نموذج رقم (1)

إقـــــرار

أنا الموقع أدناه مقدم الرسالة التي تحمل العنوان:

Extracting the Semantics of Understood–And–Pronounced of Qur'anic Vocabularies Using Text Mining Approach

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DECLARATION

The work provided in this thesis, unless otherwise referenced, is the researcher's own work, and has not been submitted elsewhere for any other degree or qualification

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كلية تكنولوجيا المعلومات

Extracting the Semantics of Understood-and-Pronounced of Qur'anic Vocabularies Using a Text Mining Approach

A Thesis Submitted to the Faculty of Information Technology in Partial Fulfillments of the Requirements for the Degree of Master in Information Technology

By

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بناءً على موافقة شئون البحث العلمي والدراسات العليا بالجامعة الإسلامية بغزة على تشكيل لجنة الحكم على أطروحة الباحثة/ مروة عبدالحكيم عامر السعافين لنيل درجة الماجستير في كلية *تكنولوجيا المعلومات* برنامج تكنولوجيا المعلومات وموضوعها:

استخلاص دلالات المنطوق والمفهوم من الكلمات القرآنية باستخدام طريقة تعتمد على تنقيب البيانات

Extracting the Semantics of Understood-andPronounced of Qur'anic Vocabularies Using a Text Mining Approach

وبعد المناقشة التي تمت اليوم الثلاثاء 07 جمادى الأولى 1436هـ، الموافق 2016/02/16م الساعة الحادية عشرة صباحاً، اجتمعت لجنة الحكم على الأطروحة والمكونة من:

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واللجنة إذ تمنحها هذه الدرجة فإنها توصيها بتقوى الله ولزوم طاعته وأن تسخر علمها في خدمة دينها ووطنها.

والله ولي التوفيق،،،

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الر كِتَابٌ أُحْكِمَتْ ءَايَٰتُهُۥ ثُمَّ فُصِّلَتْ مِنْ لَّدُنْ حَكِيمٍ خَبِيرٍ

سورة هود آية (1)

Dedication

To My Great DAD..

To My MOM..

To My Husband ,, AHMED..

To My Prince ,, KARIM ..

To My Beautiful Sweet Heart ,, SONDOS ..

To My Sister and Brothers ..

Acknowledgment

Thanks for Allah for all the blessings that he gave me „ and to give me the strength and courage to complete this thesis and research.

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ABSTRACT

This research presents an approach to extract semantics of Quran vocabularies by classifying their meanings into two categories; the Understood and the Pronounced (علم المنطوق والمفهوم). Understood vocabularies are defined as the meaning of words that are not in place of pronunciation and it has two types: the agree understood meaning, and the disagree understood meaning. In our research we focus on extracting the first type of these categories. However, the Pronounced vocabularies are defined as the meaning of words that are in place of pronunciation. This category have several types, we focus on two of them which are textual operative and interpreter operative. The approach develop the ontology with concepts to support queries needed in the approach. We develop computational analysis of the Quranic vocabularies and compare them according to ontological concepts with lexical meanings. We build some rules based on our study about Understood-and-Pronounced, we applying them as preparation for classification step. The results can be helpful to Quranic scholars and students to distinguish between the semantics of Quranic vocabularies which is one of the most important fields in Qur'an sciences and interpretation.

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Glossary

Understood Vocabularies (علم المفهوم): The meaning of words is not in place of pronunciation or speech and it has two types, the agree understood meaning (مفهوم الموافقة), and the disagree understood meaning (مفهوم المخالفة).

Agree understood meaning (مفهوم الموافقة): The speech word (Spoken word) shows many other semantic meanings not on the place of pronunciation.

Pronounced Vocabularies (علم المنطوق): The meaning of words is in place of pronunciation or speech.

Textual operative (المنطوق الصريح) : The speech of word (Spoken word) is the same of lexical meaning and do not likely to interpretation or other meaning.

Interpreter operative (المنطوق المؤول): The word has a semantic meaning that differs from the known meaning of the word.

Provisions verses (آيات الأحكام): Limited known verses, used to devise rule of religious significance of the word or the device a concept of a particular verse.

Sahih International [1]: The source of verse translations.

CHAPTER 1: INTRODUCTION

This chapter introduces the thesis by stating the underlying concept of Understood-and-Pronounced science on Quran, semantics of words, also it talks about the thesis problem, the research objectives, the research importance, the research scope and limitations, as well as the research methodology.

1.1 Overview of Understood-and-Pronounced science

Quran structure contains numerous sciences some of them are discovered but a lot are not yet. One of the most important fields of Quran sciences and interpretation is Understood-and-Pronounced. It focuses on semantics of vocabularies and identify the exact meaning of words rather than their lexical meaning. Understood-and-Pronounced (علم المنطوق والمفهوم) is divided into two categories: Understood meanings of Quranic vocabularies, defined as the meaning of words that are not in place of pronunciation, and it has two classifications: the first is agree understood meaning and the second is disagree understood meaning. The second category is named Pronounced meanings of Quranic vocabularies and is defined as the meaning of words that are in place of pronunciation. This category has several classifications, we focused on two of them: textual operative and interpreter operative. Tafsir scholars usually depend on limited known verses used as examples for clarifying the idea of Understood-and-Pronounced, called Provisions verses (آيات الأحكام) and they take them as rules to measure the semantics of other verses on the Qur'an.

In this research, "**Extracting the Semantics of Understood-and-Pronounced of Qur'anic Vocabularies Using a Text Mining Approach**", we attempt to create a computational environment using annotated corpus on Quran to help scholars extract verse semantics, and then classify them into two categories: Understood or Pronounced. This contribution aims to classify direct meaning and latent meaning according to Tafsir field in a Quran and understanding the semantics of each word and its real meaning in Quran.

Currently, a manual method is used in extracting verse semantics and meanings, depending on measuring, by taking known semantics of a verses as an example to be measured. This leads to the probability of multiplicity of opinion and additionally consumes a lot of time and effort. We build our approach by making use of an open source Quranic Corpus [1], and employing ontology and annotation. We apply extraction approach to get the Tafsir meaning for specific word based on concepts under ontology and the lexical meaning for the same word, We perform our experiments on a limited number of famous verses on understood-and-Pronounced namely Provisions verses (آيات الأحكام). Then compare between two meanings as preparation for classification step. Our rules are set by making several meetings with experts on Quran interpretation field. All of them encourage the idea and its contribution on facilitating the classification process for scholars on this field. We conclude the results by measuring the precision and recall.

The result will help Quranic scholars and students by reducing time and effort to distinguish between the semantics of Quranic vocabularies according to Understood-and-Pronounced concept**.**

1.2 Problem Statement

Understood-and-Pronounced in Quranic vocabularies is a famous science in Tafsir. Scholars and interpreters use manual methods to extract verse semantics and meanings, sometimes depending on measuring, by taking known semantic verses called Provisions verses (آيات الأحكام), and some other times depending on diligence of the scholar. So differences of understanding the verse can occur. In addition efforts are needed to understand meaning and semantics of a verse to classify it according to categories of Quranic vocabularies of Tafsir which is called Understood-and- Pronounced.

There is a need to create a computational environment for text mining using annotated corpus on Quran with rules for the classification process to extract verses semantics and meaning, and classify them into two main categories: **Understood-and-Pronounced** in Tafsir field (علم المنطوق والمفهوم في القرآن الكريم). This approach will reduce time and effort needed to identify the exact categories for the specific verse and in addition minimize the multiplicity of views.

1.3 Objectives

The objectives of this research are expressed in a main objective and a set of specific objectives.

1.3.1 Main Objective

To develop an approach by constructing an ontology for identifying Understood-and-Pronounced in the Quranic vocabularies (علم المنطوق والمفهوم في ألفاظ القرآن) to extract the semantics of Quranic verses, with less multiplicity of opinion.

1.3.2 Specific Objectives

The specific objectives of the research are:

- Develop a hierarchical relations of Quranic words as a basis for the identification process into the two categories of Tafsir field, Understood-and-Pronounced in the Quranic vocabularies
- Distinguish between direct meaning and latent meaning for specific chosen which are Provision verse according to Tafsir field in Quran.
- Develop the model for building the semantics of each word in the chosen verses and reveal its real meaning in Quran.
- Implementing the approach using an unsupervised technique based on the text mining approach.
- Conduct the required experiments on the developed approach and evaluate the it using recall, precision and accuracy measures.

1.4 Importance Of The Thesis

In Tafsir field, The science of Understood-and-Pronounced in Quranic Vocabularies (علم المنطوق والمفهوم في ألفاظ القرآن الكريم) has its significance in the interpretation of the Quranic verses which is considered a very specialized and requires special and high expertise. This research helps Quranic scholars in classifying the speech of words into Understood and Pronounced according to its semantics which is important in

interpreters' Quran community with less time, effort and minimize the opportunities of difference and multiplicity on the opinion.

1.5 Scope And Limitations

The intent of this research is to classify Quranic vocabularies into two categories in Tafsir field, Understood Vocabularies and Pronounced Vocabularies. Understood Vocabularies have two classifications: the first is Agree understood meaning, the second is Disagree understood meaning. Our research is concern with Agree understood meaning. The next category named Pronounced vocabularies, this category has several classifications we focus on two of them Textual operative and Interpreter operative.

We build our approach by making use of an open source Quranic Corpus [1]. We adapt the idea of its ontology and annotation to apply our rules for classify speech.

We apply our experiments into a limited number of famous verses on Understood-and-Pronounced named: Provisions verses (آيات الأحكام) where their classifications are known previously, then we compare the results with manual known classifications of the same verses. We use the precision and recall measures to evaluate the approach.

1.6 Research Methodology

Our work is developing an approach to extract the semantics of Quranic verses and classify them into two categories in Tafsir field (علم المنطوق والمفهوم في ألفاظ القرآن) in attempt to reduce time, effort and multiplicity of opinion. To achieve this objective and realize the specific objectives on several phases:

First: Data Collection phase: In this phase we build our ontology and annotation with hierarchal relations of Quranic words to configure lexical meaning based on ontology, additionally we determine an open source lexical meaning to make comparison. We select the famous verses called Provisions verses (آيات الأحكام) in Understood-and-Pronounced field. We set the Understood-and-Pronounced rules as a basis for the classification process.

Second: Data Analysis phase: Here, we develop the model for building the semantics of each word in the chosen verses and reveal its real meaning in Quran by applying

suggested rules and implementing the approach using unsupervised technique based on Extraction approach.

Third: Interpretation phase: To conduct the required experiments on the developed approach and evaluate it, we make several interviews with experts and check the results, and compare them with the experts interpretation of each verse. Then we use recall and precision to measure the performance of the approach.

1.7 Tools and Methods

The research depend on some known verses and compare their vocabularies and words based on lexical meaning and semantic meaning, following some rules to identify the results of verse classification. So we need to develop a hierarchical relation of Quranic words as a basis for the classification process using Protege platform, which is an extensible and customizable toolset for constructing ontology and for developing applications that use these ontology. Users edit and view ontology in a manner that insulates them from the ultimate storage format, we depend on XML format, we use Protege for several features:

– Loading and saving OWL files.

– Graphical editors for class expressions.

We use one of the text mining techniques which is information-extraction approach. Programming languages depend on Java Netbeans platform. For lexical meaning we depend on OXFAM open source API [23]. Measure system performance using precision and recall. For classification process we set three rules for the three classification categories which our research concern on discussed on chapter 4.

1.8 Thesis format

The thesis is divided into six chapters, which are structured around the objectives of the research. It is organized as follows:

Chapter 2: Theoretical and Technical Foundation, presents several topics related to the idea of the project. It presents the concept of ontology and annotation, then the concept of semantics in linguistics and how we can make use of it in computational work,

the main topics is all about text mining and how to make used on information extraction approach, we present the methods of assessment that we follow.

Chapter 3: Related Work, presents some related work on semantics and ontology, some of them concern on Quran Vocabularies and how we can deal with them to extract such information, others talk about Arabic key phrase extraction, we present some other work about web ontology and using information extraction approach.

Chapter 4: Proposed Approach, presents the approach and its steps and the architecture. An explanation of the data sets used in the experiments, preprocessing of these data set, and the experiment cases is included as well.

Chapter 5: Experimental Results and Evaluation, presents the details of the sets of experiments, and analyzes the experimental results and performs evaluations for recall and precision.

Chapter 6: Conclusion and Future Work, draws the conclusion and summarizes the research achievements and suggests future work.

CHAPTER 2:THEORETICAL AND TECHNICAL FOUNDATION

In this chapter we introduce and discuss a number of concepts and techniques that are useful for this study and serve as a bases to build up approach. Begin with Concept of Semantic, then show the role of Qur'an in improve the vocabularies and meanings, after that present in some details the main subject of the research is Understood-and-Pronounced as one of the fields of Quran sciences and Interpretation. Semantic Annotation also have a space. Our idea building on text mining experiment, so we introduce its techniques and all about information retrieval and extraction based on ontology.

2.1 Concept of Semantics

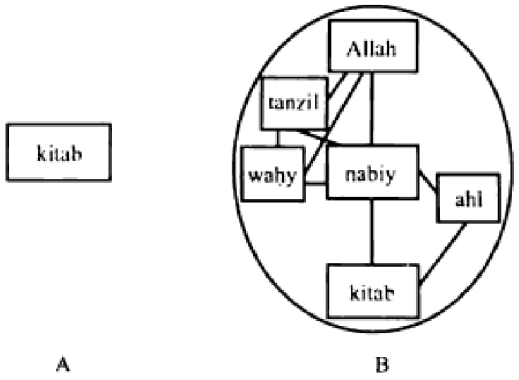
Semantics is the study of meaning, it has roots in linguistics, psychology, anthropology, logic and philosophy of language, artificial intelligence, and more. Concerning in semantics meaning may come out quite differently if one focuses on language and thought, on language and communication, on language and culture, or on language and truth. Some define semantics as the study of meaning of linguistic expressions. The language can be a natural language or an artificial language. Meaning in natural languages is mainly studied by linguists. In fact, semantics is one of the main branches of contemporary linguistics. Theoretical computer scientists and logicians think about artificial languages. In some areas of computer science, these divisions are crossed. In machine translation, for instance, computer scientists may want to relate natural language texts to abstract representations of their meanings; to do this, they have to design artificial languages for representing meanings [2].

There are strong connections to philosophy. The idea that meaningful units combine systematically to form larger meaningful units, and understanding sentences is a way of working out these combinations, has probably been the most important theme in contemporary semantics. Linguists who study semantics look for general rules that bring out the relationship between *form,* which is the observed arrangement of words in sentences and meaning. This is interesting and challenging, because these relationships

are so complex [2]. What we present is a brief for give us background of how to deal with words and vocabularies and how the word may carry several meanings additionally the semantic meaning. Each word on Holly Quran have direct meaning or semantic meaning, and here we will concern.

2.2 The Role of Qur'an In Improving The Vocabularies and Meanings

Each individual word, taken separately, has its own basic meaning or conceptual content on which it will keep its hold even if we take the word out of its Qur'anic context, Izutsu said [2]. The word *kitab* (book), for example, means basically the same thing whether it is found in the Qur'an or outside of Qur'an, as present on part A at Figure 2.1 . This word, as long as it is actually felt by the speech community to be one word, keeps its fundamental meaning in this case, a very general and non-specified meaning of 'book' wherever it is found, whether it happens to be used as a key-term in a given system of concepts or more generally outside of that particular system. This constant semantic element which remains attached to the word wherever it goes and however it is used. We may call it the 'basic' meaning of the word.



A—the word kitāb in an ordinary context showing the basic meaning of 'book' pure and simple.
B—the same word kitāb in the semantic field of Revelation peculiar to the Qur'an.

Figure 2.1: Vocabularies on Quran [2]

Henceforward, the word in the characteristically Qur'anic context will have to be understood in terms of all these related terms and this association alone gives the word *kitab* very special semantic coloring, present on part B Figure 2.1, that is very complex

and particular meaning structure which it would never have acquired if it remained outside of this system. It is to be noticed that this is also part of the meaning of the word *kitab* as long as it is used in the Qur'anic context an exceedingly important and essential part of its meaning. Indeed, far more important than the 'basic' meaning itself, the 'relational' meaning of the word to distinguish it from the latter. Thus, while the 'basic' meaning of a word is something inherent in the word itself, which it carries with it whenever it goes, the 'relational' meaning is something connotative that comes to be attached and added to the former by the word's having taken a particular position in a particular field, standing in diverse relations to all other important words in that system.
This view serve us to think in deep on build our ontology and the distribute Quran words according to suitable semantic concept for each word and determine the relation among them, see Section 4.2.

2.2.1 Semantics On Quran

Izutsu [2] study the semantics of Qur'an by presenting an analytical study for key terms which express Quranic worldview, e.g., Quranic vision of the universe. The semantics of Qur'an would deals mainly with the problem of how, in view of this scripture, the world of being is structured, what are the major constituents of world, and how they are related to each other. It would, in this sentence be a kind of ontology concrete, living and dynamic ontology and not the kind of static systematic ontology constituted by a philosopher at an abstract level of metaphysical thinking.

To clarify 'basic' Meaning and 'relational' Meaning, the study expresses those concepts, do not stand alone and in isolation but are always highly organized into a system or systems. he introduced a technical distinction between 'basic' meaning and 'relational' meaning as one of the major methodological concepts of semantics in order to facilitate subsequent analytic work.

2.3 Understood-and-Pronounced (علم المنطوق والمفهوم) As One Of The Fields of Quran Sciences And Interpretation

In Tafsir field, The science of Understood-and-Pronounced in Quranic Vocabularies (علم المنطوق والمفهوم في ألفاظ القرآن الكريم) has its significance in the interpretation of the Quranic verses which is considered a very specialized and requires special and high expertise. Now, when we need to transfer concept from mind to mind then some words and vocabularies are used, so vocabularies is a template of concepts, that is each vocabulary transfer part of concept unless transferring overall the concepts. The semantic of vocabularies on concepts by make useful of explicit speech or by hint, this cases, scholars studies the **Understood-and-Pronounced**, which have several categories classification shown in Figure 2.2. So it seems that serious of studying and research on this field, to understand the semantics of vocabularies.

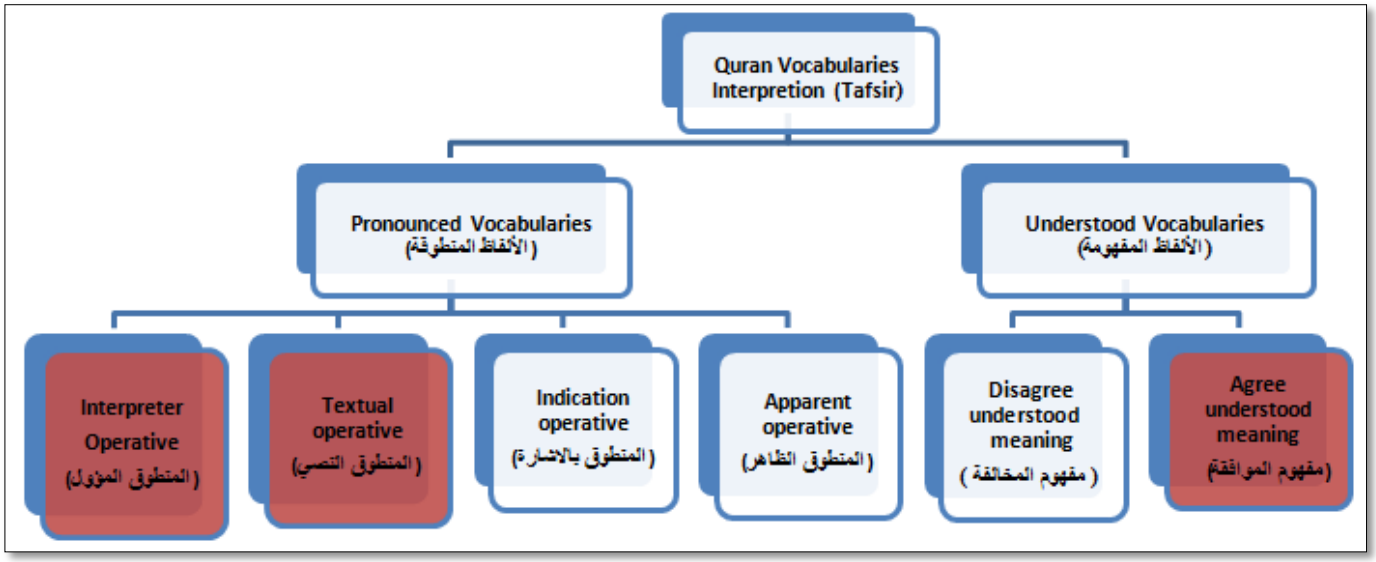


Figure 2.2: Quran Vocabularies Interpretation: Pronounced-and-Understood Vocabularies

Understood Vocabularies (علم المفهوم): The meaning of words is not in place of pronunciation or speech and it has two classification: Agree understood meaning (مفهوم الموافقة) , and Disagree understood meaning (مفهوم المخالفة). In our research we will focus on extracting the first type of this categories.

Agree understood meaning (مفهوم الموافقة): The speech word -spoken word- shows many other semantic meanings not on the place of pronunciation. Example. (لسانا عربيا)

Pronounced Vocabularies (علم المنطوق): The meaning of words is in place of pronunciation or speech. This category has several classifications and we focus on two of them which are textual operative and Interpreter operative.

Textual operative (المنطوق الصريح ***):*** The speech of word -spoken word- is the same as the lexical meaning and do not likely to interpretation or other meaning. Example on verse 2:195:

Verse**:** {فَصِيَامُ ثَلاثَةِ أَيَّامٍ فِي الْحَجِّ وَسَبْعَةٍ إِذَا رَجَعْتُمْ تِلْكَ عَشَرَةٌ كَامِلَةٌ}

Sahih International*: And whoever cannot find [or afford such an animal] - then a fast of three days during Hajj and of seven when you have returned [home].*

Interpreter operative (المنطوق المؤول ***):*** The speech of word -spoken word- has the semantic meaning that differs from the known meaning of spoken word. Example on verse 17:24,

Verse**:** { واخفض لهما جناح الذل}

Sahih International*: And lower to them the wing of humility out of mercy*

2.4 Concept of Ontology and Annotation

One studies [5], define the concepts as one Concept Item, if there are synonymies, near-synonyms or hyponyms between them in domain ontology. A concept item can be denoted as {1} $n = \leq\leq i$, where n is the amount of the concepts the Concept Item contains. A Concept Item is identified by one of those elements. Take the ontology "rental" for example, concept "phone" and "telephone" are near-synonymies, "cell phone" and "mobile phone" are synonymies, "phone" and "mobile phone" are hyponyms. Therefore, the above four concepts can be classified as a Concept Item. the Value of Concept. An instance of a concept in web pages is called a value of the concept. For example, "November 11, 2007" is a possible value of the concept "data".

In philosophy definition [4], Concepts has two approaches, some of them define concept that they are mental representations, while the other proposes that they are abstract objects. The view that concepts are mental representations takes as its starting point a

version of the Representational Theory of the Mind (RTM). The second major view of the ontological status of concepts. According to this view, concepts are not mental representations; they aren't "in the mind" at all. Instead, they are abstract objects of a certain sort.

The Quranic Ontology [6], uses knowledge representation to define the key concepts in the Quran, and shows the relationships between these concepts using predicate logic. The fundamental concepts in the ontology are based on the knowledge contained in traditional sources of Quranic analysis, including the *hadīth* of the prophet *muhammad* , and the *tafsir* (Quranic exegesis) such as *ibn kathīr*. Named entities in verses, such as the names of historic people and places mentioned in the Quran, are linked to concepts in the ontology as part of named entity tagging.

2.5 Semantic Annotation

Annotation, or tagging, is about attaching names, attributes, comments, descriptions, etc. to a document or to a selected part in a text. It provides additional information (metadata) about an existing piece of data [7].

A tag annotation element is a non-hierarchical keyword or free form term assigned to a resource. A tag implicitly describes a particular property of a resource as the computer and other consumers of the annotation do not know the meaning that the annotator intended (except if the natural language used is unambiguous). Normally, a tag is a single word or a sequence of characters without spaces (which typically serve as tag separators in the user input) [8].

A relation annotation element is a pair (Rel, Res), where Rel is the name of the relation and Res is another resource. The relation name defines how the annotated resource is related with Res. At the conceptual level, the relation annotation model is an extension of the attribute annotation model to the domain of resources, which allows the user to inter link these resources. For instance, in a scientific paper a citation referencing another paper is an example of a relation annotation which defines a relation between these documents. Relation annotations give advantage of provide a way to interlink various resources through typed links. It allows the user to navigate from one resource to another and enable search and navigation based on these relation links. The annotator has to

understand what the two resources are about and what kind of relationship holds between them.[8]

Semantic Annotation helps to bridge the ambiguity of the natural language when expressing notions and their computational representation in a formal language. By telling a computer how data items are related and how these relations can be evaluated automatically, it becomes possible to process complex filter and search operations.

Imagine your search engine understands that *"Barcelona" is a city in "Europe"*, it can answer a search query on *"IT Companies in Europe"* with a link to a document about *Yahoo Office in Barcelona*, although the exact words "Barcelona" or "Yahoo" never occur in your search query [7], see Chapter 4.

2.6 Text Mining And its Techniques

Data mining is about looking for patterns in data. Likewise, text mining is about looking for patterns in text: it is the process of analyzing text to extract information that is useful for particular purposes [9]. Text mining has become an increasingly popular and essential theme in data mining. Users need tools to compare different documents, rank the importance and relevance of the documents, or find patterns and trends across multiple documents [10].

There are many approaches to text mining, which can be classified from different perspectives, based on the inputs taken in the text mining system and the data mining tasks to be performed. In general, the major approaches based on the kinds of data they take as input are: (1) the keyword-based approach, where the input is a set of keywords or terms in the documents, (2) the tagging approach, where the input is a set of tags, and (3) the information-extraction approach.

Information-extraction approach which our approach based on it, these approach concern on inputs semantic information, such as events, facts, or entities uncovered by information extraction. A simple keyword-based approach may only discover relationships at a relatively shallow level, such as rediscovery of compound nouns (e.g., "database" and "systems") or co-occurring patterns with less significance (e.g., "terrorist" and "explosion"). It may not bring much deep understanding to the text.

The tagging approach may rely on tags obtained by *manual tagging* (which is costly and is unfeasible for large collections of documents) or by some *automated categorization algorithm* (which may process a relatively small set of tags and require defining the categories beforehand). The information-extraction approach is more advanced and may lead to the discovery of some deep knowledge, but it requires semantic analysis of text by natural language understanding and machine learning methods. This is a challenging knowledge discovery task. So we build Ontology with annotation, see Section 4.4.2. Various text mining tasks can be performed on the extracted keywords, tags, or semantic information. These include document clustering, classification, information extraction, association analysis, and trend analysis [10].

2.7 Basic Measures for Assessment: Precision and Recall

There are two basic measures for assessing the quality of text retrieval:
Precision: This is the percentage of retrieved documents that are in fact relevant to the query, also Precision defined as a measure of how much of the returned information by the system is correct. Precision is the fraction of correct results, see Section 5.1.

Recall: This is the percentage of documents that are relevant to the query and were, in fact, retrieved. It is formally defined a measure of the coverage of the system. Recall is the fraction of correct results to summation of correct results and missing results, see Section 5.1.

Precision, recall, and F-score are the basic measures of a retrieved set of documents. These three measures are not directly useful for comparing two ranked lists of documents because they are not sensitive to the internal ranking of the documents in a retrieved set. In order to measure the quality of a ranked list of documents, it is common to compute an average of precisions at all the ranks where a new relevant document is returned. It is also common to plot a graph of precisions at many different levels of recall; a higher curve represents a better-quality information retrieval system [10].

Evaluation measurement using Precision and recall depends on the following points:

1. **True positive (tp):** are correct results generated from the system and have agreement from all experts
2. **False positive (fp):** are wrong results generated from the system and have agreement from all experts that are wrong.
3. **True negative (tn):** are correct results generated from the system and have agreement from most of experts
4. **False negative (fn):** are wrong results generated from the system and have agreement from most of experts that are wrong.

Where all the numbers of the results:

$$(n) = tp + fp + tn + fn \qquad \text{eq. (2.1)}$$

Precision is a measure of how much of the returned information by the system is correct. Precision is the fraction of correct results (where tp is the true positive and fp is the false positive) to summation of correct results and unexpected results as follows:

$$\text{Precision} = tp / (tp + fp) \qquad \text{eq. (2.2)}$$

Recall is a measure of the coverage of the system. Recall is the fraction of correct results (where TP is the true positive) to summation of correct results and missing results (where FN is false negative) as follows:

$$\text{Recall} = tp / (tp + fn) \qquad \text{eq. (2.3)}$$

Usually Recall and Precision are antagonistic to one another. A system strives for coverage will get lower precision and a system strives for precision will get lower recall. To measure Accuracy Eq. (2.4) is used, which is the fraction of correct results and correct absence (true positive and true negative) to the summation of correct results, unexpected results, missing results and correct absence (true positive TP, true negative TN, false positive FP and false negative FN respectively which are known as binary evaluation). To measure error rate Eq. (2.5) is used. Error is the fraction of wrong results and wrong absence (false positive and false negative) to the summation of correct results,

unexpected results, missing results and correct absence (true positive TP, true negative TN, false positive FP and false negative FN respectively).

Accuracy = (tp + tn) *100 / (tp + tn + fp + fn) **eq. (2.4)**

Error = fp + fn tp + tn + fp + fn **eq. (2.5)**

In Chapter 5, we consider the equation expressed above to evaluate the experimental result.

2.8 Text Indexing Techniques

There are several popular text retrieval indexing techniques, including *inverted indices* and *signature files*. An inverted index is an index structure that maintains two hash indexed or B+, tree indexed tables: *document table* and *term table*, where *document table* consists of a set of document records, each containing two fields: *doc id* and *posting list*, where *posting list* is a list of terms (or pointers to terms) that occur in the document, sorted according to some relevance measure. *term table* consists of a set of term records, each containing two fields: *term id* and *posting list*, where *posting list* specifies a list of document identifiers in which the term appears [10].

With such organization, it is easy to answer queries like "*Find all of the documents associated with a given set of terms*," or "*Find all of the terms associated with a given set of documents*." For example, to find all of the documents associated with a set of terms, we can first find a list of document identifiers in *term table* for each term, and then intersect them to obtain the set of relevant documents. Inverted indices are widely used in industry. They are easy to implement. The *posting list*s could be rather long, making the storage requirement quite large. They are easy to implement, but are not satisfactory at handling *synonymy* (where two very different words can have the same meaning) and *polysemy* (where an individual word may have many meanings) [10].

2.9 Ontology-Based Information Extraction

Ontology-Based Information Extraction (OBIE) has emerged as a subfield of Information Extraction in which ontologies are used by the extraction process and the output is

generally presented through an ontology. Furthermore, to be more quickly developed and adaptive to other domains, such systems also have to be based on machine learning techniques. The main goal of Information Extraction (IE) is recognizing and extracting certain types of information from natural language texts. The decision to leave out irrelevant information is a conscious one, and it reduces the difficulty associated with the task at hand. Because IE deals with natural language sources, it is seen as a subfield of Natural Language Processing (NLP). Two important subtasks in IE are Named Entity Recognition (NER) and Relation Extraction (RE) [11].

Machine learning is widely used to approach both subtasks. For NER extraction, the performance results of the state-of-the-art systems are around 90%. On the other hand, extracting relations among entities is still a substantially harder task than NER, and NER systems exhibit considerably lower performance. Entity and relation extraction oppose numerical approaches. symbolic ones. Numerical approaches exploit the distributional aspect of data, and use statistical techniques, whereas symbolic ones exploit the structural aspect of data, and use structural information. Numerical methods have been widely used and they are the core learning component of robust, and fully automatic IE systems. However, they provide poor explanations for their results and, as observed in, they face some difficulties to grasp relations involving more than two entities. Moreover, they are relatively computationally burdensome and do not scale well with increasing amounts of input data. On the other hand, symbolic methods can be distinguished between linguistic and machine learning methods. In the former, operational definitions of the elements to be acquired are manually established by linguists, mainly with the help of morpho-syntactic patterns that identify the target entities (terms) or relations. In the latter, the relevant patterns are unknown, but examples of the target terms or relations are used as input for building supervised classifiers [11].

Ontology-Based Information Extraction (OBIE) In order to design an artifact to fulfill aforementioned requirements, IE, particularly OBIE, has been chosen as the design methodology for the proposed framework, which falls into a wider domain of text

mining. Various definitions of IE can be found in the literature. Based on a synthesis study, IE can be defined as a process consisting of 4 steps:

1. Isolating different textual elements in the natural language documents
2. Identifying different mentions of a particular class of concepts, relations, or events for a pre-defined purpose.
3. Extracting information regarding such concepts, relations or events.
4. Representing the extracted knowledge in a formalized structure.

To further understand the role of IE, let us imagine a spectrum with one pole as Information Retrieval , fetching relevant information for certain purposes and the other pole as textual understanding (completely understanding the content of the documents). IE should be located in the middle of the spectrum – which means only the relevant parts of the documents are processed in IE. Three types of knowledge are extracted in IE systems, namely entities, relationships between entities, and properties describing entity. Although IE systems are typically designed for a particular purpose (thus have distinct structures), some of the common modules across different IE systems can include: text zoning, preprocessing, lexical analysis, filter, parsing, semantic interpretation and disambiguation, co-reference resolution, and template generation [12].

A widely-accepted definition of OBIE is that an OBIE system is a system that extracts particular types of knowledge from semi-structured/unstructured natural language texts and provides outputs guided by ontologies. OBIE is a particular type of IE which highly relies on the ontologies, which serve as the formal and explicit representation of domain knowledge, provide not only the guidelines for the extraction processes, but also the format and standardization for representing the outputs. Particularly in knowledge-based IE systems, ontological information embedded serves as the basis for crafting extraction rules/patterns. OBIE systems aim at processing unstructured/semi-structured natural language sources with the guidance from the ontology the knowledge within the ontology provides assistance for the concept annotation/disambiguation purposes. To the best of our knowledge, there is no existing IE system for analyzing the prospectus documents [12].

2.10 Summary

Our approach is to extract the semantics of Quranic verses and classify them into the two categories of Tafsir field, Understood-and-Pronounced in the Quranic vocabularies. To achieve that we read several topics serve us to configure the idea. We need to read about Understood-and-Pronounced science, this is have a role of set the rules for classification process. Then we find the interesting to read about concept of semantic, ontology and annotation. Also, reading on the role of Quran in improving the vocabularies help us to understand the real meaning and semantic meaning on Quran, so we can build the ontology and a hierarchical relations of Quranic words for building the semantics of each word in the chosen verses and extract its real meaning in Quran. Implementing the approach based on the information extraction approach, so we read more about this and its uses, and how much it fit our idea. We present the methods of assessment that we follow to evaluate our project which are using recall, precision and accuracy measures.

CHAPTER 3: RELATED WORKS

In this chapter we present a review of related works. The end of the chapter we give an overall discussion with summary of the related works.

3.1 Semantics On The Qur'an

On Chapter 2 we presented some philosophy and technical view about analyzing the words on Quran, this is clear in [2]. Also [1] expresses his thought about the words. Words exist connected with each other in multiple relationships and thus form a number of largely overlapping areas or sectors. These areas constituted by the various relations of words among themselves called 'semantic fields'. Each semantic field represents a relatively independent conceptual sphere which is quite similar in nature to vocabulary. The difference between 'vocabulary' and 'semantic field' is obviously a relative one; essentially there can be no difference at all between them. A 'semantic field' is an organized whole like 'vocabulary', because it is a whole body of words arranged in a meaningful pattern representing a system of concepts ordered and structured in accordance with a principle of conceptual organization.

3.2 Information Extraction

In order to our approach is related on Extraction information, we find to present several study about this issue.

3.2.1 Key phrase from documents

Study [14], talk about Arabic Key phrase extraction from document using linguistic knowledge and machine learning techniques, this paper studies a supervised learning technique for extracting key phrases of Arabic documents. The extractor is supplied with linguistic knowledge to enhance its efficiency instead of relying only on statistical information such as term frequency and distance. During analysis, an annotated Arabic corpus is used to extract the required lexical features of the document words. The

knowledge also includes syntactic rules based on part of speech tags and allowed word sequences to extract the candidate key phrases. The abstract form of Arabic words is used instead of its stem form to represent the candidate terms. The Abstract form hides most of the inflections found in Arabic words. The paper introduces new features of key phrases based on linguistic knowledge, to capture titles and subtitles of a document.

So, we observe that the study based on making use of both linguistic knowledge and machine learning techniques for extracting key phrases of Arabic documents. And the results prove that the introduced methodology improves the accuracy of extracting key phrases of Arabic documents relative to the available extractors.

They defined two important issues: how to define the candidate key phrase terms, and what features of these terms are considered discriminative, i.e., how to represent the data, and consequently what is given as input to the learning algorithm. The motivation was that adding linguistic knowledge (such as lexical features and syntactic rules) to the extraction process, rather than relying only on statistics, may obtain better results [14].

Thus, the work is based on combining the linguistic knowledge and the machine learning techniques to extract key phrases from Arabic documents with reasonable accuracy. The proposed system is based on three main steps: Linguistic pre-processing, candidate phrase extraction, and feature vector calculation [14].

3.2.2 Extracting user-interested information

Other study [6] concerns on how to extract user interested information automatically or semi automatically. The used information extraction approaches can be divided into two categories:

(1) Wrapper-based information extraction methods. A wrapper can be seen as a procedure that is designed for extracting content of a particular information source and delivering the content of interest in a self-describing representation. In the Web environment, its purpose is to convert information implicitly stored as an HTML document into information explicitly stored as a data structure for further processing.

(2) Concept model-based information extraction methods. The current information extraction methods based on concept model mainly focus on free text. By firstly obtain the structure of a text sentence. Then the sentence is judged to be an extracted object or not by verifying if the sentence's structure is matched to concept relationship defined in domain ontology. Since this method only extracts information from the grammatical aspects, so the recall rate is difficult to guarantee; in addition, it takes statements as a unit to extract information and doesn't take account of the relationship between sentences as well as between paragraphs.

3.2.3 Document object modeling

There are approach [15] for information extraction of e-commerce WebPages, has proposed a semantic Document Object Model DOM (SDOM). With the combination of content and structure information, the precision and recall can achieve a good result which is shown in their experiments on list page and table page data sets. With the development of electronic technology and e-commerce, semi-structured information extraction technology for web pages has attracted a lot of research efforts which becomes one of the hottest topics recently. Many approaches are adopted in this specific research domain such as machine learning [1], data mining [2] and conceptual modeling [3] etc. to obtain process-required information. Differs from the characteristics of the general WebPages, bulletin board systems, blog, facebook and professional B2C websites resemble each other very much in the sense.

Document object model (DOM) describes a document using a tree structure. Each node in the tree manifests an HTML tag or the text item contained in the HTML tag. This kind of tree structure precisely describes informative data are stored in a tabular format such as table, list, div and etc [15].

This paper is the first work to introduce the concept of semantic document object model (SDOM) to deal with this new domain. the correlation between and among tags and text items in the HTML document. Such correlation includes child type, parent type and sibling type. It can make use of standard interface provided by DOM to realize the operation to nodes, including adding node, deleting node, and obtaining parent node or child node of the current.

3.3 Ontology based systems

There are several studies which talk about using ontology systems, and how to employ them to serve Quran field, Sharaf study [13] improve a novel project towards frame semantics which starts by developing FrameNet frames for Quranic verbs, but can be extended to include non-verbal predicates in the Quran and can further be extended to include predicates in Modern Standard Arabic. No previous attempts has been made towards integrating Arabic verbs to FrameNet frames.

The auther chose two chapters from the Qur'an; chapter 2 and chapter 7. This choice was made based on comparing various attributes and features which are likely to influence text mining task. Chapter 2 is a Madani surah (i.e, revealed in Medina) and the largest chapter in the Qur'an and contains a wide range of topics from legislations to stories of prophets. Chapter 7 is a Makki surah and overlaps in some of the topics like the story of Moses and creation of Adam. Together they contain 9,482 words comprising around 12% of the Qur'an.

Then he describe their data by investigating, analyzing and enriching sample chapters with annotations as a preparation of text mining step. Through this annotation process, gradually build some useful resources for computational analysis of the Qur'an as well. Multilayered annotation carried out in this step including part-of-speech tagging, syntactic parsing, named entities and their relations co-reference resolution, and semantic role labeling. These layers populated by manual and semi-automated process after developing annotation guidelines taking into account Arabic grammar and Tafsir rules [13].

This extensive annotation process should produce gradually a set of resources which will be necessary for text mining. These resources include: a database of Qur'anic patterns, a WordNet type of hierarchical relations between Qur'anic words, a Treebank of syntactic parsing of the Qur'an, ontology like relations between Qur'anic concepts, and FrameNet type of lexicon containing semantic frames. These layers will be represented in XML.

Tokenization and segmentation process is used, the raw Qur'anic verses are first tokenized into words delimited by whitespace. These words may contain multiple morphemes but that broken into single units in the POS layer. Each word of the Qur'an can thus be accessed with a unique ID. A single Qur'anic verse often does not correspond to a complete syntactic sentence that conveys a single meaning. Rather, often one verse contains several sentences, and often several verses join to complete one sentence. Qur'anic scholars included within a verse various pause marks to indicate completed meaningful segments within this verse [13].

After that they adopted the Crescent corpus which is publicly available (http://quran.uk.net) and is being manually checked. This corpus was produced using Backwater morphology analyzer followed by manual checking. Then they organize the Qur'anic vocabulary (verbs, nouns and adjectives) into a hierarchy of semantic relations including: hyponymy, holonymy, metonymy (part-whole relation). Verbs can exhibit special relations like entailment and cause in wordNet task. WordNet construction in a new language is usually done by either translating from the English project and develop semi-automated approach followed by manual verification. Once finished, this hierarchy of words can be mined for interesting patterns and associations which can give insight into linguistic behavior of God. Moreover, developing wordnet style synsets help forming conceptual clusters of the Qur'an and can play the role of Qur'anic wordnet construction, books of tafsir and Arabic lexicon can be consulted in cases of ambiguity.

Then they made Syntactic Analysis following traditional Arabic grammar relations in annotation layer. Standards books available exhaustively analyzed the syntax of the entire Qur'an. After that they performed annotation of Qur'an with named entities based on a developed guideline. Majority of Quranic proper names are consumed by: names of Allah, names of angels, names of Prophets, their tribes and their prophets. They work on Quran Ontology by Finding domain specific entities and defining their relationships will facilitate creation of ontology of the Qur'an.

They considered the actual text mining task on the text (i.e., Qur'an) for modeling which have been prepared and enriched with annotation in previous phases. In the final step of the pilot project, they experimented with few text mining techniques on the initial annotation [13].

Using semantic on web presented on paper [21] has shown how semantic web technology used the Web Ontology language (OWL) in acquiring important knowledge from the Holy Quran. they use queries in Natural Language. to enhance the Model that cope with more complex and ambiguous queries.

Ontology reused gives the opportunity of improving the capabilities and knowledge of the existing ontology. They build the ontology from the already existing Quran ontology built at University of Leeds United Kingdom [1]. As mentioned earlier Leeds Ontology is compose of 300 concepts and about 350 relationships linking the concepts. However these concepts may not be enough to answer all the queries that we want our query model to answer. They decided to improve the ontology by adding more concepts and more relationship to link these concepts. they assume this help in answering more queries than the using only Leeds ontology for our semantic retrieval model.

They use knowledge representation to define the key more concepts in the Quran, and show the relationships between these concepts using predicate logic. the target is to cover as much all the necessary concepts in the Quran including various acts like solat, zakkat, sin, and reward. They used protégée to build our ontology by identifying major concepts in Quran. they used top down ontology development process, the development process starts with the definition of the most general concepts in the domain and subsequent their various sub concepts, their necessary relationships, and related them to various verses in which they are mentioned in the Quran [21].

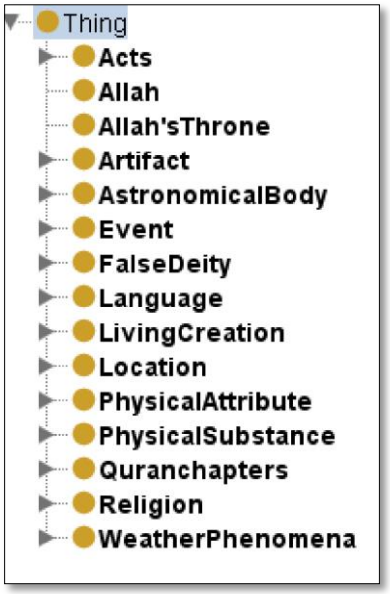


Figure 3.1: Quran Ontology concepts [21]

Figure 3.1 illustrates the top hierarchal of Quran ontology. Thing is the main concept or class from which 15 concepts are created including Quran chapters (which contains the whole Quran chapters). It is from these 15 concepts that various related sub-concepts are formed. Concepts and concept inheritance relationship provides the semantics. Concept inheritance relationships are linked through the properties of the concepts. Properties are object property and data property. An object property describes relationship among concepts. While are use to provide relationship between concepts and its literal.

Concept inheritances relationship provides semantically annotated information which makes retrieval model retrieve important knowledge from the Quran. The query language that is supported by the plug-in is based on the Manchester OWL syntax. Figure 3.2 presents the result of a query for retrieve all those halal (non-prohibited food) food mentioned in Quran. Query: "*is Halal some Food"* [21].

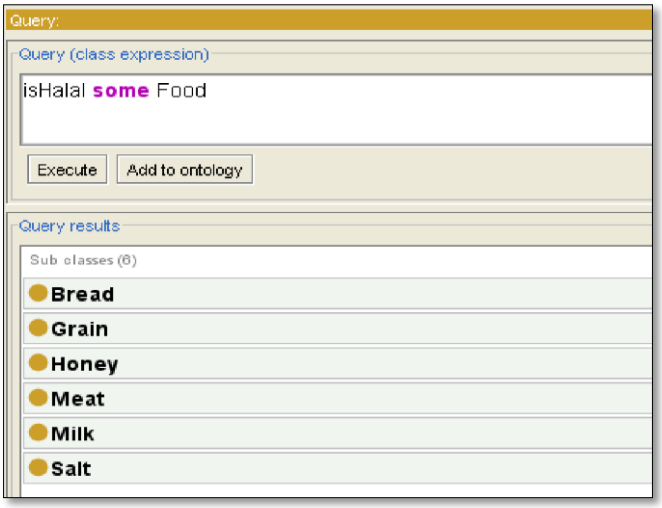


Figure 3.2: Snapshot Query result

Table 3.1 presents Input query using Manchester OWL syntax and the result of these query:

Table 3.1 : Sample Queries & Results

Input Query (Manchester Owl Syntax)	**Concept**	**Verses**
Religion ***and*** *(mentionedIn* ***some*** *Quran)* ***and*** *(onlyAccepted* ***some*** *Religion)*	*Islam*	9 Verse , e.g (ch2:208) (ch3:19)
isNonhalal **some** *Food*	*Carrion, Pork, Wine*	10 Verses , e.g (ch5:90) (ch1:145)
whereMuslimsFaceDuring **Some** *Solat*	*Masjid Haram*	20 Verses , e.g (ch17:7) (ch22:25)
hasGivenName **value** *Ahmad*	*Prophet Muhammad*	1Verse , e.g (ch61:6)

The same authors [22] published a study on the same area based on Concepts using OWL-DL Ontology. They improve the search capability of the current Quran knowledge search systems, they proposed a semantic search system, which goes beyond the traditional keyword search. This system enables users to semantically search for verses relating to concepts found in the Quran and their corresponding relationships. The system includes the creation of a Quran ontology model, which is composed of important Quran concepts found in the Holy Quran and the annotation of these concepts with various properties and restrictions. The semantic search model enables the user to semantically search for the desired knowledge from the Holy Quran.

So the experiment in their model categorizes the queries used into simple and complex queries. For this experiment, they used 40 queries asked by ordinary people. The user

wants to retrieve all the halal (non-prohibited food) foods mentioned in the Quran. Query: “is Halal some Food”, food mentioned in Quran that is halal (prohibited food). Then show the verses. They use a popular precision and recall technique in the evaluation of the effectiveness of their system.

Other study [16] use an ontology-based information extraction system to extract relevant instances from handwritten text resources. By means of information extraction, unstructured text is stepwise transformed into formal knowledge relating it to the originating ontology and instance base. Conceiving the extraction pipeline as black box algorithm, mandatory input parameters are as follows:

1. The input ontology is formalized as an RDF graph. It comprises vocabularies and schemes used for describing instance data. The classes (e.g., persons or companies), data type properties of these classes (e.g., person’s first and last names or addresses of company headquarters) and object properties between instances of these classes (e.g., persons being employed in companies) define a search space of possible instances and facts that may be extracted from text.

2. Formal concepts of the classes are represented as instances inside the instance base. The given data type property values of these instances are used for extracting instances from the handwritten text. Object properties between instances are used for disambiguating instances with similar data type property values or ranking the relevance of extracted instances.

Ontology and instance base are analyzed during a preceding processing and training phase. This training has been performed on other data in previous work. Results are index structures (e.g., suffix arrays, B*-trees) and learning models (e.g., conditional random fields, k-nearest neighbor classifiers) that can now be used by efficient extraction tasks inside the extraction pipeline.

3.4 Summary

To summarize these related works, we have found that [1] is interested on Words, and determine that the relation among them establish the semantic field, we make use of this concept on build our ontology based on words and relation between them, and set each word on the concept fit to it. Our project depend on extraction approach so we present

several studies [6], [14] and [15] used extraction approach in different sides, [14] present extraction key phrase from document, we make use of it by configure the idea of extraction words from ontology corpus. Study [6] which about extracting user interested information, based on extracting information from texts, they defined texts and sentences on domain ontology, they take a statements as a unit to extract information and not take account of relationship between sentences as well as between paragraphs, this study add to our knowledge methods of extracting from ontology although we consider the relation between words on ontology. Although [15] is far from the idea of our project, but we have use from the field concepts of semantic and how dealing with this domain, we build our ontology based on determine concepts for each word. We focus on ontology based system studies such as Sharaf study [13] and how they employ ontology to serve Quran field. We interesting on how they tokenize verses and make annotation and build ontology by protégé platform, we make use of analysis the Qur'anic verses into primary items such as tokens, symbols. To prepare annotation, then could be used with text mining to extract useful idea. On study [16] used an ontology based information extraction system to extract relevant instance from hand written text resources, it adds to our knowledge how the unstructured text transformed into formal knowledge relating it to the originating ontology and instance base.

Our study is based on several concepts, ontology, annotation, semantics field and extraction approach, all related works show these concepts in several uses and different sides, we will use these concepts to extract the semantics of Understood-and-Pronounced of Quran vocabularies.

CHAPTER 4 : THE PROPOSED APPROACH FOR EXTRACTING THE SEMANTICES OF UNDERSTOOD-AND-PRONOUNCED OF QURANIC VOCABULARIES

In this chapter, we present and explain the proposed approach **for Extracting the Semantics of Understood-and-Pronounced of Quran Vocabularies.** Approach is described using flowcharts and figures. The methods tasks are introduced as phases. In the data collection phase, we determine the famous verses called Provisions verses (الأحكام آيات) on Understood-and-Pronounced field and some other related verses, and build a hierarchal relations of Quranic words to create the ontology. In the data analysis phase, we configure rules for classification process. We consider the word and its lexical root as a basis for the classification process, we execute two types of extraction process, first identifying lexical and Tafsir meaning, second extracting word semantics by applying Understood-and-Pronounced rules. In the interpretation phase we explain the output of information extraction.

4.1 Overall Structure of the Proposed Approach

Figure 4.1 shows the basic elements of the approach. It consists of the data collection phase represented by the word in question, its lexical annotation and Tafsir annotation. In the data analysis phase, we build the model for extracting the semantics of each word in the chosen verses using unsupervised learning based on the information extraction approach. Such approach is one of the text mining techniques and is used to reveal the real meaning of the said word in Quran. Next we apply some suggested rules to implement a comparison between two extracted data sources and discover understood/pronounced semantics. In the interpretation phase, we conduct the required experiments on the developed approach and analyze the output of extracted information. After that, we compare the output of the implemented approach with what it is thought about each verse by experts. Finally, we calculate precision and recall of the approach based on the experimental results. The criteria is less time, effort and multiplicity of opinion. Next we present the details of these stages of the approach.

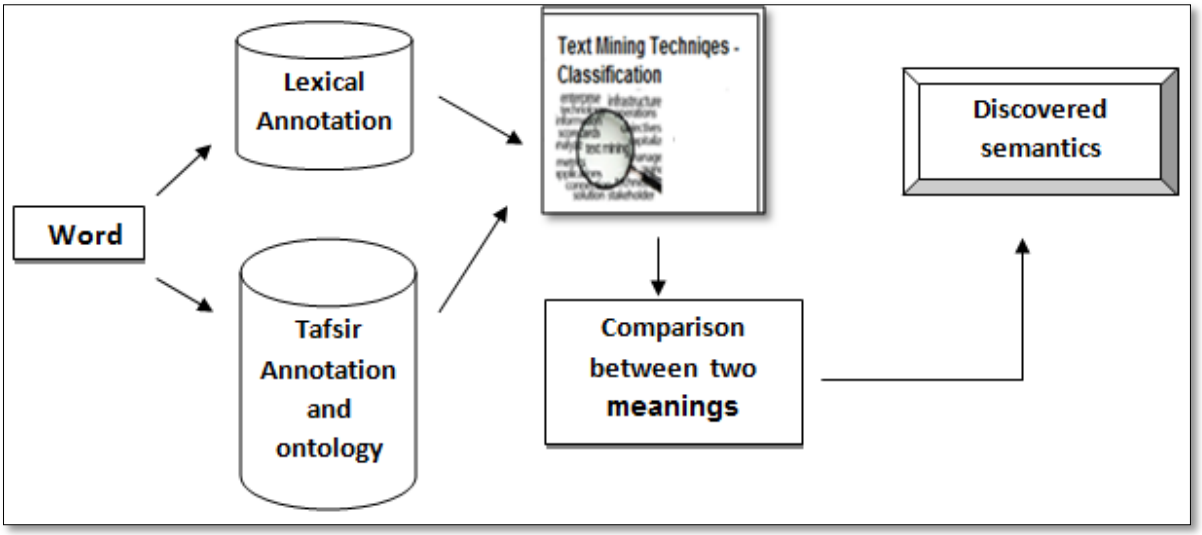


Figure 4.1: General view of the structure of the approach

4.2 Phase 1: Data Collection

The Holy Qur'an includes 114 chapters (سورة) and each chapter includes different number of verses, we build our model by using a famous verses called Provisions verses (آيات الأحكام) as a sample to implement our approach. So we can say The entire Quran is represented as an individual verses which is Provisions verses (آيات الأحكام). Each verse is a sequence of tokens. These are pieces of text delimited by spaces, each word on the verse has a number, building ontology started for the verse by tokenizing the words on this verses and each token can be accessed by the unique number, let us take an example for tokenized a verse into separated word:

Verse: (فلا تقل لهما أف ولا تنهرهما)

Sahih International: *say not to them [so much as], "uff," and do not repel them but speak to them a noble word.*

This verse is tokenized into the following words: (فلا،تقل،لهما،أف،ولا،تنهرهما) shown in Figure 4.2. The specific word that we want to extract the semantic meaning is (*uff* أف), so tokenization process help us to count the position of the word on verse. Also each word identified by number, e.g. 17:23:19, Where 17 is a number of chapter on Quran, 23 is a number of verse on chapter, 19 a number of word on the verse.

```
<HolyQuran>
<ChapterNo ="17">
<VerseNo ="23">
<WordNo ="16">فلا</WordNo>
<WordNo ="17">تقل </WordNo>
<WordNo ="18">لهما</WordNo>
<WordNo ="19">أف</WordNo>
<WordNo ="20">ولا</WordNo>
<WordNo ="21">تنهرهما</WordNo>
</VerseNo>
</ChapterNo>
</HolyQuran>
```

Figure 4.2: Verse Analysis

Our sample was 44 verses, 52 words, 6 concepts and 50 sub-concepts. So, our ontology hierarchical built by insert basic concepts , each concept include sub- concepts, each sub-concepts have several annotated verses according to semantic of interpreter (see Figure 4.3).

Example: Word (Body) is a concept on our ontology, it has 5 sub-concepts which are (Side, Wing, Hand, Tongue, Arm).

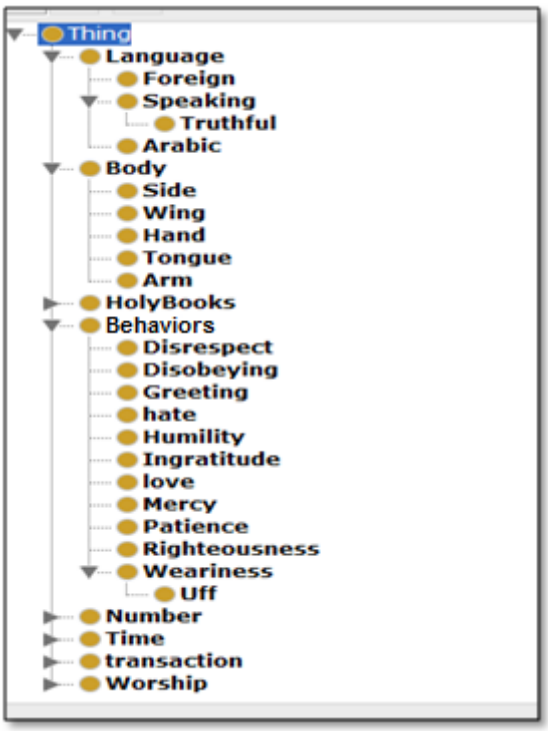


Figure 4.3: Hierarchicay of proposed ontology

We need a linguistic root for lexical meaning, interpret word by word, we used website http://thesaurus.altervista.org, it provide the meaning word by word, available either in XML or JSON format [23].

4.3 Ontology Construction

We develop a hierarchical relation of Quranic words as a basis for the classification process depending classification on the Quranic Arabic Corpus [1]. They analyzed word by word and annotated linguistic resources for each word in the holy Quran. We make use of these classification to know the interpretation of the specific word then placing it to appropriate concept on ontology, see Section 2.4, by this way we build our ontology by placing each word to its semantic (concept) on Quran interpretation. And feed each concept by verses that carry the same word with same meaning. To create that we depend on several steps.

Step 1: Determine the Domain and Scope of the Ontology

The first step in ontology development is defining ontology domain and scope, in which the ontology will be developed in order to answer some basic questions:

- *What is the domain that the ontology will cover?*

The domain of the ontology will cover Quran Vocabularies. In our ontology we are concern with the vocabularies existing on the Provisions verses as a sample and all related verses with this vocabularies.

- *What is the use of the ontology?*

The ontology is to provide a specific interpretation for each word in verses by giving several concepts represented as classes and sub concepts represented as sub classes, which is used by the approach to make judgments on the verses classification according to Understood-and-Pronounced science.

- *What is the use of the annotation inside the ontology?*

Each concept is provided with related verses by the same meaning of word even if it does not have the same of spoken word. The annotation would be comprehensive for each sample of verses.

- *Who will use the ontology?*

The ontology will be available for the approach to extracting Tafsir meaning.

Step 2: Enumerate the Important Terms of Ontology

The main term we want to talk about on ontology is the vocabulary. We add more properties and concepts for these terms by studying the science Understood-and-Pronounced in addition Provision verses which is explained in Section 2.3 (Understood-and-Pronounced as one of the fields of Quran sciences and interpretation).

Step 3: Define Classes and Class Hierarchy of Ontology

This step starts by defining classes. Terms selected whether they describe objects having independent existence or terms that describe these objects. The terms in Table 4.1 are classes in the ontology and will become anchors in the class hierarchy.

Table 4.1: Ontology Classes

No.	Class	Description
1	Behaviors	11 subclasses under it, each of them has several verses as annotation and some them has children.
2	Body	5 subclasses under it, each of them has several verses as annotation
3	Holy Books	1 subclass here and these have two child, each of them has several verses as annotation
4	Language	3 subclasses under it, each of them has several verses as annotation and some them has children.
5	Number	5 subclasses under it, each of them has several verses as annotation and some them has children.
6	Time	5 subclasses under it, each of them has several verses as annotation and some them has children.
7	Transaction	9 subclasses under it, each of them has several verses as annotation and some them has children.
8	Worship	7 subclasses under it, each of them has several verses as annotation and some them has children.

There are three possible ways to develop the class hierarchy [13]: top-down approach, bottom-up approach, or combination of both. In our approach, we use the bottom-up concept such as selected word existing on such verse on annotation, Then we generate the class that could belong to it. The ontology produces an OWL source code. A full copy of the OWL source code is the found in Appendix B: OWL Source Code. In our case most of the values types are string either using ASCII or UTF-8 (Arabic). A sample of the code listed in Figure 4.4 to represent the classes in OWL format.

```
<SubClassOf>
  <Class IRI="#Righteousness"/> <Class IRI="#Behaviors"/> </SubClassOf>
<SubClassOf> <Class IRI="#Sale"/>  <Class IRI="#transaction"/>
</SubClassOf> <SubClassOf>
  <Class IRI="#Side"/>
  <Class IRI="#Body"/>
</SubClassOf>
```

Figure 4.4: Ontology Main Classes in OWL

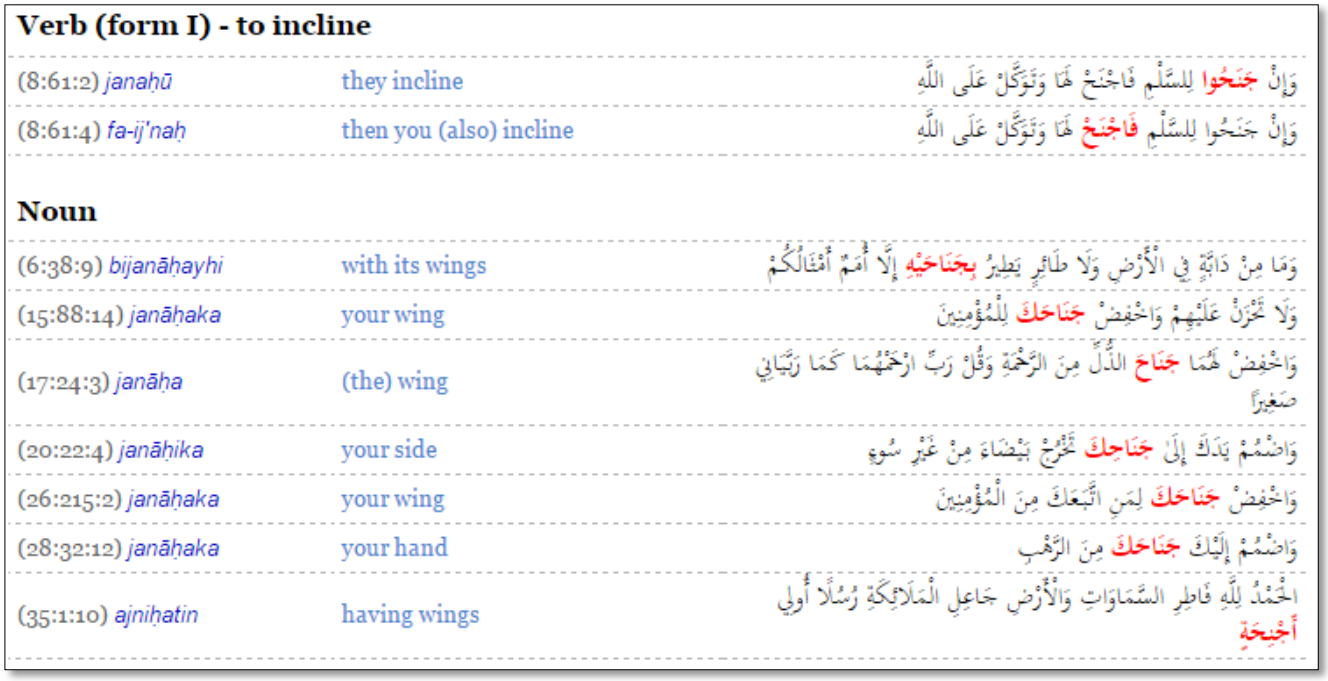
Step 4: Create Classes in the Hierarchy and Feeding Annotation

When we take an example of the Provision verses, it is from chapter 17 (AL israa), the word number 3 is (*wing* جناح)

Verse: (واخفض لهما جناح الذل من الرحمة)

Sahih International: *And lower to them the wing of humility out of mercy and say, "My Lord, have mercy upon them as they brought me up [when I was] small.*

When we looking for the word (جناح) in Quranic corpus we find it in several position and different meanings, see Figure 4.5, this guide our brain storming activity to determine the main concepts for each word, and the word itself is a sub concept.



Verb (form I) - to incline

(8:61:2) *janaḥū*	they incline	وَإِنْ جَنَحُوا لِلسَّلْمِ فَاجْنَحْ لَهَا وَتَوَكَّلْ عَلَى اللَّهِ
(8:61:4) *fa-ij'naḥ*	then you (also) incline	وَإِنْ جَنَحُوا لِلسَّلْمِ فَاجْنَحْ لَهَا وَتَوَكَّلْ عَلَى اللَّهِ

Noun

(6:38:9) *bijanāḥayhi*	with its wings	وَمَا مِنْ دَابَّةٍ فِي الْأَرْضِ وَلَا طَائِرٍ يَطِيرُ بِجَنَاحَيْهِ إِلَّا أُمَمٌ أَمْثَالُكُمْ
(15:88:14) *janāḥaka*	your wing	وَلَا تَحْزَنْ عَلَيْهِمْ وَاخْفِضْ جَنَاحَكَ لِلْمُؤْمِنِينَ
(17:24:3) *janāḥa*	(the) wing	وَاخْفِضْ لَهُمَا جَنَاحَ الذُّلِّ مِنَ الرَّحْمَةِ وَقُلْ رَبِّ ارْحَمْهُمَا كَمَا رَبَّيَانِي صَغِيرًا
(20:22:4) *janāḥika*	your side	وَاضْمُمْ يَدَكَ إِلَىٰ جَنَاحِكَ تَخْرُجْ بَيْضَاءَ مِنْ غَيْرِ سُوءٍ
(26:215:2) *janāḥaka*	your wing	وَاخْفِضْ جَنَاحَكَ لِمَنِ اتَّبَعَكَ مِنَ الْمُؤْمِنِينَ
(28:32:12) *janāḥaka*	your hand	وَاضْمُمْ إِلَيْكَ جَنَاحَكَ مِنَ الرَّهْبِ
(35:1:10) *ajniḥatin*	having wings	الْحَمْدُ لِلَّهِ فَاطِرِ السَّمَاوَاتِ وَالْأَرْضِ جَاعِلِ الْمَلَائِكَةِ رُسُلًا أُولِي أَجْنِحَةٍ

Figure 4.5: Word is found in several position and different meanings

Table 4.2 presents word (*wing* جناح) on each position on ontology and its annotation:

Table 4.2 : Ontology concepts and annotation

Concept	Sub concept	Annotation	The verse
Body	Hand	28:32:12	واضمم إليك جناحك من الرهب
	Side	20:22:4	واضمم يدك إلى جناحك تخرج بيضاء من غير سوء
	Wing	35:1:10	الحمد لله فاطر السماوات والأرض جاعل الملائكة رسلا أولي أجنحة
		6:38:9	وما من دابة في الأرض ولا طائر يطير بجناحيه إلا أمم أمثالكم
Behaviors	Humility	26:215:2	واخفض جناحك لمن اتبعك من المؤمنين
		17:24:3	واخفض لهما جناح الذل من الرحمة
		15:88:14	ولا تحزن عليهم واخفض جناحك للمؤمنين

We find one word may belong to several concepts, each concept differs from others in its semantic. For example the word (*Tongue* لسان) may belong to the concept (*Body*) and at the same time may belong to the concept (Language) in the ontology, this is refer that the semantic of the word (*Tongue* لسان) is differ according to Quranic context. Next we present and discuss the phases of the approach.

4.4 Phase 2: Data analysis

To find the semantics of Quranic words, we focus on selecting words from the verse and knowing what semantics they carry, this is obtained through using information extraction technique, project run through corpus ontology and check meaning for each word, extracting process is to extract the relevant information and ignore non-relevant information, then link related information and output in a predetermined format, we have two steps for extraction process, first is identify lexical and tafsir meaning, the second is extracting word semantics by applying understood-and-pronounced rules. Before that we explain the role of information extraction on our approach based on definition on Section 2.6 (Text Mining and its techniques).

4.4.1 Suggested Rules for Classification Process

We extract the suggested Understood-and-Pronounced Rules through several interviews with Quranic interpreters, they use them unprompted. we need to create these rules to help us on classification process and extract the semantics.

Initially, we need to clarify the expressions that we use:

- ***Lexical Meaning (LMeaning):*** is the meaning of the word on lexical book, we used website http://thesaurus.altervista.org, it provide the meaning word by word, available either in XML or JSON format [23].
- ***Tafsir Meaning (TMeaning)***: is the meaning of the word on Quran Dictionary provided on the Quranic Arabic Corpus web site[1], and it refers to ontology concept.

Now, we present the suggested rules and an example for each rule:

Rule 1 (Pronounced: Textual operative)

Textual operative (المنطوق الصريح***):*** the speech of word -spoken word- is the same of lexical meaning and do not likely to interpretation or other meaning.

The rule is:

If LMeaning#1 = TMeaning#1

Result is the word belong to pronunciation (textual operative)

Example:

Table 4.3 : Example Rule # 1 on verse 2:275

Classification Category	Verse	Word	LM	Ontology	Rule
Textual operative	ذلك بأنهم قالوا إنما البيع مثل الربا *That is because they say, "Trade is [just] like interest.*	البيع	Trade	Concept :transaction Sub concept : trade	Rule # 1
		الربا	interest	Concept :transaction Sub concept : interest	

Rule 2 (Pronounced: Interpreter operative)

Interpreter operative (المنطوق المؤول ***):*** The speech of word (Spoken word) have the semantic meaning differs from known meaning of speech word.

The Rule is:

If LMeaning#1 != TMeaning#1 then TMeaning#1 is True

Result is the word belong to pronunciation (Interpreter operative)

Example:

Table 4.4 : Example Rule #2 on verse 17:24

Classification Category	Verse	Word	LM	Ontology	Rule
Interpreter operative	واخفض لهما جناح الذل من الرحمة *And lower to them the wing of humility out of mercy*	جناح	Wing	Concept :Behaviors Sub concept : Humility	Rule # 2

Rule 3 (Understood : Agree Understood)

Agree understood meaning (مفهوم الموافقة***):*** the speech word -spoken word- shows many other semantic meanings not on the place of pronunciation**.**

The rule is:

LMeaning#1 = TMeaning#1 and

LMeaning#1 = TMeaning#2 and

LMeaning#1 = TMeaning#3

Result is the word belong to understood - agree understood

Table 4.5 : Example Rule #3 on verse 17:24

Classification Category	Verse	Word	LM	Ontology	Rule
Agree Understood	فلا تقل لهما أف ولا تنهرهما *say not to them [so much as], "uff," and do not repel them*	أف	weariness	Concept :Behaviors Sub concept : disobeying Sub concept : disrespect Sub concept : ingratitude	Rule # 3

4.4.2 Information Extraction as Text Mining Technique

Our approach is concerned with ontology concepts and annotations as information (verses) as input to our semantic extraction process. The deep knowledge that the information extraction approach may discover is the semantic of selected words in a verse in the Quranic context. Information extraction requires semantic analysis of text by natural language understanding, so we build the ontology concepts with annotation presented on Section 4.2 (Ontology Construction). For example, the word (*Tongue* لسان) exists as sub concept in two concepts which are Body, Language, in each position the word has annotations of several verses including the same word. this information is serving to find knowledge about the word (*Tongue* لسان) based on its semantic in Quranic context. This is achieved by information extraction.

Extracting Lexical and Tafsir Meaning:

Each word on the verse will have two checks; Lexical meaning (LMeaning) and Tafser meaning (TMeaning), as illustrated on Figure 4.6, a verse has several words and a word may have several LMeanings and TMeanings.

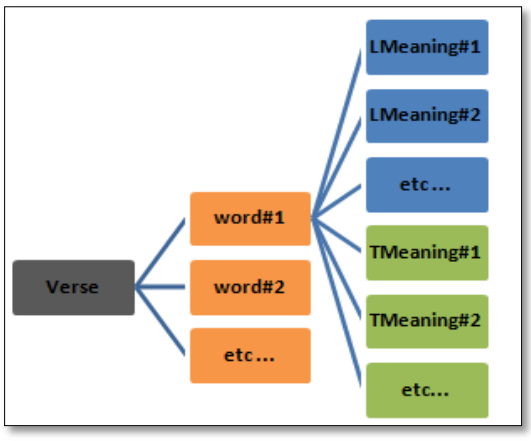


Figure 4.6: Words Classification

For Example the verse (فلا تقل لهما أف ولا تنهرهما), searched for the word (*Uff* أف), then we perform two checks. On the first check for lexical meaning (LMeaning) is presented on Oxfam dictionary and returns (*weariness*). On the second check for tafsir meaning (TMeaning) is performed on the ontology and returns the concepts (*behaviors*) and the sub concepts*: uff , ingratitude, disobeying* and *weariness*.

Identify word semantics by applying understood-and-pronounced Rules:

System combine query result from LMeaning and TMeaning checks, and execute comparison process by applying understood-and-pronounced rules which explained in Section 4.2.1 (Suggested rules for classification process) to determine to which role does the word belongs and therefore to which category (Semantic) of understood or pronounced, as presented on Figure 4.7 , to explain that let us take this example: word (*Uff* أف), in verse (فلا تقل لهما أف ولا تنهرهما) on the LMeaning returns (*weariness*). On TMeaning is performed on the ontology returns the concepts (*behaviors*) and the sub concepts*: uff , ingratitude, disobeying* and *weariness*. Here, when applying comparison we find LMeaning is equal several TMeanings that presented on rule #3 which explained in Section 4.2.1. Rule 3 is defined as the speech of word -spoken word- shows many other semantic meanings not on the place of pronunciation.

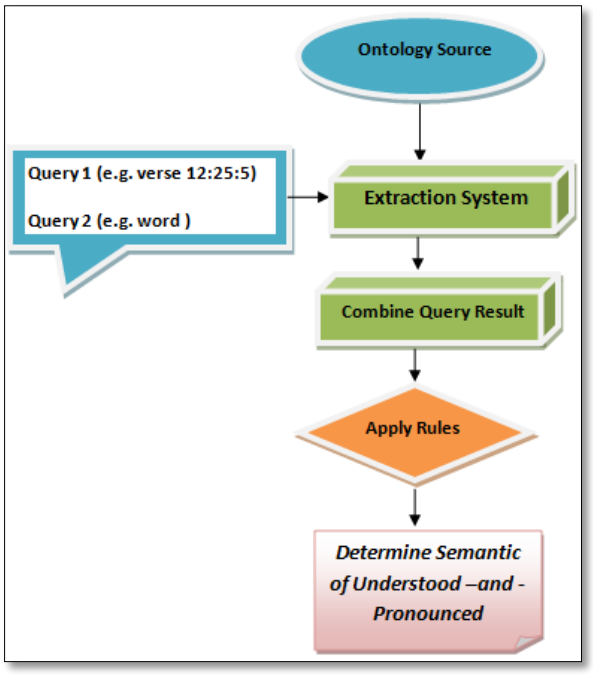


Figure 4.7: Extraction of partial knowledge in the text.

4.4.3 Interpretation

In this step we explain the output of information extraction task on our ontology data. Each entered verse are classified to one of Understood or Pronounced categories, based on analyzing Lexical meaning and Tafsir meaning and compare between them. The result is determine semantic of each verse according to its classification, so we create table includes all samples verses and these system output results to prepare the experimental process by compare the implemented approach (see Chapter 5) result with what it is thought about each verse manually by meetings with experts on Quran vocabularies fields there are : Dr. Abd Alkarim (view no1), Dr. Ramadan Assaife (view no2), and Ms. Manar Elhelo (View no3), see appendix A. The results generated from our system and views of experts are listed on Table 5.1.

Based on experimental results, we calculate precision, recall, and accuracy for performance. The criteria for accepted performance is less multiplicity of opinion, and this is elaborated in Chapter 5.

4.5 Implementation Issues

After building our ontology and annotation which is explained in Section 4.2 (Ontology Construction) based on analysis of Provision verses words and link each verse with appropriate classes called concepts, and the searching on tafsir meaning for each word that means searching through ontology contents of concepts and sub concepts. Each concept or sub concept has an annotations for all verses which include the same word and the same Tafsir meaning, all of that are presented on Section 4.2.

We used an java parser to read the exported ontology xml file from protégé. The Ontology in OWL is presented in Appendix B. In Figure 4.8 presents our ontology with some classes in java. We linked the API of Thesaurus dictionaries [23] for lexical analysis.

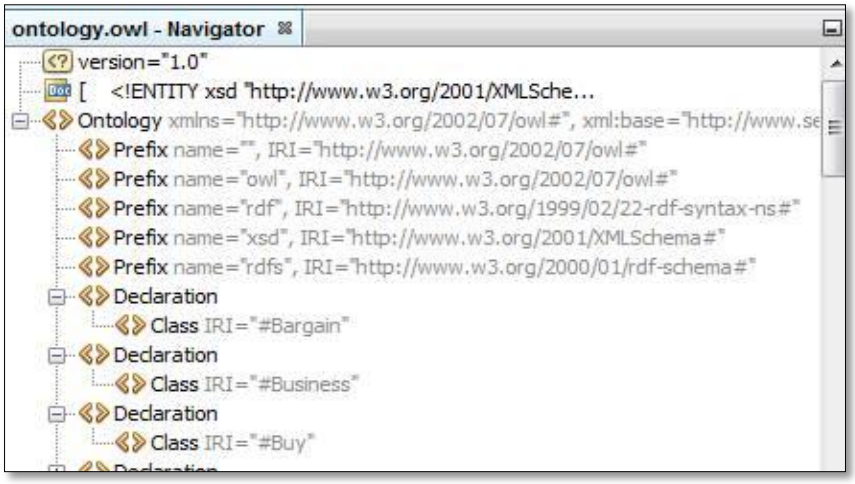


Figure 4.8: Ontology on java parser

In the input is the number of word existing on specific verse and chapter, as shown in Figure 4.9.

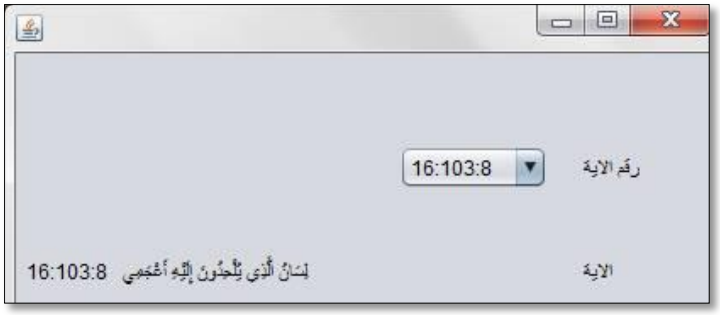


Figure 4.9: Word number as input

For example the verse (فلا تقل لهما أف ولا تنهرهما) is from Chapter (Al Esraa) and its number is 17, the verse is number 23, and the word (*uff* أف) is set on 19th position on over all verse, so the search is be by select the number 17:23:19.

Word (*uff*) have two types of checks, first is through the ontology, so parser search for this word on annotation and extract the meaning that it belong from ontology, illustrated in Figure 4.10, which present the flowchart explain the input which is word number on the verse, pass to process illustrated on code see Appendix C1, the output is class or sub class that the specific word belongs to it.

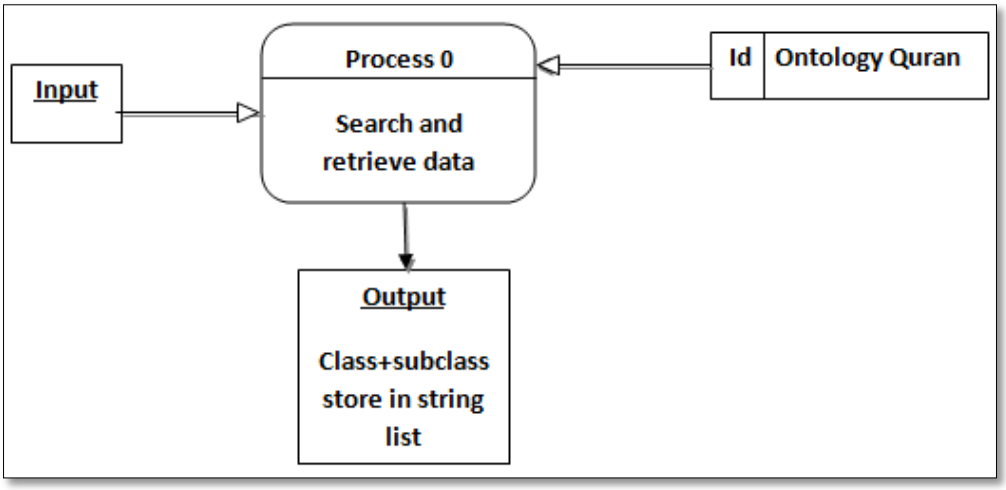


Figure 4.10: Search through the ontology

Second check is for lexical meaning, the code is illustrated in Figure 4.11, explain how the java parser search through the API and extract the specific related meaning and ignores the unrelated one, see Appendix C2 contains the code used to searching through the ontology.

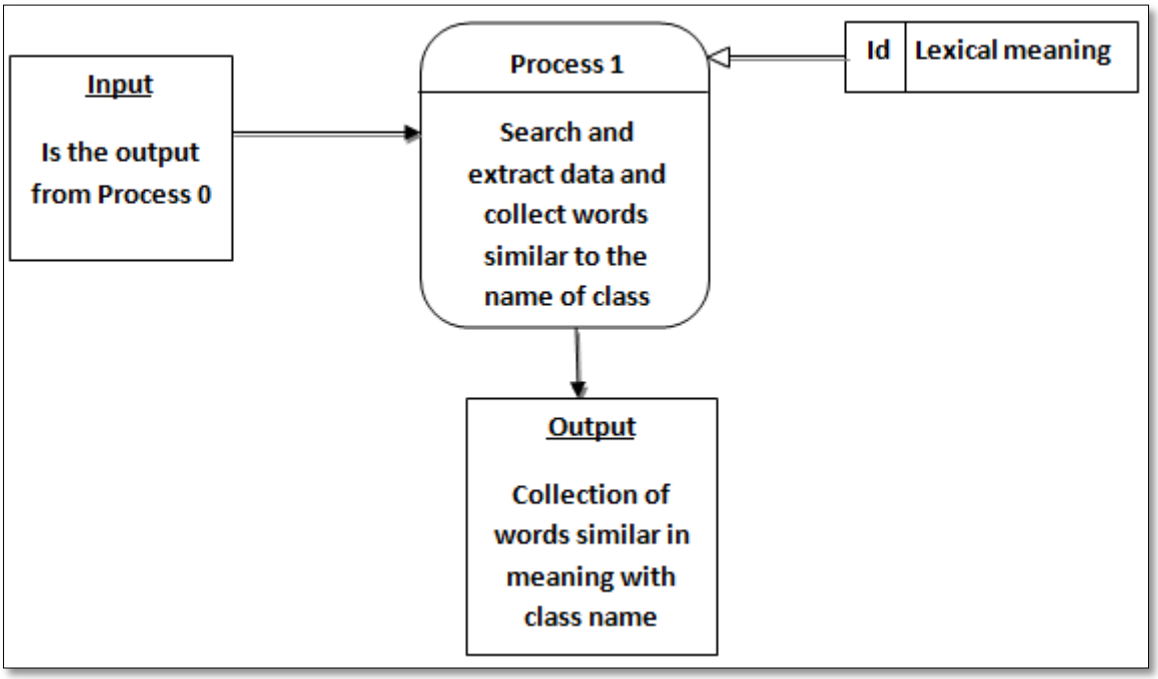


Figure 4.11: Search Lexically for the word

Next step according to the following flowchart in Figure 4.12 is extracting semantic meaning by applying Understood-and-Pronounced rules on the two combination of

meanings: LMeaning and TMeaning by make comparison between them. Appendix C3 contains the code used to applying Understood-and-Pronounced rules.

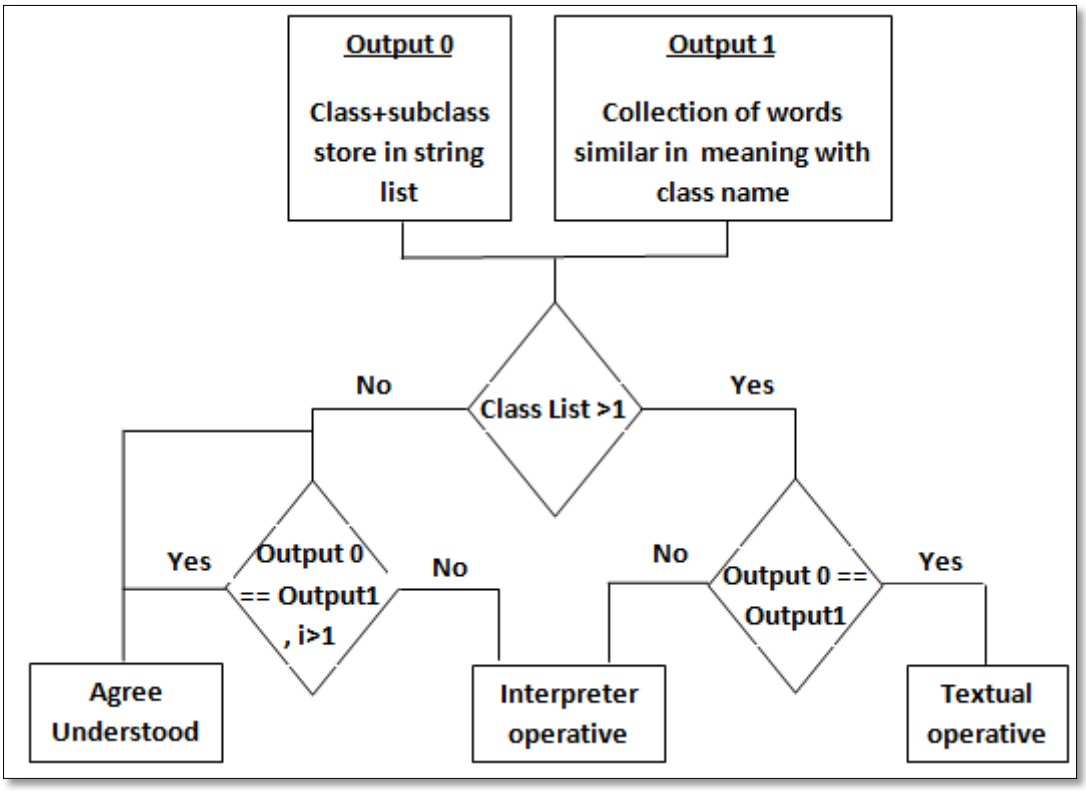


Figure 4.12: Comparison for classification process

4.6 Summery

we present and explain our proposed approach for Extracting the Semantics of Understood-and-Pronounced of Quran Vocabularies using flowcharts and figures. The methods tasks are introduced as phases. In the data collection phase, we determine the famous verses called Provisions verses (آيات الأحكام) on Understood-and-Pronounced field and some other related verses, and build a hierarchal relations of Quranic words to create the ontology, also we configure rules for classification process. In the data analysis phase, we consider the word and its lexical root as a basis for the classification process, we execute two types of extraction process, first extracting lexical and Tafsir meaning, second extracting word semantics by applying Understood-and-Pronounced rules. In the interpretation phase we explain the output of information extraction, finally we introduce points of the implementation issues which are we followed to achieve our goal.

CHAPTER 5: EXPERIMENTAL RESULTS AND EVALUATION

In this chapter we describe the experimental procedures and results of the implementation. First the experiment procedure covers the actions that we follow to achieve the goals, second the experimental results are presented as the system results and view of experts. Third we evaluate the results based on performance measurement. Finally we present the discussion about performance results.

5.1 Experiment Procedure

The goal of experiments is to evaluate system performance in achieving overall goals of time reduction and minimization of multiplicity opinions. The evaluation is based on measurement of precision, recall, accuracy and error for each output rule, see Section 2.7 (Basic Measures for assessment: Precision and Recall). The results are stated on Table 5.1. In the next section, we take each verse from sample verses and pass it to our system then write the output result into a table on *system output* record. In addition we show the same verses to experts (see Appendix A), and take their opinions about the classification of each word on sample verses, we write their views on *viewNo* records.

According to the following points which presented in details on Section 2.7 we measure the range of agreement between our approach and the expert views.

1. True positive (tp): are correct results generated from the system and have agreement from all experts
2. False positive (fp): are wrong results generated from the system and have agreement from all experts that are wrong.
3. True negative (tn): are correct results generated from the system and have agreement from most of experts
4. False negative (fn): are wrong results generated from the system and have agreement from most of experts that are wrong.

5.2 Experimental results

The results generated from our system and views of experts are listed on Table 5.1 which includes the following:

- Number of the sample verses which are 52 verses, 7 of them are duplicates.
- Verses section, which include 44 verses, 7 of them are Provision Verses (آيات الأحكام).
- Word number on the verse which represented by three parts of numbers (chapter number: verse number: word number).
- Ontology means the meaning of the specific word on the ontology which belong to real meaning on Tafsir.
- System output, what our approach result.
- View no1, No2 and No3 are of the experts we met. See Appendix A.

Example:

- The verse is : (واسلك يدك في جيبك تخرج بيضاء من غير سوء وَاضْمُمْ إِلَيْكَ جَنَاحَكَ مِنَ الرَّهْبِ)

- Sahih International: *Insert your hand into the opening of your garment; it will come out white, without disease. And draw in your arm close to you [as prevention] from fear, for those are two proofs from your Lord to Pharaoh and his establishment. Indeed, they have been a people defiantly disobedient."*

- Word no: 28:32:12 , which is Chapter 28 (Al qassass), verse 32, word number 12 in the verse.

- Ontology: the word belongs to the concept: *Body* and to subconcept: *Arm*.

According to our proposed approach the meaning of the specific word on Tafsir is different of the Speech word -Spoken Word- that is mean the semantic of these word is (Arm) and not (Wing).

So the system generate the result Rule2, ***Interpreter operative (***المنطوق المؤول***):*** The speech of word (Spoken word) have the semantic meaning differs from known meaning of speech word, see Section 4.2.1.

Table 5.1: Extracting Rules from Sample Verses with Experts views

N	Verse	Word no	ontology	Sys. output	View No1	View No2	View No3
1.	وَاضْمُمْ إِلَيْكَ جَنَاحَكَ مِنَ الرَّهْبِ	28:32:12	Body - hand	R2	R2	R2	R2
2.	وَاضْمُمْ يَدَكَ إِلَىٰ جَنَاحِكَ تَخْرُجْ بَيْضَاءَ مِنْ غَيْرِ سُوءٍ	20:22:4	Body – Side	R2	R2	R2	R2
3.	لعِنَ الَّذِينَ كَفَرُوا مِنْ بَنِي إِسْرَائِيلَ عَلَىٰ لِسَانِ دَاوُودَ وَعِيسَى ابْنِ مَرْيَمَ	5:78:8	Body - Tonque	R1	R1	R1	R1
4.	لِسَانُ الَّذِي يُلْحِدُونَ إِلَيْهِ أَعْجَمِي	16:103:8	Body - Tonque	R1	R1	R2	R1
5.	وَإِنَّ مِنْهُمْ لَفَرِيقًا يَلْوُونَ أَلْسِنَتَهُمْ بِالْكِتَابِ لِتَحْسَبُوهُ مِنَ الْكِتَابِ	3:78:5	Body - Tonque	R1	R1	R1	R1
6.	وَاحْلُلْ عُقْدَةً مِنْ لِسَانِي	20:27:4	Body - Tonque	R1	R1	R1	R2
7.	وَاسْمَعْ غَيْرَ مُسْمَعٍ وَرَاعِنَا لَيًّا بِأَلْسِنَتِهِمْ	4:46:16	Body - Tonque	R1	R1	R1	R1
8.	وَتَصِفُ أَلْسِنَتُهُمُ الْكَذِبَ أَنَّ لَهُمُ الْحُسْنَىٰ	16:62:6	Body - Tonque	R1	R1	R1	R1
9.	الْحَمْدُ لِلَّهِ فَاطِرِ السَّمَاوَاتِ وَالْأَرْضِ جَاعِلِ الْمَلَائِكَةِ رُسُلًا أُولِي أَجْنِحَةٍ	35:1:10	Body - Wing	R1	R1	R1	R1
10.	وَمَا مِنْ دَابَّةٍ فِي الْأَرْضِ وَلَا طَائِرٍ يَطِيرُ بِجَنَاحَيْهِ إِلَّا أُمَمٌ أَمْثَالُكُمْ	6:38:9	Body - Wing	R1	R1	R1	R1
11.	وَمِنْ آيَاتِهِ خَلْقُ السَّمَاوَاتِ وَالْأَرْضِ وَاخْتِلَافُ أَلْسِنَتِكُمْ وَأَلْوَانِكُمْ	30:22:7	Language – Tongue	R2	R2	R2	R2

N	Verse	Word no	ontology	Sys. output	View No1	View No2	View No3
12.	بِلِسَانٍ عَرَبِيٍّ مُبِينٍ	26:195:1	Language - Arabic – Tongue	R2	R2	R2	R2
13.	وَهَٰذَا كِتَابٌ مُصَدِّقٌ لِسَانًا عَرَبِيًّا لِيُنْذِرَ الَّذِينَ ظَلَمُوا	46:12:10	Language - Arabic – Tongue	R2	R2	R2	R2
14.	وَهَٰذَا لِسَانٌ عَرَبِيٌّ مُبِينٌ	16:103:14	Language - Arabic – Tongue	R2	R2	R2	R2
15.	هُوَ أَفْصَحُ مِنِّي لِسَانًا فَأَرْسِلْهُ مَعِيَ رِدْءًا يُصَدِّقُنِي	28:34:6	Language - Speaking – Tongue	R2	R2	R2	R2
16.	وَمَا أَرْسَلْنَا مِنْ رَسُولٍ إِلَّا بِلِسَانِ قَوْمِهِ لِيُبَيِّنَ لَهُمْ	14:4:6	Language - Speaking – Tongue	R2	R2	R2	R2
17.	وَاجْعَلْ لِي لِسَانَ صِدْقٍ فِي الْآخِرِينَ	26:84:3	Language - Speaking- Truthful – Tongue	R2	R2	R2	R2
18.	وَوَهَبْنَا لَهُمْ مِنْ رَحْمَتِنَا وَجَعَلْنَا لَهُمْ لِسَانَ صِدْقٍ عَلِيًّا	19:50:7	Language - Speaking- Truthful -Tongue	R2	R2	R2	R2
19.	فَلَا تَقُلْ لَهُمَا أُفٍّ وَلَا تَنْهَرْهُمَا وَقُلْ لَهُمَا قَوْلًا كَرِيمًا	17:23:19	Behaviors- Disobeying – uff	R3	R3	R3	R3
20.	فَلَا تَقُلْ لَهُمَا أُفٍّ وَلَا تَنْهَرْهُمَا وَقُلْ لَهُمَا قَوْلًا كَرِيمًا	17:23:19	Behaviors - Disrespect – uff	R3	R3	R3	R3
21.	وَاخْفِضْ جَنَاحَكَ لِمَنِ اتَّبَعَكَ مِنَ الْمُؤْمِنِينَ	26:215:2	Behaviors - Humility - wing	R2	R2	R2	R2

N	Verse	Word no	Ontology	Sys. output	View No1	View No2	View No3
22.	وَاخْفِضْ جَنَاحَكَ لِمَنِ اتَّبَعَكَ مِنَ الْمُؤْمِنِينَ	26:215:2	Behaviors - Humility - wing	R2	R2	R2	R2
23.	وَاخْفِضْ لَهُمَا جَنَاحَ الذُّلِّ مِنَ الرَّحْمَةِ وَقُلْ رَبِّ ارْحَمْهُمَا	17:24:3	Behaviors - Humility - wing	R2	R2	R2	R2
24.	وَلَا تَحْزَنْ عَلَيْهِمْ وَاخْفِضْ جَنَاحَكَ لِلْمُؤْمِنِين	15:88:14	Behaviors - Humility - wing	R2	R2	R2	R2
25.	فَلَا تَقُلْ لَهُمَا أُفٍّ وَلَا تَنْهَرْهُمَا وَقُلْ لَهُمَا قَوْلًا كَرِيمًا	17:23:19	Behaviors - Ingratitude – uff	R3	R3	R3	R3
26.	فَلَا تَقُلْ لَهُمَا أُفٍّ وَلَا تَنْهَرْهُمَا وَقُلْ لَهُمَا قَوْلًا كَرِيمًا	17:23:19	Behaviors - Weariness – uff	R3	R3	R3	R3
27.	فَمَنْ لَمْ يَجِدْ فَصِيَامُ ثَلَاثَةِ أَيَّامٍ فِي الْحَجِّ وَسَبْعَةٍ إِذَا رَجَعْتُمْ	2:196:53	Number - seven	R1	R1	R1	R1
28.	فَعَقَرُوهَا فَقَالَ تَمَتَّعُوا فِي دَارِكُمْ ثَلَاثَةَ أَيَّامٍ	11:65:6	Number – Three	R1	R1	R1	R1
29.	مَنْ لَمْ يَجِدْ فَصِيَامُ ثَلَاثَةِ أَيَّامٍ فِي الْحَجِّ وَسَبْعَةٍ إِذَا رَجَعْتُمْ	2:196:49	Number - Three	R1	R1	R1	R1
30.	فمن لم يجد فصيام ثلاثة أيام في الحج وسبعة إذا رجعتم	2:196:50	Time – day	R1	R1	R1	R1
31.	مِنْ قَبْلِ أَنْ يَأْتِيَ يَوْمٌ لَا بَيْعٌ فِيهِ وَلَا خُلَّةٌ وَلَا شَفَاعَةٌ	2:254:13	transaction – Bargain	R3	R1	R2	R3
32.	مِنْ قَبْلِ أَنْ يَأْتِيَ يَوْمٌ لَا بَيْعٌ فِيهِ وَلَا خُلَّةٌ وَلَا شَفَاعَةٌ	2:254:13	transaction – Exchange	R3	R1	R2	R3

N	Verse	Word no	ontology	Sys. output	View No1	View No2	View No3
33.	مِنْ قَبْلِ أَنْ يَأْتِيَ يَوْمٌ لَا بَيْعٌ فِيهِ وَلَا خُلَّةٌ وَلَا شَفَاعَةٌ	2:254:13	transaction – Sale	R3	R1	R2	R3
34.	إِذَا نُودِيَ لِلصَّلَاةِ مِنْ يَوْمِ الْجُمُعَةِ فَاسْعَوْا إِلَىٰ ذِكْرِ اللَّهِ وَذَرُوا الْبَيْعَ	62:9:15	transaction – Business	R3	R3	R3	R3
35.	إِذَا نُودِيَ لِلصَّلَاةِ مِنْ يَوْمِ الْجُمُعَةِ فَاسْعَوْا إِلَىٰ ذِكْرِ اللَّهِ وَذَرُوا الْبَيْعَ	62:9:15	Transaction-Sale	R3	R3	R3	R3
36.	إِذَا نُودِيَ لِلصَّلَاةِ مِنْ يَوْمِ الْجُمُعَةِ فَاسْعَوْا إِلَىٰ ذِكْرِ اللَّهِ وَذَرُوا الْبَيْعَ	62:9:15	transaction – Trade	R3	R3	R3	R3
37.	رِجَالٌ لَا تُلْهِيهِمْ تِجَارَةٌ وَلَا بَيْعٌ عَنْ ذِكْرِ اللَّهِ	24:37:6	transaction – Sale	R1	R1	R1	R1
38.	ذَٰلِكَ بِأَنَّهُمْ قَالُوا إِنَّمَا الْبَيْعُ مِثْلُ الرِّبَا	2:275:18	transaction - Trade	R1	R1	R1	R1
39.	مِنْ قَبْلِ أَنْ يَأْتِيَ يَوْمٌ لَا بَيْعٌ فِيهِ وَلَا خِلَالٌ	14:31:18	transaction – Trade	R3	R1	R2	R3
40.	مِنْ قَبْلِ أَنْ يَأْتِيَ يَوْمٌ لَا بَيْعٌ فِيهِ وَلَا خِلَالٌ	14:31:18	Transaction-Sale	R3	R1	R2	R3
41.	مِنْ قَبْلِ أَنْ يَأْتِيَ يَوْمٌ لَا بَيْعٌ فِيهِ وَلَا خِلَالٌ	14:31:18	Transaction-Exchange	R3	R1	R2	R3
42.	وَأَحَلَّ اللَّهُ الْبَيْعَ وَحَرَّمَ الرِّبَا	2:275:23	transaction - Trade	R1	R1	R1	R1
43.	اتَّقُوا اللَّهَ وَذَرُوا مَا بَقِيَ مِنَ الرِّبَا إِنْ كُنْتُمْ مُؤْمِنِينَ	2:278:10	transaction – Usury	R1	R1	R1	R1
44.	الَّذِينَ يَأْكُلُونَ الرِّبَا لَا يَقُومُونَ إِلَّا كَمَا يَقُومُ الَّذِي يَتَخَبَّطُهُ الشَّيْطَانُ مِنَ الْمَسِّ	2:275:3	transaction – Usury	R1	R1	R1	R1

N	Verse	Word no	ontology	Sys. output	View No1	View No2	View No3
45.	ذَٰلِكَ بِأَنَّهُمْ قَالُوا إِنَّمَا الْبَيْعُ مِثْلُ الرِّبَا	2:275:20	transaction – Usury	R1	R1	R1	R1
46.	وَأَحَلَّ اللَّهُ الْبَيْعَ وَحَرَّمَ الرِّبَا	2:275:25	transaction – Usury	R1	R1	R1	R1
47.	وَأَخْذِهِمُ الرِّبَا وَقَدْ نُهُوا عَنْهُ وَأَكْلِهِمْ أَمْوَالَ النَّاسِ بِالْبَاطِلِ	4:161:2	transaction – Usury	R1	R1	R1	R2
48.	وَمَا آتَيْتُمْ مِنْ رِبًا لِيَرْبُوَ فِي أَمْوَالِ النَّاسِ فَلَا يَرْبُو عِنْدَ اللَّهِ	30:39:4	transaction – Usury	R1	R1	R1	R1
49.	يَا أَيُّهَا الَّذِينَ آمَنُوا لَا تَأْكُلُوا الرِّبَا أَضْعَافًا مُضَاعَفَةً	3:130:6	transaction – Usury	R1	R1	R1	R2
50.	يَمْحَقُ اللَّهُ الرِّبَا وَيُرْبِي الصَّدَقَاتِ	2:276:3	transaction – Usury	R1	R1	R1	R1
51.	أحل لكم ليلة الصيام الرفث إلى نسائكم	2:187:4	Worship - Fast	R1	R1	R1	R1
52.	فمن لم يجد فصيام ثلاثة أيام في الحج وسبعة إذا رجعتم	2:196:48	Worship - Fast	R1	R1	R1	R1
53.	فمن لم يجد فصيام ثلاثة أيام في الحج وسبعة إذا رجعتم	2:196:52	Worship - Hajj	R1	R1	R1	R1

5.3 Evaluation results

The following calculation is taken into consideration and evaluation measurement based on it:

- Number of Total verses: (44) verses ,
- Number of Provisions verses (آيات الأحكام) : 7 verses, and all of them , system and experts views agree with result.

- (37) verses have the same word exist on provision verses was annotated.
- System agree with view 3 in verse (2:254:13) and (14:31:18), but disagree with view 1 & 2 , so the Fn was (2).
- System agree with view 1 & 2 in verse (4:161:2) and (3:130:6) , but disagree with view 3, so the Tn was (2).
- System checked 44 verses , there are four verses have multiplicity of opinion, so we found (40) verses is Tp.
- System did not generate any result quite contrary to the opinion of experts, so Fp was (0).
- All of the above are shown on Table 5.2

By applying the equations presented on Section 2.7 to calculate Precision and Recall measures, we find the results on Table 5.2, let us present an example of applying precision equation:

Precision = tp / (tp + fp) **eq. (2.2)**

Tp = 40 because the system checked 44 verses , there are four verses have multiplicity of opinion

Fp = 0 because the system did not generate any result quite contrary to the opinion of experts, so precision based on eq.(2.2) is :

Precision = 40 / (40 + 0)

Precision = 1 .

Here the rest of equations we used to measure performance:

Recall = tp / (tp + fn) **eq. (2.3)**

Accuracy = (tp + tn) *100 / (tp + tn + fp + fn) **eq. (2.4)**

Error = fp + fn tp + tn + fp + fn **eq. (2.5)**

Table 5.2 : Table Calculating precision, recall , accuracy and error.

Performance	Measure of Multiplicity of opinions
Tp	40
Fp	0
Fn	2
Tn	2
Precision	1
Recall	0.95
Accuracy	95.4 %
Error	0.045

From the above evaluation, measures and comparisons we can find that:

- Our system reduced the multiplicity of opinions, achieving accuracy of 95.4% indicating that it can be a way to facilitate understanding of semantics of Quran vocabularies.
- Ratio of obtained errors does not mean that the system generated erroneous results, but in fact it agrees with most views and disagrees with few.
- The system and the experts agree with all samples of Provision verses, which already have known classifications.

CHAPTER 6: CONCLUSION AND FUTURE WORK

6.1 Conclusion

Our approach, can be a way to facilitate understanding of semantic of Quran vocabularies. it extracted the semantics of Quranic verses and classify them into two categories of Tafsir field: Understood and Pronounced in the Quranic vocabularies (علم المنطوق والمفهوم في ألفاظ القرآن) with less time, effort and multiplicity of opinion.

we build the model for extracting the semantics of each word in the chosen verses using unsupervised learning based on the information extraction approach. Next we apply some suggested rules to implement a comparison between two extracted data sources and discover understood/pronounced semantics. Then, we conduct the required experiments on the developed approach and analyze the output of extracted information. After that, we compare the output of the implemented approach with what it is thought about each verse by experts. Finally, we calculate precision and recall of the approach based on the experimental results. The criteria is less time, effort and multiplicity of opinion. Our system reduced the multiplicity of opinions, by record the result of true positive by 40 verses from 44, Achieving accuracy of 95.4% indicate that it can be a way to facilitate understanding of semantic of Quran vocabularies.

This effort was to help Quranic scholars in classifying the speech of words into Understood-and- Pronounced according to its semantics which is an important in interpreters' Quran community.

6.2 Future Work

- Develop a hierarchical relation of ontology overall Quran words with annotations for all related verses.
- Applying all classification categories on Understood-and-Pronounced science and developing suitable rules to extract the results, example: Disagree understood meaning, Indication operative and Apparent operative meaning.
- Develop application with interface for end user, to make use of the system.
- Improve our ontology on Quran to cover the relation between semantic meaning of the word with its pronounced and recited letters.

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Appendix A

Meetings with experts on Quran vocabularies fields:

- Dr. Abd Alkarim Aldahshan, Associate Professor on Interpretation and Quranic Sciences Islamic University, President of the Holy Quran Radio, presented (view no 1).
- Dr. Ramadan Assaife, Director of the miracle in the interpretation of the Quran Sciences in the Quran and Sunnah, presented (view no 2).
- Ms. Manar Elhelo, Master of Interpretation and Quranic Sciences From Islamic University, presented (View no 3).

Appendix B

OWL Source Code for the Quran Vocabularies ontology and annotation

```
Prefix(:=<http://www.w3.org/2002/07/owl#>)

Prefix(owl:=<http://www.w3.org/2002/07/owl#>)

Prefix(rdf:=<http://www.w3.org/1999/02/22-rdf-syntax-ns#>)

Prefix(xml:=<http://www.w3.org/XML/1998/namespace>)

Prefix(xsd:=<http://www.w3.org/2001/XMLSchema#>)

Prefix(rdfs:=<http://www.w3.org/2000/01/rdf-schema#>)

Ontology(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5>

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Arabic>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Arm>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Bargain>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Behaviors>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Body>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Business>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Buy>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Disobeying>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Disrespect>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Exchange>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Fast>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Foreign>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Greeting>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Hajj>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Hand>))
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Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#HolyBooks>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Humility>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Ingratitude>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Language>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Mercy>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Number>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Obedience>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Patience>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Praise>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Profit>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Quran>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Righteousness>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Sale>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Side>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Speaking>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Taseel>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Three>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Time>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Tongue>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Trade>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Truthful>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Uff>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Usury>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Weariness>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Wing>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Worship>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Zakat>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#century>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#day>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#dept>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#dostor>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#first>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#hate>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#hour>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#love>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#month>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#one>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#pray>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#seven>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#seventh>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#thekr>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#tongue>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#transaction>))

Declaration(Class(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#year>))

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Arabic> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Language>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Arm> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Body>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Bargain> "2:254:13 مِنْ قَبْلِ أَنْ يَأْتِيَ يَوْمٌ لَا بَيْعٌ فِيهِ وَلَا خُلَّةٌ وَلَا شَفَاعَةٌ"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Bargain> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#transaction>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Business> "62:9:15 <إِذَا نُودِيَ لِلصَّلَاةِ مِنْ يَوْمِ الْجُمُعَةِ فَاسْعَوْا إِلَىٰ ذِكْرِ اللَّهِ وَذَرُوا الْبَيْعَ"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Business> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#transaction>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Buy> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#transaction>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Disobeying> "17:23:19 <فَلَا تَقُلْ لَهُمَا أُفٍّ وَلَا تَنْهَرْهُمَا وَقُلْ لَهُمَا قَوْلًا كَرِيمًا"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Disobeying> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Behaviors>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Disrespect> "17:23:19 <فَلَا تَقُلْ لَهُمَا أُفٍّ وَلَا تَنْهَرْهُمَا وَقُلْ لَهُمَا قَوْلًا كَرِيمًا"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Disrespect> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Behaviors>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Exchange> "2:254:13 <مِنْ قَبْلِ أَنْ يَأْتِيَ يَوْمٌ لَا بَيْعٌ فِيهِ وَلَا خُلَّةٌ وَلَا شَفَاعَةٌ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Exchange> "14:31:18 <مِنْ قَبْلِ أَنْ يَأْتِيَ يَوْمٌ لَا بَيْعٌ فِيهِ وَلَا خِلَالٌ"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Exchange> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#transaction>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Fast> "2:187:4 أحل لكم ليلة الصيام الرفث إلى نسائكم"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Fast> "2:196:48 فمن لم يجد فصيام ثلاثة أيام في الحج وسبعة إذا رجعتم"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Fast> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Worship>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Foreign> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Language>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Hajj> "2:196:52 فمن لم يجد فصيام ثلاثة أيام في الحج وسبعة إذا رجعتم"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Hajj> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Worship>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Hand> "28:32:12 وَاضْمُمْ إِلَيْكَ جَنَاحَكَ مِنَ الرَّهْبِ"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Hand> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Body>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Humility> "15:88:14 وَلَا تَحْزَنْ عَلَيْهِمْ وَاخْفِضْ جَنَاحَكَ لِلْمُؤْمِنِينَ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Humility> "17:24:3 وَاخْفِضْ لَهُمَا جَنَاحَ الذُّلِّ مِنَ الرَّحْمَةِ وَقُلْ رَبِّ ارْحَمْهُمَا كَمَا رَبَّيَانِي صَغِيرًا"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Humility> "26:215:2 وَاخْفِضْ جَنَاحَكَ لِمَنِ اتَّبَعَكَ مِنَ الْمُؤْمِنِينَ"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Humility> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Behaviors>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Ingratitude> "17:23:19 فَلَا تَقُلْ لَهُمَا أُفٍّ وَلَا تَنْهَرْهُمَا وَقُلْ لَهُمَا قَوْلًا كَرِيمًا"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Ingratitude> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Behaviors>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Language> "30:22:7 وَمِنْ آيَاتِهِ خَلْقُ السَّمَاوَاتِ وَالْأَرْضِ وَاخْتِلَافُ أَلْسِنَتِكُمْ وَأَلْوَانِكُمْ"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Mercy> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Behaviors>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Obedience> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Worship>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Patience> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Behaviors>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Praise> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Worship>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Profit> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#transaction>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Quran> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#HolyBooks>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Righteousness> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Behaviors>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Sale> "2:254:13 مِنْ قَبْلِ أَنْ يَأْتِيَ يَوْمٌ لَا بَيْعٌ فِيهِ وَلَا خُلَّةٌ وَلَا شَفَاعَةٌ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Sale> "62:9:15 إِذَا نُودِيَ لِلصَّلَاةِ مِنْ يَوْمِ الْجُمُعَةِ فَاسْعَوْا إِلَىٰ ذِكْرِ اللَّهِ وَذَرُوا الْبَيْعَ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Sale> "14:31:18 مِنْ قَبْلِ أَنْ يَأْتِيَ يَوْمٌ لَا بَيْعٌ فِيهِ وَلَا خِلَالٌ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Sale> "24:37:6 رِجَالٌ لَا تُلْهِيهِمْ تِجَارَةٌ وَلَا بَيْعٌ عَنْ ذِكْرِ اللَّهِ"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Sale> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#transaction>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Side> "20:22:4 وَاضْمُمْ يَدَكَ إِلَىٰ جَنَاحِكَ تَخْرُجْ بَيْضَاءَ مِنْ غَيْرِ سُوءٍ"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Side> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Body>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Speaking> "14:4:6 وَمَا أَرْسَلْنَا مِنْ رَسُولٍ إِلَّا بِلِسَانِ قَوْمِهِ لِيُبَيِّنَ لَهُمْ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Speaking> "28:34:6 هُوَ أَفْصَحُ مِنِّي لِسَانًا فَأَرْسِلْهُ مَعِيَ رِدْءًا يُصَدِّقُنِي"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Speaking> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Language>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Taseel> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Quran>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Three> "2:196:49 مَنْ لَمْ يَجِدْ فَصِيَامُ ثَلَاثَةِ أَيَّامٍ فِي الْحَجِّ وَسَبْعَةٍ إِذَا رَجَعْتُمْ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Three> "11:65:6 فَعَقَرُوهَا فَقَالَ تَمَتَّعُوا فِي دَارِكُمْ ثَلَاثَةَ أَيَّامٍ"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Three> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Number>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Tongue> "16:103:8 لِسَانُ الَّذِي يُلْحِدُونَ إِلَيْهِ أَعْجَمِي"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Tongue> "5:78:8 عِنَ الَّذِينَ كَفَرُوا مِنْ بَنِي إِسْرَائِيلَ عَلَىٰ لِسَانِ دَاوُودَ وَعِيسَى ابْنِ مَرْيَمَ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Tongue> "20:27:4 وَاحْلُلْ عُقْدَةً مِنْ لِسَانِي"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Tongue> "16:62:6 وَتَصِفُ أَلْسِنَتُهُمُ الْكَذِبَ أَنَّ لَهُمُ الْحُسْنَىٰ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Tongue> "3:78:5 وَإِنَّ مِنْهُمْ لَفَرِيقًا يَلْوُونَ أَلْسِنَتَهُمْ بِالْكِتَابِ لِتَحْسَبُوهُ مِنَ الْكِتَابِ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Tongue> "4:46:16 وَاسْمَعْ غَيْرَ مُسْمَعٍ وَرَاعِنَا لَيًّا بِأَلْسِنَتِهِمْ"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Tongue> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Body>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Trade> "2:275:23 وَأَحَلَّ اللَّهُ الْبَيْعَ وَحَرَّمَ الرِّبَا"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Trade> "62:9:15 إِذَا نُودِيَ لِلصَّلَاةِ مِنْ يَوْمِ الْجُمُعَةِ فَاسْعَوْا إِلَىٰ ذِكْرِ اللَّهِ وَذَرُوا الْبَيْعَ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Trade> "14:31:18 مِنْ قَبْلِ أَنْ يَأْتِيَ يَوْمٌ لَا بَيْعٌ فِيهِ وَلَا خِلَالٌ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Trade> "2:275:18 ذَٰلِكَ بِأَنَّهُمْ قَالُوا إِنَّمَا الْبَيْعُ مِثْلُ الرِّبَا"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Trade> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#transaction>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Truthful> "26:84:3 وَاجْعَلْ لِي لِسَانَ صِدْقٍ فِي الْآخِرِينَ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Truthful> "19:50:7 وَوَهَبْنَا لَهُمْ مِنْ رَحْمَتِنَا وَجَعَلْنَا لَهُمْ لِسَانَ صِدْقٍ عَلِيًّا"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Truthful> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Speaking>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Uff> "17:23:19 فَلَا تَقُلْ لَهُمَا أُفٍّ وَلَا تَنْهَرْهُمَا وَقُلْ لَهُمَا قَوْلًا كَرِيمًا"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Uff> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Weariness>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Usury> "30:39:4 وَمَا آتَيْتُمْ مِنْ رِبًا لِيَرْبُوَ فِي أَمْوَالِ النَّاسِ فَلَا يَرْبُو عِنْدَ اللَّهِ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Usury> "الَّذِينَ يَأْكُلُونَ الرِّبَا لَا يَقُومُونَ إِلَّا كَمَا يَقُومُ الَّذِي يَتَخَبَّطُهُ الشَّيْطَانُ مِنَ الْمَسِّ

2:275:3"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Usury> "2:276:3 يَمْحَقُ اللَّهُ الرِّبَا وَيُرْبِي الصَّدَقَاتِ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Usury> "4:161:2 وَأَخْذِهِمُ الرِّبَا وَقَدْ نُهُوا عَنْهُ وَأَكْلِهِمْ أَمْوَالَ النَّاسِ بِالْبَاطِلِ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Usury> "2:278:10 اتَّقُوا اللَّهَ وَذَرُوا مَا بَقِيَ مِنَ الرِّبَا إِنْ كُنْتُمْ مُؤْمِنِينَ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Usury> "3:130:6 يَا أَيُّهَا الَّذِينَ آمَنُوا لَا تَأْكُلُوا الرِّبَا أَضْعَافًا مُضَاعَفَةً"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Usury> "2:275:20 ذَٰلِكَ بِأَنَّهُمْ قَالُوا إِنَّمَا الْبَيْعُ مِثْلُ الرِّبَا"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Usury> "2:275:25 وَأَحَلَّ اللَّهُ الْبَيْعَ وَحَرَّمَ الرِّبَا"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Usury> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#transaction>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Weariness> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Behaviors>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Wing> "6:38:9 وَمَا مِنْ دَابَّةٍ فِي الْأَرْضِ وَلَا طَائِرٍ يَطِيرُ بِجَنَاحَيْهِ إِلَّا أُمَمٌ أَمْثَالُكُمْ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Wing> "الْحَمْدُ لِلَّهِ فَاطِرِ السَّمَاوَاتِ وَالْأَرْضِ جَاعِلِ الْمَلَائِكَةِ رُسُلًا أُولِي أَجْنِحَةٍ

35:1:10"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Wing> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Body>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Zakat> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Worship>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#century> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Time>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#day> "2:196:50 فمن لم يجد فصيام ثلاثة أيام في الحج وسبعة إذا رجعتم"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#day> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Time>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#dept> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#transaction>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#dostor> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Quran>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#first> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Number>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#hate> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Behaviors>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#hour> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Time>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#love> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Behaviors>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#month> <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Time>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#one>
<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Number>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#pray>
<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Worship>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#seven> "2:196:53 فَمَنْ لَمْ يَجِدْ فَصِيَامُ ثَلَاثَةِ أَيَّامٍ فِي الْحَجِّ وَسَبْعَةٍ إِذَا رَجَعْتُمْ"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#seven>
<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Number>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#seventh>
<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Number>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#thekr>
<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Worship>)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#tongue> "16:103:14 وَهَٰذَا لِسَانٌ عَرَبِيٌّ مُبِينٌ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#tongue> "26:195:1 بِلِسَانٍ عَرَبِيٍّ مُبِينٍ"^^xsd:string)

AnnotationAssertion(rdfs:label <http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#tongue> "46:12:10 وَهَٰذَا كِتَابٌ مُصَدِّقٌ لِسَانًا عَرَبِيًّا لِيُنْذِرَ الَّذِينَ ظَلَمُوا"^^xsd:string)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#tongue>
<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Arabic>)

SubClassOf(<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#year>
<http://www.semanticweb.org/jit/ontologies/2015/2/untitled-ontology-5#Time>)

)

Appendix C

Appendix C1: Searching through ontology to extract Tafsir Meaning (TMeaning)

```
File fXmlFile = new File("../project/src/asaasss/test/hhll.xml");

DocumentBuilderFactory dbFactory = DocumentBuilderFactory.newInstance();
DocumentBuilder dBuilder = dbFactory.newDocumentBuilder();
Document doc = dBuilder.parse(fXmlFile);

//optional, but recommended
//read this - http://stackoverflow.com/questions/13786607/normalization-in-dom-p
doc.getDocumentElement().normalize();

System.out.println("Root element :" + doc.getDocumentElement().getNodeName());

NodeList nList = doc.getElementsByTagName("AnnotationAssertion");

System.out.println("----------------------------");

for (int temp = 0; temp < nList.getLength(); temp++) {

Node nNode = nList.item(temp);
```

Appendix C2: Searching through API open source to extract Lexical Meaning (LMeaning)

```
class SendRequestt {
  final String endpoint = "http://thesaurus.altervista.org/thesaurus/v1";
static String ss ;
 List<String> supplierNames1 = new ArrayList<String>();

    String[] temp = null;
  public SendRequestt(String word, String language, String key, String output) {

 // String[] ad = new String[8];
    try {
      URL serverAddress = new URL(endpoint + "?word="+URLEncoder.encode(word, "UTF-8")+"&language="+language+"&key="+key+"&out
      HttpURLConnection connection = (HttpURLConnection)serverAddress.openConnection();
      connection.connect();
      int rc = connection.getResponseCode();
      if (rc == 200) {
        String line = null;
        BufferedReader br = new BufferedReader(new java.io.InputStreamReader(connection.getInputStream()));
        StringBuilder sb = new StringBuilder();
        while ((line = br.readLine()) != null)
          sb.append(line + '\n');
        JSONObject obj = (JSONObject) JSONValue.parse(sb.toString());
        JSONArray array = (JSONArray)obj.get("response");
      //System.out.println(array);

        for (int i=0; i < array.size(); i++) {
          JSONObject list = (JSONObject) ((JSONObject)array.get(i)).get("list");
          //ad[i]= (String)list.get("synonyms");
```

Appendix C3: Applying comparison by using understood-and-pronounced rules to extract the semantic meaning of word.

```
     int p=0;
    for(int i=0; i<supplierNames1gg.size();i++){
SendRequestt aaa= new SendRequestt(supplierNames1gg.get(i), "en_US", "NCi8XaWnn2mxHUQ2Wp1z", "json");
//System.out.println(IRI.get(i));
   for(int j=0; j<aaa.temp.length;j++){
    //System.out.println(aaa.temp[j]);
    if(aaa.temp[j].contains(IRI.get(i).toLowerCase())){
     p=p+1;
    //System.out.println(aaa.temp[j]);
  }
}
    }
     if(p>=1 && supplierNames1gg.size()>1){
      jLabel1.setText("agree understood");
     //System.out.println("agree understood ");
    }else if(p>=1){
     //System.out.println("textual operative ");
     jLabel1.setText("textual operative");
    }else{
     //System.out.println("Operative apparent");
     jLabel1.setText("Interpreter operative");
    }
```