Bilkent University
Department of Computer Engineering

Senior Design Project

Kalas-Iris: Clothes recognition and rich attribute prediction using computer vision service for online clothing retail

Project Specifications Report

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1. Introduction

Online shopping is becoming more and more popular. There are around 7.1 million online retailers in 2020 [i] and 1.8 billion people are shopping online each year[ii]. The demand on online shopping is requiring more resources to be spent for customers. There are two main ways customers find the goods that they buy in those websites: Browsing and searching. According to *Oberlo*, 75% of the search queries of the customers are brand new. Therefore, it is important for customer to find the good that they are searching for.

Currently big e-commerce websites such as Hepsiburada use textual matching for searching products. To get better results, most of the products are labeled and categorized. In addition to those labels, categories and descriptions, there are additional handwritten rules for better customer experience. This is very expensive and hard to maintain even for big e-commerce websites. Currently the search results of those products are not inspired from the images of the product. Machine learning is only used for showing relevant products to another product, which is affected by the behavior of the customers.[iii]

Most of the current search engines of small e-commerce websites recommend a good match to the given search query via matching the search queries with the labels associated with each product. Although successful to provide the customer with the products they are looking for, such services lack a high rate of accuracy. This mainly stems from the fact that small e-commerce owners do not have the flexibility to spend extensive time and effort on keeping a thorough and detailed log for their inventory on a digital platform. Required information about goods are put in the system by hand and sometimes directly gathered from the distributor. When the information lacks in the system, workers add the description based on the image of the product. Additionally, the products have different filters and labels. Labeling these products are time consuming and there can be missing information. The amount of detail in those descriptions also can be limited. Additionally, there can be semantic problem such as

synonym or similar words. In order to overcome those problems, we want to create an algorithm that can create descriptions and labels for items and also can show the best matching products according to a search query. We expect this algorithm to benefit from mostly the images of the products and additionally descriptions.

1.1 Description

Kalas-Iris aims to ease the process of online shopping for clothes by providing a tool that creates labels and an additional description for a given image of a clothing item. Usually, online clothing retailers arrange a database for their products, in which they keep information and data about the products. This data lacks labels and sometimes description when the retailer gets items from the wholesaler. This data usually contains one or more images of the product and optionally labels and a description. The labels the description and labels are usually enough for a basic search algorithm. But we would like to reduce the cost of maintaining the descriptions and labels of each individual product by manually generating them from their images. In addition, we would like to create a semantic search algorithm for those newly generated descriptions and labels. This algorithm should sharply increase the amount of detail user can search and relevancy of the results of the query projected in natural language.

Kalas-Iris will serve as a web service that e-commerce website owners can sign up and buy plans from. Our service will automatically label and create a better description for newly added items or already existing ones. Labeling and annotating algorithms will be used for those tasks. Also, an additional search option will be presented to the website owners for enhanced searching. Searching algorithm will use natural language processing algorithms and semantic analysis of the text.

Finally, the platform will be available as a web service to the customers. The customers can create profiles and login to their profiles from this website. They will also add the relevant endpoints of their website in their admin panel or even use hooks for automatically handling newly added items.

1.2 Constraints

1.2.1 Implementation Constraints

The machine learning algorithm will be written in Python3 using PyTorch or TensorFlow. The backend will be implemented using (Django/Flask/Nodejs) framework and the frontend will be implemented in JavaScript using React. We will be using git with GitHub for version control.

1.2.2 Economic Constraints

The primary economic constraints on Kalas-Iris will be imposed by the cost associated with server hosting and maintenance of the web application. Additionally, computation power will be required for training and maintaining machine learning models.

1.2.3 Privacy and Legal Constraints

Kalas-Iris should comply with the instated laws and regulations of the host country/international community, such as KVKK (Kişisel Verilerin Korunması Kanunu)[iv] in Turkey or GDPR (General Data Protection Regulation)[v] in EU.

1.2.4 Language Constraints

Kalis-Iris will be a product with English as the primarily supported language. Although it may be considered to provide support for other languages in the future, for initial development, English will be the main focus for the project. This stems from different reasons, the most important one being that it is mandatory. It is also important for the initial release of the product to be in English, since finding large enough datasets for the development of the project would be difficult in other languages. Further, if the product is English, it will be easier for it to become a global product, available to the use of various companies around the world.

1.3 Professional and Ethical Issues

In many e-commerce websites, the main stepping stone of a product search is matching the search query with product metadata. The results of this match shape the result of the product search, as products that contain more matching keywords get listed above compared to other products, by default.

Customers tend to click on the products listed in the first page of their search result[vi], compared to the ones listed in the second or further pages. Thus, in Kalas-Iris, every single product in a category must be processed with the same accuracy as the products from its competitors. Also, to establish a fair marketplace for each vendor, there is not going to be sponsored products listed above the more relevant results. Hence, the algorithm should try to help the customer find the best product possible, not interfered by any advertisement. Advertisements are in responsibility of the e-commerce website not our algorithm.

2. Requirements

2.1 Functional Requirements

2.1.1 User Accounts

- Each e-commerce website will be able to sign up as a user to the Kalas-Iris via its website.

- Users will enter their website information to the panel before they can use.

- Users will receive a private key for authentication. Users can make API calls to our service using this private key.

- Users will add desired endpoints of their website for automating the process of labeling and generating improved description.

2.1.2 Product Management

- Users can add webhooks to their services when they add an item which points to one of the Kalas-Iris endpoints. This endpoint will automatically process the product, resulting in a description and labels. This information will be sent to the user's website.

- Users can process the existing items on the website using an endpoint from Kalas-Iris. This endpoint will process the items and return the result to the website.

- Users can individually add items to the website to see the result.

2.1.3 Image Based Annotation

- Product images will be annotated by machine learning and deep learning algorithms.

- The product will be labeled into multiple categories using the images of the product.

2.1.4 Querying Service

- Given a query string, the system will list the best matching items.

- The search query will be processed using natural language processing and semantic analysis.

- The querying service should find similar results for different queries with similar semantic meanings, such as wedding dress or bridal outfit.

2.2 Non-functional Requirements

2.2.1 Accuracy

The system should:

- Provide accurate annotation and labels for the products.

- Find relevant results for the given search query.

2.2.2 Scalability

The system should:

- Be able to manage thousands of product information from different customers.

- Grow without a problem as more products are being logged to the system.

2.2.3 Efficiency and Response Time

The system should:

- Provide a fast response time for user experience. Otherwise the e-commerce website will have a sloppy experience for their customers.

- Run efficiently in a webserver so that it's cost can be affordable.

2.2.4 Flexibility and Integrability

The system should:

- Be flexible enough so that any website owner can use our API.

- Be integrable to any website without much effort.

2.2.5 Reliability and Failure Management

The system should:

- Should be reliable enough so that users can search even though the Kalas-Iris is down. This will be achieved using the original search endpoint as a fallback.

- Deal with invalid input such as phones, televisions or vice versa.

3. References

[i] "THE 2020 BREAKDOWN OF THE ECOMMERCE INDUSTRY", October 2020, https://www.etailinsights.com/online-retailer-market-size

[ii] "Summary: Online Shopping Statistics 2020", October 2020, https://www.oberlo.com/blog/online-shopping-statistics.

[iii] Interview with Yağız Demirsoy, Hepsiburada Product Engineering Manager, 10 October 2020.

[iv] "Kişisel Verilerin Korunması Kanunu",October 2020, https://www.mevzuat.gov.tr/mevzuat?MevzuatNo=6698&MevzuatTur=1&MevzuatTertip=5.

[v] "General Data Protection Regulation (GDPR) - Official Legal Text", October 2020, https://gdpr-info.eu/

[vi] "WSH News Exclusive | Amazon Changed Search Algorithm in Ways That Boosts Its Own Products", October 2020, https://www.wsj.com/articles/amazon-changed-search-algorithm-in-ways-that-boost-its-own-products-11568645345