Improving User Experience in the Fashion Industry with Deep Learning

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Introduction: Business case

The Fashion industry is changing. Online sales are increasing every year and are displacing traditional shopping. Online stores have more and more clothing items, and although this may be good for the final consumer it can also be confusing due to the number of options to filter having increased noticeably and finding the clothes you really want is not so easy anymore.

On the other hand, with the increasing influence of social media and other internet platforms there is a strong demand from people to find a specific item that may be appealing to them.

This project will try to offer a solution to these problems by allowing customers to have recommendations of products they may be interested to purchase based on an image they have previously provided.

Main reference:

Hadi Kiapour, Xufeng Han, Svetlana Lazebnik, Alexander C. Berg, Tamara L. Berg. Where to Buy It:Matching Street Clothing Photos in Online Shops. In International Conference on Computer Vision (2015)

Link to the above paper and to the dataset.

Machine specifications, requirements and dependencies

Hardware:

- i7 7700HQ CPU @2.8 GHz
- RAM 16GB
- NVIDIA GeForce GTX 1050 (4GB) - A GPU of at least this specification is required for this project
- At least 40GB of free disk space

Environment:

- Windows 10

Tools:

- Jupyter Notebooks
- Python 3.6.5
  - pandas 0.23.0
  - numpy 1.14.3
  - matplotlib 2.2.2
  - scipy 1.1.0
  - flask 1.0.2
  - joblib 0.12.3
  - tqdm 4.25.0
  - PIL 5.1.0
  - cv2 3.4.2
  - keras 2.2.2 (using tensorflow backend and enabled gpu computing, a guide is provided as reference for installation on Windows on the notebooks directory)

Dataset and starting steps

- The dataset being used is street2shop. Due to diverse challenges, please see README file from "./notebooks/dataset-reconciliation", we will provide a final dataset and we are happy for the notebooks included in this folder to not be evaluated. The final dataset has been sized down from ~200GB to 19GB.
- To comply with legal requirements a dataset will only be shared for evaluation of this project as per request to lorenzo.cht@gmail.com and antonioramosglz@gmail.com. Once a request has been made we will promptly provide a direct link to the dataset for download. Once downloaded please place all the images within the photos_resized folder from the repository root directory.
- Labels can be downloaded from the dataset website. Please unzip the meta file and place all the json files within the labels folder from the repository root directory.
- Labels include information from the two sets, customer and retrieval (store images). The customer set also includes bounding boxes coordinates to facilitate cropping.

Methodology and project overview:

Our project comprises 3 different notebooks and a web application:

- 01-data-wrangling.ipynb:

  On this notebook we explore the challenges within the dataset such as starting from the original json files to create the final sets of customer and retrieval and removing noisy images as well as blank images to improve accuracy when evaluating the model.

- 02-data-exploration.ipynb:

  On this notebook we explore the clothing categories as well as the customer and retrieval sets and the matches between them. We explore the challenges from having multiple bounding boxes and/or multiple categories on a same image. Finally, we define the criteria we follow to select the final set of images.

- 03-model-evaluation.ipynb:

  This notebook is the core of the project. We evaluate different pre-trained neural networks and use them to extract feature representations from images, then a custom KNeighbors Search algorithm is used to retrieve the "k" most similar images based on different distance metrics. We also introduce accuracy@k as the metric of evaluation.

  Through evaluation we have concluded that cosine method and MobilNet model have the best accuracy-performance relationship for the purpose of this project. The accuracy achieved is around 45% for the first 10 products retrieved and is also consistent with the test set.

- Web application:

  We attempt to reproduce the original business problem and put the final algorithm into production. In order to do this, we replicate a dummy online shopping website on a python flask application powered by keras. The following open source boostrap templates have been used in the application: new-age and karl.

Front-End instructions

Our front-end consists on a Flask-based web application. In order to run the app for the first time:

1 - Given that the street2shop dataset has been downloaded and placed on the correct folder, now from the utils directory run the script *start_store.py* with python from command line. This will create all dependencies. It will place the image photos for the store in the required folder, and it will create an embeddings file and a csv file with labels from the photos.

```
python utils/start_store.py
```

2 - From the root directory run the script *app-site.py* with python. This will open a fully functional flask application on http://localhost:5000/

```
python app_site.py
```

3 - In order to use the app simply upload an already cropped image from a dress or a female top. To make it relevant to the business case, the image uploaded should match the expectation of what a typical user image would look like.