VISUAL SIMILARITY BASED INTERACTIVE PRODUCT RECOMMENDATION SYSTEM

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Abstract - *In Recommender systems, the way by which end users interact with the system plays major role in order to achieve their desired results. Finding a product from the website is still time consuming and less interesting part of purchasing from websites. Typing keywords describing product may lead to mismatched results due to user keywords and product description. A new product may enter into the market for which name would not be familiar and this product recommender system would resolve those issues faced by customers. This paper gives an overview of recommending product to the target users by using image input as well as keywords making it easier for recommendation over the web. It is targeted to the use case scenarios like, recommendation of new arrivals in the market and acts as a gateway for multimedia images for recommendation using machine learning in the market. We found that deep KNN features are useful for modelling visual dimensions.*

Keywords: Recommendation system, machine learning, KNN.

1. INTRODUCTION

The on-line retail ecommerce system is inevitable growing round world. However, the explosive growth within the obtainable digital information has created the challenge of data overload for online

shoppers, which inhibits timely access on the internet. This has increased the demand for recommender systems. All kinds of recommendations are not encouraged since its incapability in analysis of the product. While a few pioneering works about image-based search are applied, the appliance of image matching using AI within the ecommerce industry remains largely unexplored. Based on this concept, here we build a sensible recommendation system, which takes images of objects instead of description text as input.

The term data mining refers to a broad spectrum of mathematical modelling techniques and software tools that are used to find patterns in data and uses these to build models. As data mining algorithms have been tested and validated in their application to recommender systems, a variety of promising applications have evolved. Classifiers are general computational models for assigning categories to the product.

The task of identifying what an image represents is called image classification. An image classification model is trained to recognize various classes of images. In this system, we focus on training a model to recognize photos representing many different types of products ranging from watches, shirts, foot wear, women's dresses, cell phones and accessories. This is done using tensorflow. Tensorflow lite provides an optimized pre-trained model that you can deploy in your mobile applications.

Sufficient amount of training data (often thousands of images per label), an image classification model can learn to predict whether new images belong to any of the classes that have been trained on. This process of prediction is known as the inference.

1.**Classification:**given a photo of the product taken by the customer, find the category that the product most likely belongs to. We have 25 categories with over 1000 images each in a dataset. The details of these categories are shown in the Datasets and features section. For example, an image of an iPhone(s) will be classified as cellphones and accessories but an iPhone should be distinctively recommended for the purchase.

2.**Recommendation**: given the features of the photo and the category that this product belongs to, calculate the similarity score and find the most similar products from our database. Ideally people looking for an apple watch should only get that watch.

2. ADVANTAGES OF VISUAL SIMILARITY BASED INTERACTIVE PRODUCT RECOMMENDATION SYSTEM

Since real lifetime images are given as input to the system we expect the most relevant products as output to the users. Even new arrivals on the market can be photographed by sellers and trained using the inception model of TensorFlow for the best recommendation. This system mainly focuses mainly on real life photographing of images and predicting features from that model.

Though many images are fed as input we train the model to peculiarly identify the desired image. For example though we have a wide range of images for the category "cell phones and accessories" , if a oneplus mobile is uploaded by a user we work on to recommend only that particular mobile providing accuracy on the results. Annoy is a memory-optimized k-NN library, it is also used by Spotify to handle their recommendation tasks. Hence memory optimization will also become possible.In this system we filter results from newest to oldest and also from minimum price to maximum price.

3. EXISTING SYSTEM

In the existing system the products from ecommerce sites are found using keyword based approach. New fashionable images are found by using keywords and product description. Desired products can be found. Most of the recommendation system tend to find products which are in general not having specificity on the type of product required. Traditional E-commerce based search engines are still struggling for an optimal recommendation system because most of these services employ text-based searching. Most Of these systems use textual meta-data of products such as attributes, descriptions, and purchase histories of the different users. The textual and key-words based systems can mis-lead the recommendation system for the inferior quality and non-related products needed by the users. Recently, machine learning algorithms and models have shown its efficacy in detection and recognition scenarios, for example, NeuralNetworks (NN), Decision Trees (DT), and Deep Learning(DL).

4. PROPOSED SYSTEM - VISUAL SIMILARITY BASED INTERACTIVE PRODUCT RECOMMENDATION SYSTEM

Phrase 1 : Product Category Recommendation

Phrase 2 : Recommendation

In Phase 1, the proposed approach models and learns the class/category of the product based on the image character-istics. Once the category is selected by Phase 1, Phase 2retrieves the closely matched similar products from the cor-responding category. The model is used to find the class/type of products that are searched or clicked by the user. For the first ML phase of a product class learning, we use the RF classifier due to its generalization capabilities and increased performance in state of the art. For learning the class of the products and for extracting image features, we use the JPEG coefficients as image features. The RF is further integrated into the DL setup for performance analysis and performance enhancements. The image vectorizer which passes each data through an inception-v3 model and collects the bottleneck layer vectors and stores it in the disk.

For a query image, the image category is retrieved by Phase 1. The query image is then searched in the corresponding category in Phase 2. It retrieves related images based on the similarity in particular category. The next step is finding the similarity between the feature vector of the query image and the feature vectors of the category images. For similar products selection and vectormatching, we use the Euclidean distance between all the vectors of the category images to the vector of the query image. These are represented as the similarity values of the query image with all the images in a particular category.

4.1 Training and estimation of models.

4.2Feature extraction flowchart

5. K-NEAREST NEIGHBOR ALGORITHM K-Nearest Neighbor algorithm is one among the only Machine Learning algorithms supported by Supervised Learning technique. K-NN algorithm assumes the similarity between the new case/data and available cases and put the new case into the category that's most almost like the available categories. K-NN algorithm stores all the available data and classifies a replacement datum supported the similarity. This suggests when new data appears then it is often easily classified by using K-NN algorithm. K-NN algorithm are often used for regression also for Classification but mostly it's used for classification problems. K-NN algorithm is at the training phase just stores the dataset and when it gets new data, then it classifies the data into a category that's much almost like the new data. KNN are often used in detecting outliers. One such example is mastercard fraud detection.

$$d(p,q) = d(q,p) = \sqrt{(q_1 - p_1)^2 + (q_2 - p_2)^2 + \cdots + (q_n - p_n)^2}$$

$$= \sqrt{\sum_{i=1}^{n} (q_i - p_i)^2}.$$

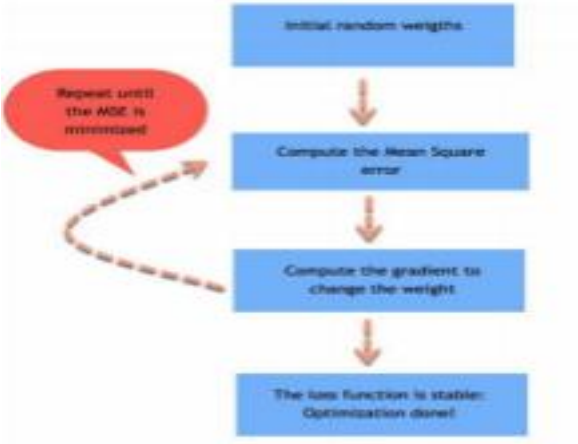

Fig 5.1 Working of algorithm

6. MODULE DESCRIPTION

Step 1: Gathering the datasets..

Step 2:Evaluating and predicting features. Step 3:Recommendation of the products. Step 4: Testing phase.

Step 5:Deployment as web app using REST API.

6.1. SOFTWARE USED

- Ubuntu OS
- Python
- REST API
- Libraries used
    - TensorFlow
    - SciPy
    - Pickle
    - NumPy

6.2 Libraries used

- **NumPy:***NumPy* is a *Python library* used for working with arrays. It also has functions for working in the domain of linear algebra, fourier transform, and matrices. *NumPy* was created in 2005 by Travis Oliphant. It is an open source project and you can use it freely.
- **SciPy:** SciPy, a scientific library for Python is an open source, BSD-licensed library for mathematics, science and engineering. The SciPy library depends on NumPy, which provides convenient and fast N-dimensional array manipulation. The main reason for building the SciPy library is that it should work with NumPy arrays.
- **Pickle:**Pickle in Python is primarily used in serializing and deserializing a Python object structure. In other words, it's the process of converting a Python object into a byte stream to store it in a file/database, maintain program state across sessions, or transport data over the network.

6.3. TensorFlow

TensorFlow is a free and open-source software library for machine learning. It can be used across a range of tasks but has a particular focus on training and inference of deep neural networks. Tensorflow is a symbolic math library based on dataflow and differentiable programming.

Currently the most famous deep learning library in the world is Google's tensorflow. Google product uses machine learning in all of its products to improve the search engine, translation, image capturing or recommendations. Google wants to use machine learning to take advantage of their massive datasets to give users the best experience. Researchers, Data scientists, Programmers all use the same toolset to collaborate with each other and improve efficiency. Google does not just have data they have the world's most massive computer, so TensorFlow was built to scale. TensorFlow is a library developed by the Google Brain Team to accelerate machine learning and deep neural network research. It was built to run on multiple CPUs or GPUs and even mobile operating systems, and it has several wrappers in several languages like Python, C++ or Java. The name Tensorflow is because it takes input as a multidimensional array, also known as tensors. The input goes in at one end, and then it flows through this system of multiple operations and comes out the other end as output.

Tensorflow architecture works in three parts: • Preprocessing the data

- Build the model

6.4 REST API

Representational state transfer (REST) is a software architectural style which uses a subset of HTTP.It is commonly used to create interactive applications that use Web services. A Web service that follows these guidelines is called *RESTful*. Such a Web service must provide its Web resources in a textual representation and allow them to be read and modified with a stateless protocol and a predefined set of operations. This approach allows interoperability between the computer systems on the Internet that provide these services. REST is an alternative to, for example, SOAP as a way to access a Web service.

Flask is a popular micro framework for building web applications. Since it is a micro-framework, it is very easy to use and lacks most of the advanced functionality which is found in a full-fledged framework. Therefore, building a REST API in Flask is very simple.We build using flask_restful library.

Flask Restful is an extension for Flask that adds support for building REST APIs in Python using Flask as the back-end. It encourages best practices and is very easy to set up. Flask restful is very easy to pick up if you're already familiar with flask.

In flask_restful, the main building block is a resource. Each resource can have several methods associated with it such as GET, POST, PUT, DELETE, etc. for example, there could be a resource that calculates the square of a number whenever a get request is sent to it. Each resource is a class that inherits from the Resource class of flask_restful. Once the resource is created and defined, we can add our custom resource to the api and specify a URL path for that corresponding resource.

7. CONCLUSION

Modelling visual appearance and its evolution is vital to gain a deeper understanding of users preferences, especially in domains like fashion. During this paper, we built scalable models n top of product images. We found that deep KNN features are useful for modelling visual dimensions. Low rank structures learned on top of such features are useful for modelling visual dimensions also because the associated temporal dynamics and help our method significantly outperform state-of-the-art approaches. We found that deep KNN features are useful for modelling visual dimensions also because the associated temporal dynamics also as how fashion has shifted over the past decade.

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