

## Towards the Development of Human Community Ontology

Muhammad Shahab Siddiqui, Dr. Zubair A. Shaikh, Dr. Abdul Rahman Memon  
*GSESIT, FEST, Hamdard University, Karachi National University of Computer and Emerging  
Sciences, Karachi Campus, FEST, Hamdard University, Karachi*  
*shahab.siddiqui@ieee.org, zubair.shaikh@nu.edu.pk, armemon2001@yahoo.com*

### Abstract

*Human beings form different human communities. These Communities can be analyzed to extract valuable information and can be hold in some proper frame structure (ontology). Therefore, there is a need to develop the ontology for Human Community. We can select the level of ontology from Meta-, Domain to Instance Ontologies. In an earlier research paper [15], we developed Profile Ontology for registering individuals in a community and Community Ontology for defining community in general. In order to maintain ontology, we need to add or delete (update) concepts (attributes) and relations in the ontologies. We will use this Human Community Ontology in our on going research on Community Algorithm [14, 17] development.*

**Keywords:** Human Community, Ontology Development 101, Human Profiling, Human Community Ontology

### 1. Introduction

In the world, human belong to different human communities. We can capture information from these communities. Analysis can lead to emergence of different roles of human in different human communities, by applying different operators and methods.

The word community is derived from the Latin word *communitas* (meaning the same), which is in turn derived from *communis*, which means "common, public, shared by all or many". *Communis* comes from a combination of the Latin prefix *com* (which means "together") and the word *munis* (which has to do with performing services).

Community can be viewed as a social structure. In a community, there can be roles as a leader or follower in groups. Community defined in "The encyclopedia of informal education" [10] as nested; one community can

contain another – for example a geographic community may contain a number of ethnic communities.

Classifying human communities will help in identifying roles of individuals in different human communities. Human Community can be hold in frame structures (tuples or ontology). Therefore, it is necessary to develop human community ontology.

This paper is been organized in 7 sections. Section 1 introduces community and ontology, Section 2 discusses the related work about communities, Section 3 defines human community, Section 4 describe the logic by which we can combine different human communities, Section 5 discuss human profiling, Section 6 describe the process of ontology development, and Section 7 describe important points of ontology maintenance. As the research is at its initial stage, gaps will be noticeable and shall be taken care of as the research progress.

### 2. Related Work

Different computer science researchers define Community as a graph [1, 2, 3, 4, 5, 6, 7, 8]. Kumar et al. proposed community as a dense directed bipartite subgraph which contains a complete bipartite subgraph of a certain size. Flake, Lawrence, Giles proposed community of web pages, also termed as "FLG-Communities" in [6], as a vertex subset in which each member vertex has at least as many edges connecting to member vertices as it does to non-member vertices. Said et al. discussed reputation of web services communities [8], two projects of virtual student communities – Lifestyle Communities and the Cosmos (Community Online Services and Mobile Solutions) Project were discussed. Mujtaba Khambatti et al [9] describes the Community for P2P (peer-to-peer) communication. In [16] Fang et al. describe some characteristics for Personal Ontology and Role Ontology, which was used in the development of a framework for personal query system.

### 3. Defining Human Community

Human Community can be defined as a group or an association or an aggregate:

- an incorporated town, city, township, village, or unincorporated area of a county
- of people living in a local area and having ethnic or racial or cultural or religious belief or sexual orientation or profession characteristics or socio-economic similarities and common interests, may have common ownership
- of nations having common interests and similar objective
- political entity which has the authority to adopt and enforce laws and ordinances for the area under its jurisdiction

We can define two major types of Human Community, Global (General) Community and Local Community. Human community along with animal community, world community and plant community can be considered as Global Communities, i.e. the communities which exists naturally. While student community [8], teacher community, employee community, alumni, Memon community, Pakistani community, Urdu speaking community, Punjabi community, Hindu community, Muslim community, sports community, doctor community, engineer community, lawyer community, women community, businessmen community, etc. are communities based on area, ethnic, language, racial, cultural, religious belief, profession characteristics, sexual orientation, socio-economic similarities, common interests, and ownership can be termed as Local Communities.

### 4. Combining Human Communities

We can have a combination of two local communities to form a hybrid community like Women Engineers Community (WEC) is the intersection of Women Community (WC) and Engineer Community (EC), i.e.

$$WEC = WC \cap EC$$

Using the characteristics of set theory we know that intersection is symmetric in nature. Therefore, all common individuals who are either women in engineer community or engineer in women community will be included in the WEC set. So the individual belongs to WEC set must have the characteristics of WC and EC sets.

We can also have a combination of three or more communities like Pakistani Women Engineers Community (PWEC), which can be an intersection of Pakistani Community (PC), Women Community (WC) and Engineer Community (EC), i.e.

$$PWEC = PC \cap WC \cap EC$$

Using the characteristics of set theory we know that intersection of three sets is transitive in nature. Therefore, all common individuals in the three sets will be included in the PWEC set. So the individual belongs to PWEC set must have the characteristics of PC, WC and EC sets.

We can also have sub-community of a human community like South East Asian Community (SEAC), which is a sub-community of Asian Community (AC). In set theory, the relationship between the two communities can be handled by the sub-set notation, i.e.

$$SEAC \subseteq AC$$

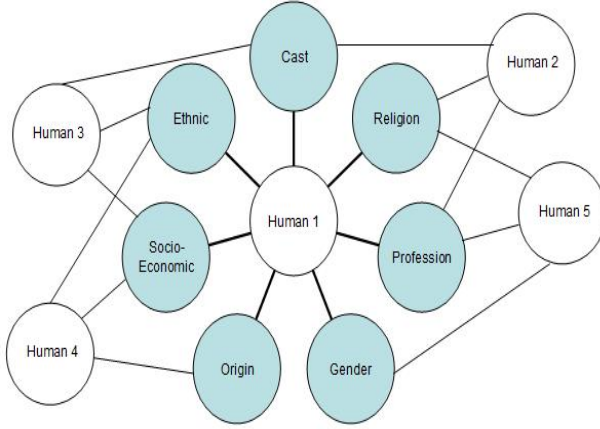
Similarly, we can have a global community which is a composition of number of communities like world (W) community is based on Asian (As), African (Af), Antarctic (An), Australian (Au), European (E), North American (NA) and South American (SA) communities. We can express world community as a union of all communities in set theory, i.e.

$$W = As \cup Af \cup An \cup Au \cup E \cup NA \cup SA$$

According to the set theory, here the world community appears to be a Universal set (U). Therefore all other global communities, i.e. animal community, human community and plant community, are Universal sets in their respective domains.

### 5. Human Profiling

Figure 1 show Human Profiling i.e. how well human being can link with each other based on their human characteristics, like birth place, living place, caste, race, ethnic, gender, religion, education, habit, hobbies, etc. One human can link to other human on the basis of links l1, l2, l3, and so on, which will help in human profiling. As this profiling become complex after some period of time, roles of different nature will emerge with the help of knowledge model. These roles can be denoted by r1, r2, r3, and so on, which leads to get impact factor of each of the role, played by same human being in different community. Each of the community will hold individuals (Human) as h1, h2, h3, and so on in the Community Space, which is used in our ongoing research of Community Algorithm [14].



**Figure 1: Human Profiling**

## 6. Ontology Development

For the development of Ontologies of profile and community, we used Protégé 3.3.1 [12], a free, open-source platform, a popular tool of Stanford University for developing Domain Ontology. Ontology Development 101 [13] was followed step-by-step, as defined by Noy and McGuinness.

### 6.1. Steps of Ontology Development 101

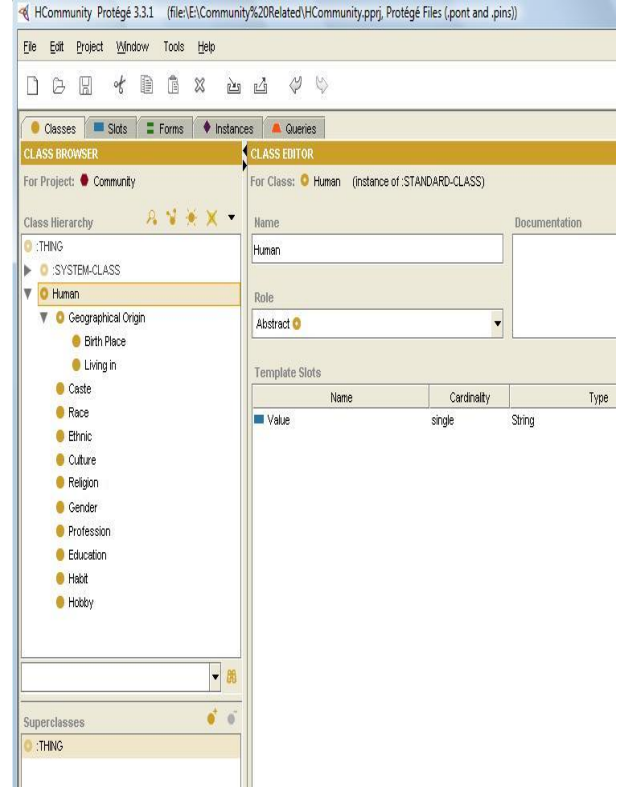
Following are the steps described in [13] by Noy and McGuinness:

1. Determine the domain and scope of the ontology
2. Consider reusing existing ontologies
3. Enumerate important terms in the ontology
4. Define the classes and the class hierarchy
5. Define the properties of classes—slots
6. Define the facets of the slots
7. Create instances

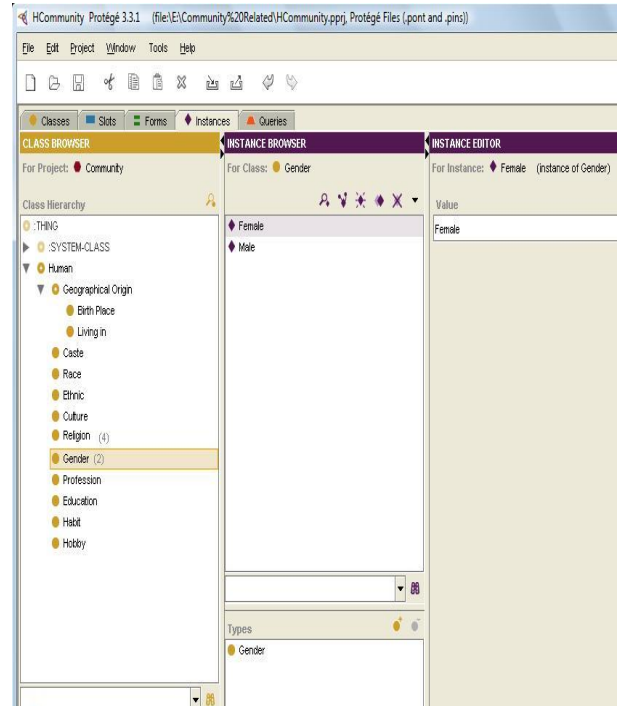
For the development of Human Community Ontology, we skip step 2 of Ontology Development 101, which will be considered when we make Human Community Ontology more generalized, in future. We are using the Community Ontology [15], which was developed by us earlier and is discussed in next section.

### 6.2. Human Community Ontology

Figure 2 shows Human Community Ontology, developed in Protégé 3.1.1 [12]. Human Community is a type of global community, which contains different local communities based on birth place, living place, caste, race, ethnic, gender, religion, education, habit and hobbies of human beings, Figure 3 and 4 shows different local communities.



**Figure 2: Global Human Community Ontology in Protégé**



**Figure 3: Local Community Ontology based on Religion**

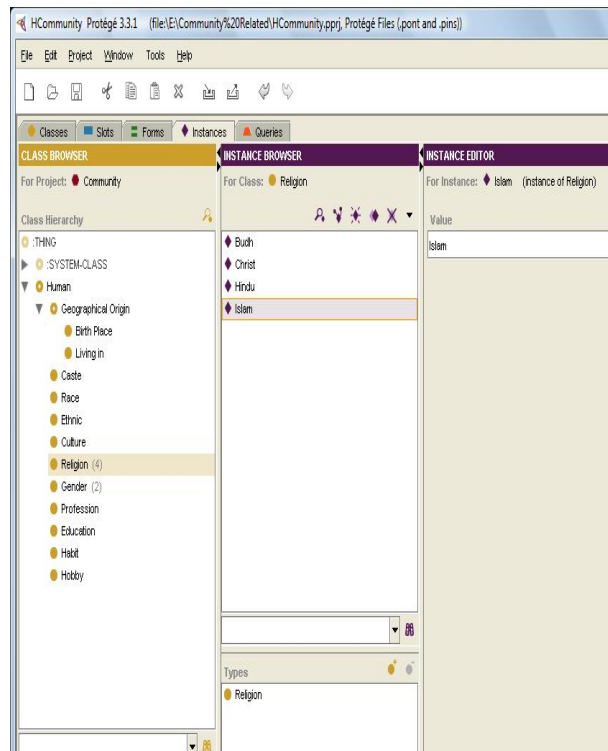


Figure 4: Local Community Ontology based on Gender

## 7. Ontology Maintenance

As the time passes, Ontologies changes its shape, their concepts and relations being modified and updated with new ones. Anna V. Zhdanova described Ontology Management Technique in [11], which can be incorporated in order to have capabilities for ontology maintenance.

### 7.1. Methods of Ontology Maintenance

The following are some of the major methods used for Ontology Maintenance:

1. User Feedback (also known as Beta Testing)
2. Textual Analysis of Knowledge Representation
3. Concept Factoring (based on replication or repeat instances)
4. Extraction of relations
5. Applying Maintenance Frameworks

### 7.2. Other Approaches

More mature fields of research and development can extend their characteristics of maintenance into ontology maintenance. The methods of Software Maintenance and Open Source Maintenance can be used in ontology maintenance as it is or with some appropriate changes.

## 8. Conclusion and Future Work

We define ontology (frame structure) to hold human communities in this research paper, which is the first objective in our research work for Community Algorithm. We have already started research work from June 2008 and will finish it by February 2010. In these two years, we will complete targeted research objectives and come up with appropriate results by achieving proposed Community Algorithm [14, 17].

## 9. Acknowledgement

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