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An Ontology Based Approach to Search Woman Clothing from Pakistan's Top Clothing Brands

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Abstract

The trend of online shopping in Pakistan has been getting more popular since the last decade. Online clothing shopping is also excessively growing and a wider range of clothing items, including stitched and unstitched, are available from different retailers. It has been observed that most women prefer branded clothing whenever they proceed for the online shopping. Many female consumers are faced with the problem of searching for their desired apparel based on the dress attributes from the collection of their favorite brands. The research is aimed to provide a platform for the users to find their desired dresses from the latest available collection of top brands in Pakistan based on different attributes of a dress. A wider range of clothing including stitched and unstitched items will be made available in the system for more precise and accurate search. The system will extract major attributes of dresses, i.e., color, style, and pattern, from the images uploaded by the brands registered in the system. The system will allow consumers to find clothing from their favorite vendors/brands based on major dress attributes using domain knowledge base defined as ontology (OWL/RDF).

Keywords: Women-clothing, brands, top-brands, clothing, ontology

1. Introduction

The trend of online shopping has been drastically increasing in Pakistan since the last few years. Pakistan has one of the largest populations of internet users. The trend of e-shopping for clothing is also growing in Pakistan. For the retailers and marketers, it is very essential to identify the requirements of their customers to fulfill their shopping needs [1]. E-retailers of clothing are more focused on improving the online shopping experiences of their customers [2]. They keep on exploring the factors that directly impact on customers' satisfaction and finding ways to provide their customers a perfect place to find what they want to wear. Men and women may differ in evaluating different attributes of a product before purchasing it [3]. In online shopping, women can be interested in the more detailed information of a particular product, also numerous search options for example color combination, design, and other features like embroidered dress, sleeveless,

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with-collar, without-collar, long length, short length, etc., can enhance their intentions of purchase.

It has been observed that for the fabric quality, prints, and style, women's consumers mostly prefer their favorite brands. They prefer to purchase their dresses from specific brands to avoid quality related issues as the online shopping cannot provide touch and feel options. Women in Pakistan are more emotional towards a brands status, quality, and design uniqueness [4]. In Pakistan, different clothing brands attracts female by building trust on quality and by providing a wider range of designs, prints, and styling options.

Mostly young females from universities and colleges are more attracted to brands as they are more aware of the designs, quality of the fabric, latest fashion trends, discounts, and sales because of the internet and social media accessibility [5]. Gul Ahmed, Nishat Linen, Junaid Jamshaid, Alkaram Studio, Sana Safinaz, Maria.B, and Khaadi are among the most popular clothing brands in Pakistan and people are more interested in the products' collection of these brands because of their uniquely appealing designs and quality [6].

The aim of the system is to gather all these well-reputed and famous brands on a single platform to display their products with all their features and attributes of the products. So that the system will provide an advanced search option not only based on price range or category but also based on different dress attributes. The system will be using an ontology-based approach to populate its knowledge base with the dress attributes. An already existing approach will be used to extract the attributes of any particular dress from the uploaded image by the registered brand in system.

2. Literature Review

There are some ontology-based frameworks that have been built to provide recommendations for dresses on the basis of their personality and color of garment. The reasoning model in a garment domain is based on the construction of observation model (OM) and recommendation model (RM) that have been designed previously [7]. Knowledge-based systems have been developed to provide suggestions on the basis of colors and mix-match module for dresses and worked as dress advisor [8]. Garment recommendation for occasions after learning personality attributes like body color and body dimensions from the photograph of the user by using domain knowledge described via MOWL (Multimedia Web Ontology Language) [9]. Another approach is employed for improving quality of clothing recommendations by establishing a knowledge graph of user, clothing and context [10].

The semantic description of fashion ontology helps in populating clothing attributes with images. The attributes includes; clothing pattern, major color, sleeve length, Collar

presence, dress category like (tank top, long shirt, short kurti, etc.) [11].

Estimation of human posture will help in extracting clothes from an image by just subtracting the detected body parts from the captured image. Shape matching templates defined in body-model helps in identifying various body parts of human with different postures. The basic body parts template contains descriptions of various posture of legs, hands, head, upper and lower body [12, 13]. Recent research has been conducted on cloth parsing from photographs using novel dataset to perform a precise cloth estimation of a person's outfit and then labeling the outfit using labeling tools for various possible garment types [14].

The domain ontology needs to be populated automatically after the dress attributes extraction. Many mechanisms have been used for the automatic ontology population. Classification of ontology classes and finding instances from the text is considered as an approach for automatic or semi-automatic ontology populations [15].

The above cited papers dealt with a few concerns related to searching in clothing domain, but a more precise and accurate search model for women's clothing on the basis of dress attributes, from the collection of top Pakistani brands with complete knowledge-based information of on women-clothing using ontology (semantic approach), is still needed.

3. Methodology and Approach

A. Development of Domain-Ontology

The ontology of the domain will consist of a few major classes and their sub-classes. Protégé is a tool used for domain modelling or defining ontologies [16]. It is an easy-to-understand tool to describe ontology classes, instances, attributes, and relations among them. The system needs an ontology or a domain related vocabulary to be defined. The ontology for the system is designed on Protégé -5.2.0 as shown in Figure 1.

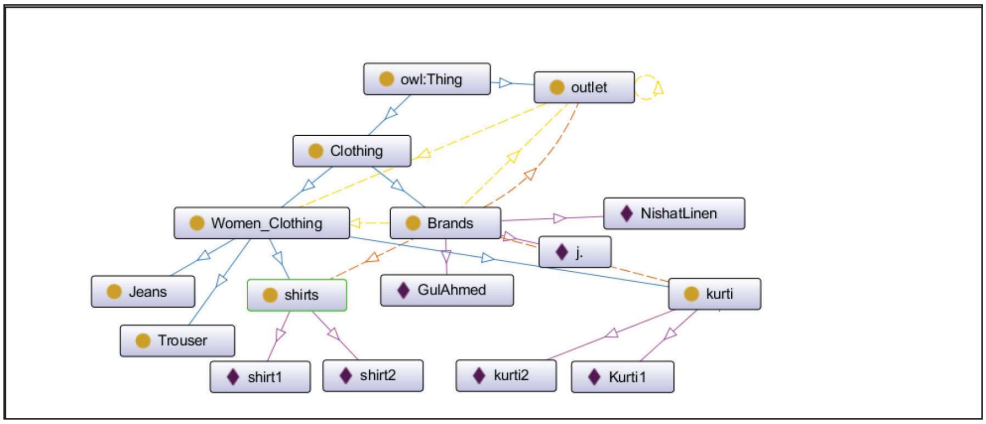

Figure 1: OntoGraf of Domain-Ontology

B. Extraction of Dress Attributes from Image

The system will get the already uploaded images (uploaded by registered brands) from the system's database. A human Pose Estimation, body parts and posture detection technique is used to separate human body parts from the image [17]. This previously defined mechanism will help to get the major part of the dress by subtracting the detected human parts from the dress. After removing unnecessary details the image, the system will work on this separated part of the image that contains only that significant part of dress shown in Figure 2 [18].

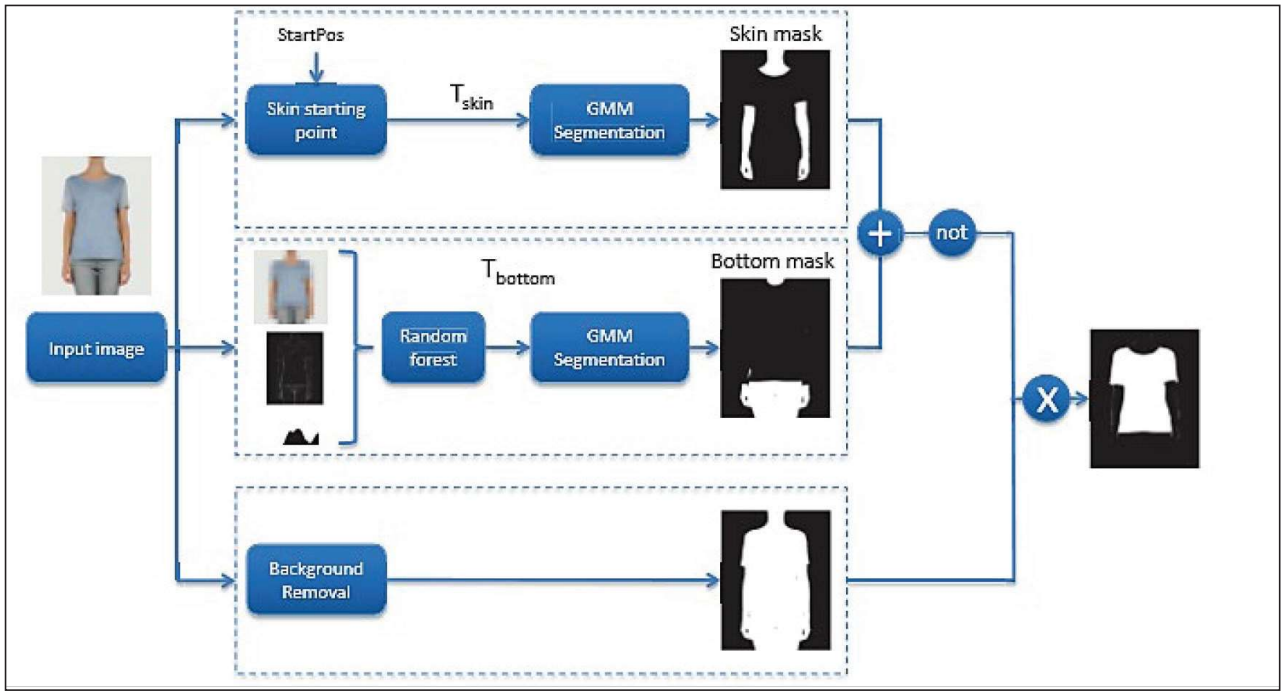

Figure 2: Segmentation of Garment

The already defined automated system that is capable of finding different attributes of the dress from an image will make it easier for the system to separate out the major properties of any dress, shown in Figure 3.

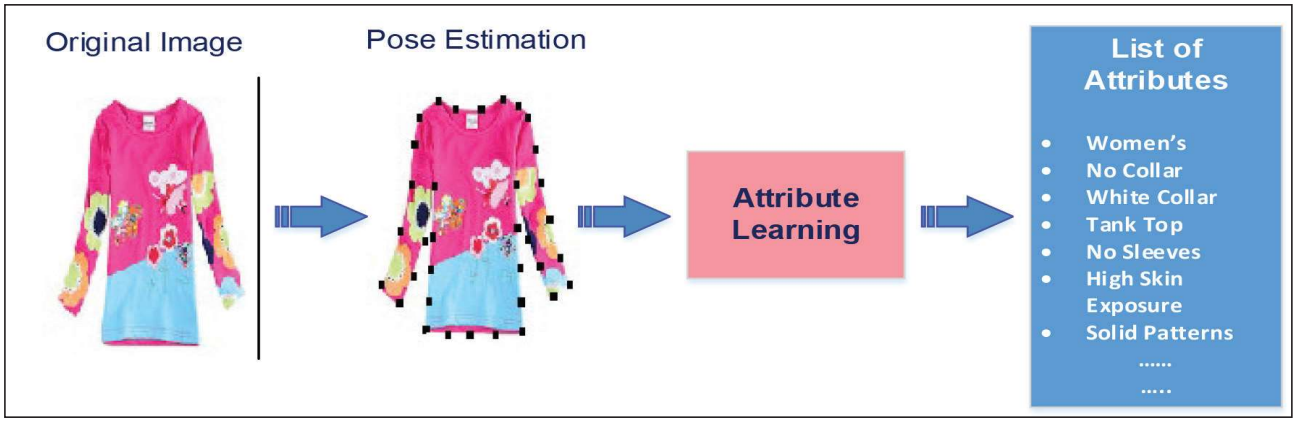

Figure 3: Extracting Dress Attributes

The major attributes of dress defined in the proposed ontology model are:

Color:	*any RGB (0-255)*
Major Color:	*any RGB (0-255)*
Type of Dress:	*Long shirt, Short shirt, Tank top*
Pattern:	*Stripped, Floral*
Is-Collar:	*Yes, No*
Is-Sleeve:	*Yes, No*

After learning the image for these defined attributes, the system will then use an automatic ontology update mechanism to update the ontology after adding individuals to it. Automatic ontology population after learning data sources like images and text, considers as the necessary approach to make such semantic based systems more effective and independent to update their knowledge [15].

For example, the image we are using in Figure 3 lies in the category (class) “kurti”, so the system will consider it as an individual for the already defined class “kurti”, with any name like “Kurti3” in this example. So, the system will automatically add an individual to the already defined ontology.

The extracted attributes from kurti3:

:Color "white" ;
:is-collar "No" ;
:is-sleeve "yes" ;
:pattern "solid pattern" ;
:type "Tank Top"

C. Automatic population of Ontology

RDF (Resource Description Framework) stores information in the form of Triples:

Subject->Predicate->Object
or
Object->Property->Value

So, the system will automatically insert a triple while updating the ontology. There are many RDF management systems that have been developed by researchers to handle millions of triples defining ontology related to a particular domain [19]. Ontology is about enriching vocabulary related to the domain or about adding triples to the RDF

graph. So, it requires some mechanisms to populate ontology automatically. The different systems have been designed for automatic population of ontology by extracting concepts or classes, relations from text as in [20]. In this system, it is needed to enrich the ontology by adding classes, concepts, individuals and properties as per requirements. SPARQL (SPARQL Protocol and RDF Query Language) pattern matching techniques are also helping in identifying different ontological components. SPARQL queries are also used in mapping patterns to accurately populate ontology [21]. So, we need to execute a SPARQL query for the insertion of an individual with the following five data properties:

i. Color
ii. Type
iii. Is-sleeves
iv. Is-Colar
v. Patterns

After query execution the graph has now populated with an individual named with kurti3.This individual contains five object properties. The graph in figure 4 is visualized on OWLGrED, an online ontology visualization tool that allows a graphical representation of OWL classes in a form of UML classes in order to get more clear view of any domain-specific ontology (OWL) [22].

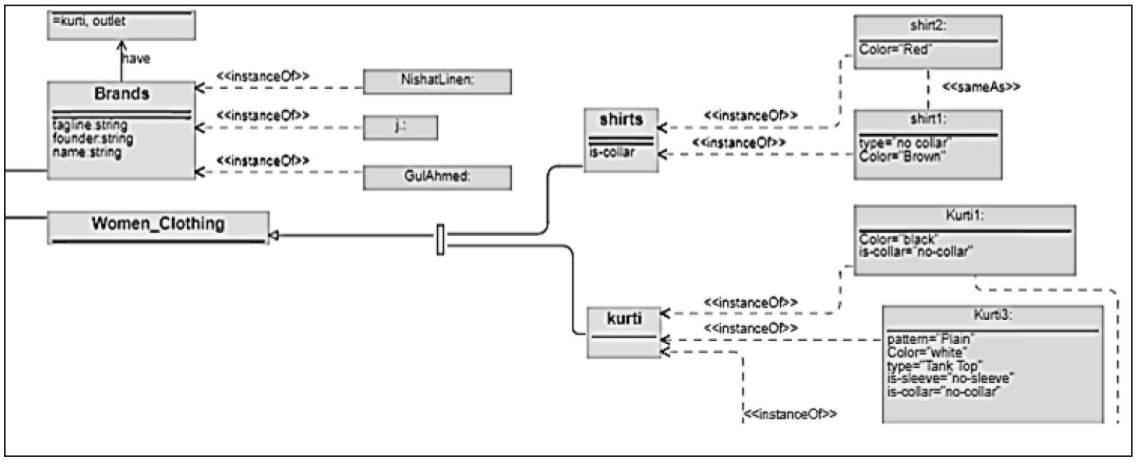

Figure 4: Graphical Representation of OWL and UML

Data properties of the recently added individual 'kurti3' can be shown in figure 5 using Protégé -5.2.0.

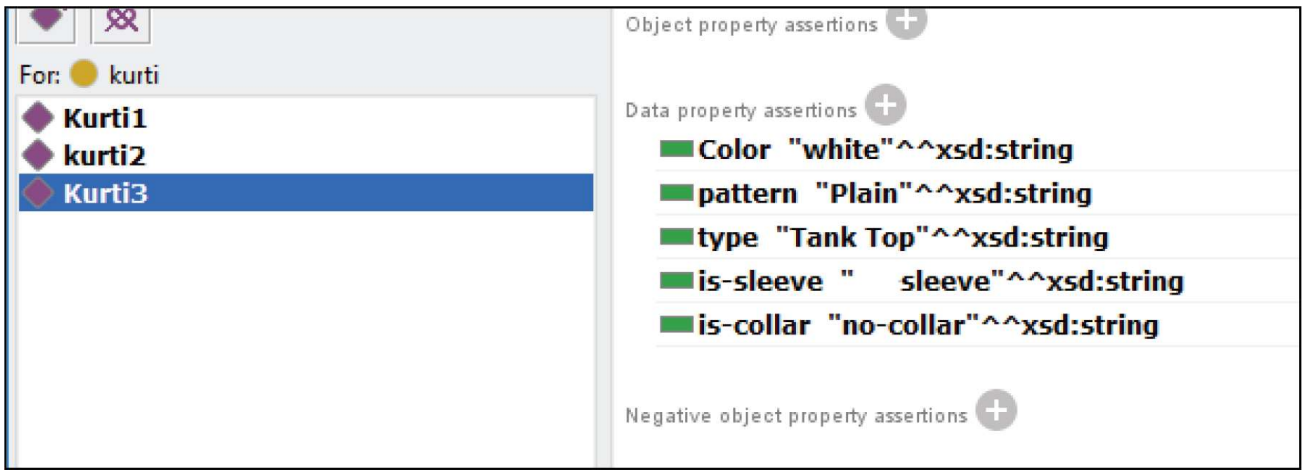

Figure 5: Data Properties of the individual 'kurti3'

D. User search module using SPARQL

SPARQL is used as the standard language for querying RDF or Ontology/Knowledge based systems [23]. A user can search for a dress as per their desire like color, type, or any other specification of the dress like no-collar, sleeveless, etc.
The system will generate query of SPARQL according to the user input or query request.

For example
User enters color= white
PREFIX
dc:<http://www.semanticweb.org/arbab/ontologies/2017/10/Women_Clothing.owl>
SELECT ?subject ?predicate
WHERE {
?subject ?predicate 'white'
}

The search results of the above *query is shown in Figure 6. If the user is searching for a dress with color white, for example, the query will return the result, that is based on triple pattern defined in the WHERE clause.

*Query is executed on Apache Jena Fuseki server to test the results.

	subject	predicate
1	dc:#kurti2	dc:#Color
2	dc:#Kurti3	dc:#Color

Figure 6: Search results of the query as subject and predicate

4. System Frontend

The front end of the system is based on the.NET Technology, C#. It is designed using the Windows Form Application provided by Microsoft Visual Studio using version 2013. DotnetRDF is an open-source .NET library that supports a way to interact with RDF via queries. Different Semantic based systems use this technology for constructing GUI under windows as in [24-25]. It provides a framework to construct a GUI for RDF based system. It contains a lot of supportive classes like IGraph, Graph, Triple, Node, TripleStore, etc. to interact with the triples of any RDF. There are multiple supportive classes with different methods that helps in querying RDF, it also provides support for connection with third-party stores like Jena-Fuseki, Virtuoso, AllegroGraph, store4, etc.

DotnetRDF provides ExecuteQuery() function that helps to execute any SPARQL query. The Following example shows the execution of the query that will return a result in a result set that will contain all the triples available in the provided graph.

Example:
Query string in C# syntax:
String query= "SELECT ?subject ?predicate ?object WHERE {?subject ?predicate 'white'}";

The query is executed with the help of defined DotnetRDF classes.
Results of the query is displayed using Windows form application as shown in Figure 7 user is querying for 'white' kurti and results are returned to the user.

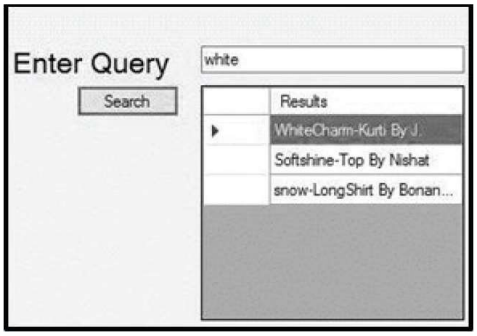

Figure 7: Search Results of the requested query

5. Conclusion

In this article, an ontology-based system is introduced for searching women's clothing from the top brands in Pakistan on the basis of dress attributes like dress color, type, and other specifications of dress like sleeveless, no collar, etc. The Protégé tool is used for defining domain ontologies. The proposed system is able to automatically populate the domain ontology from the knowledge sources. The system uses existing tools for

processing images to extract dress attributes from the already available images in the system in order to populate the domain ontology. A user can make a search query that can include any desired dress attribute or attributes, the proposed system is capable of handling user queries by using SPARQL to find the desired results.

6. Future Work

There is a broader scope of extension in the proposed system by adding more versatility in cloth searching, more specifically, extracting dress attributes of man's and children's clothing and adding them to the domain knowledge base. Further, conceptual advancements in the discussed system are also achievable on the basis of the feedback from users and testing results in order to make searching more accurate.

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