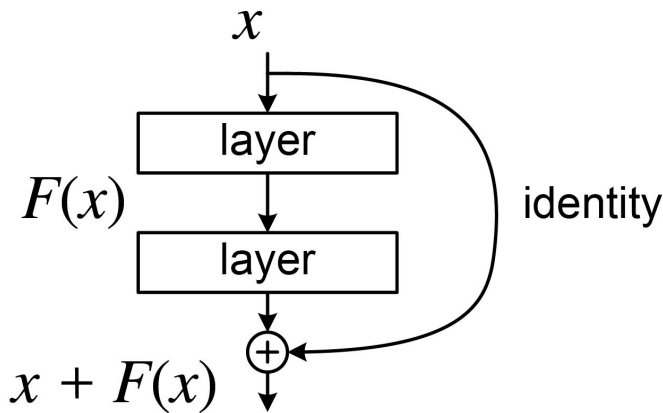


styles.csv (4.33 MB)

```
1 id,gender,masterCategory,subCategory,articleType,baseColour,season,year,usage,productDisplayName
2 10005,Men,Apparel,Topwear,Tshirts,Blue,Fall,2011,Sports,Nike Men As Ss Trainin Blue T-Shirts
```

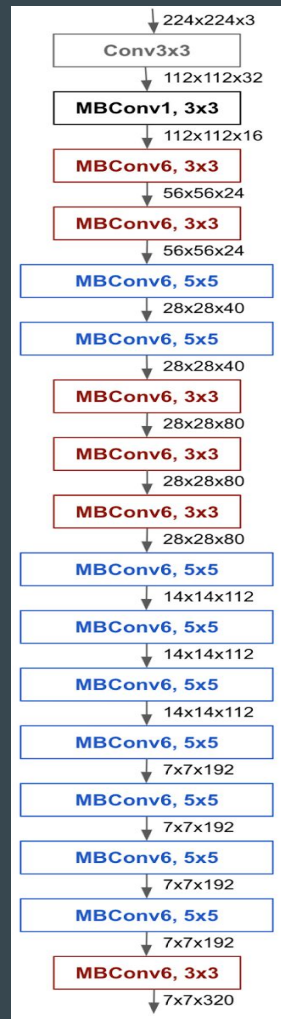
Resnet

- Easy to train even when deep.
 - Good baseline performance on image classification tasks.
 - Robust and widely adopted.
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- Solves the **vanishing gradient** problem.
 - Uses **skip connections** to let gradients flow across layers.



EfficientNet

- State-of-the-art performance with less computation.
- Adapts well to different hardware and application needs.
- Works great for fine-grained tasks like fashion classification.



Accuracy and Metrics (Resnet) Smaller Dataset

- The data set was highly skewed
- F1 -Score is used: 77.66%
- Accuracy for Small Dataset:

 Test Accuracy: 0.9649, F1 (macro): 0.7766

Accuracy and Metrics (Efficient Net)

- Similar results with Resnet
- Slightly lower around 77.63%

 Test Accuracy: 0.9655, F1 (macro): 0.7763

Accuracy and Metrics (Resnet) Larger Dataset

- The data set was highly skewed
- F1 -Score is used: 79%
- Accuracy for Large Dataset:



Test Accuracy: 0.9626, F1 (macro): 0.7973

Accuracy and Metrics (Efficient Net)

- F1 Score: 82%



Test Accuracy: 0.9682, F1 (macro): 0.8164

Thank You!