Abstract: - Arabic language has much more syntactical and morphological information. Diacritics, which are marks placed over and below the letters of Arabic word, play a great role in adding linguistic attributes to Arabic word in part-of-speech tagging system. This paper describes a tagset that were built based on the inflectional morphology system which derived from traditional Arabic grammatical theory. The tagset developed represent an early stage of research related to automatic morphosyntactic annotation in Arabic language. This paper aims to present a general tagset for use in diacritics-based automated tagging system that is underdevelopment by the author.

Key-Words: - Part-of-Speech (POS), Arabic Language, Tagset, Diacritics, Syntactical, Morphological.

1 Introduction

A tag is a code which represents some features or set of features and is attached to the segment in a text. Single or complex information are carried by a tag [8]. In the case of POS Tagging, a POS tagset to categories and mark up the words of the target text is an absolutely necessary preliminary [3]. The development of a tagset to support diacritical based tagging system is at early stage. Little work has been done in developing Arabic tagset. The need for such a tagset comes from the fact that there is no standardized and comprehensive Arabic tagset.

An overview of Arabic language followed by diacritics in Arabic described in this paper. Tagset background and EAGLES guidelines overview presented. Finally we will present our tagset (Analysis and Hierarchy) followed by conclusion and future work.

2 Arabic Language

2.1 Background

The Arabic language is spoken in more than 20 Countries, from Egypt to Morocco and throughout the Arabian Peninsula. It is the native language of over 195 million people. Plus, at least another 35 million speak Arabic as a second language.

Modern Standard Arabic (MSA) is the official language throughout the Arab world, and its written form is relatively consistent across national boundaries. MSA is used in official documents, in educational settings, and for communication between Arabs of different nationalities. However, the spoken forms of Arabic vary widely, and each Arab country has its own dialect. Dialects are spoken in most informal settings, such as at home, with friends, or while shopping.

The Arabic language belongs to the Semitic family of languages, written from right to left. Arabic has been a literary language since the 6th century A.D., and is the liturgical language of Islam in its classical form.

The Arabic writing system is quite different from the English system. The Arabic alphabet consists of 28 letters that change shape depending on their position within a word and the letters by which they are surrounded. Some Arabic letters must be connected to other letters; others may stand alone. Arabic vowels are indicated by marks (Diacritics) above and below the consonants. In many cases, these diacritics play the role of vowels in English and thus influence pronunciation. Additionally, there are no special forms, such as the use of capital letters in English, to indicate proper nouns or the beginning of a sentence [10].

2.2 Diacritics in Arabic

Diacritics are marks placed over and below the letters of Arabic word. This feature plays a great role in adding linguistic attributes to Arabic words which help us to assign the most likely tag of the word in POS tagging system and in indicating pronunciation and grammatical function of the words. It is particularly of interest for the purpose of this paper. Table 1 shows Arabic vowel diacritics.
The pronunciation of diacritized languages words cannot be fully determined by spelling their characters only; special marks are put above or below the characters (Diacritics) to determine the correct pronunciation and indicate the grammar function of the word within the sentence. For example, the word " كتاب " without mark (Diacritic) may be pronounced to mean "He wrote", "It was written", "books". The reader may refer to the context the word appears in to decide which of the words is actually intended. In such languages, two different words may have identical spelling whereas their pronunciations and meanings are totally different [2].

In Arabic, short vowels are not apart of the Arabic alphabet. They are used in both Noun and Verb in Arabic Language. They indicate the case of the noun and the mood of the verb.

<table>
<thead>
<tr>
<th>Short Vowels (Diacritics)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Fatha</td>
<td>Damma</td>
</tr>
<tr>
<td>Symbol</td>
<td>/a/</td>
<td>/u/</td>
</tr>
<tr>
<td>Explanation</td>
<td>Written above</td>
<td>Written above</td>
</tr>
<tr>
<td></td>
<td>the consonant.</td>
<td>the consonant.</td>
</tr>
<tr>
<td>Example</td>
<td>ba</td>
<td>Bu</td>
</tr>
</tbody>
</table>

Table 1: Arabic vowel diacritics

<table>
<thead>
<tr>
<th>Nūnun &quot;Tanween&quot; (Diacritics)</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Name</td>
<td>Tanween Fatha</td>
<td>Tanween Damun</td>
</tr>
<tr>
<td>Symbol</td>
<td>/an/</td>
<td>/un/</td>
</tr>
<tr>
<td>Explanation</td>
<td>Written above</td>
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</tr>
<tr>
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<td>the consonant.</td>
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<tr>
<td>Example</td>
<td>ba</td>
<td>bun</td>
</tr>
</tbody>
</table>

3 Arabic Tagset and EAGLES guidelines

EAGLES [9] guidelines outline a set of features for Tagsets, these guidelines were designed to help standardize tagsets for what were then the official languages of the European Union.

EAGLES tags are defined as sets of morphosyntactic attribute-value pairs (e.g. Gender is an attribute that can have the values Masculine, Feminine or Neuter)[3]. The tagset discussed here is not being developed in accordance with the EAGLES guidelines for morphosyntactic annotation of corpora. Arabic is very different from the languages for which EAGLES was designed, and belongs to the Semitic family rather than the Indo-European one.

Following a normalized tagset and the EAGLES recommendations would not capture some of Arabic relevant information, such as the jussive mood of the verb and the dual number that are integral to Arabic. Another important aspect of Arabic is inheritance, where all subclasses of words inherit properties from the classes from which they are derived. For example, all subclasses of the noun inherit the "Tanween" nunciation when in the indefinite which is one of the main properties of the noun [7].

3.1 Previous work on POS tagsets

There are numbers of popular tagsets for English, such as: 87-tag tagset used Brown Corpus, 45-tag Penn Treebank tagset and 61-tag C5 tagset, TOSCA tagset, ICE tagset, LUND tagset [5][3]. For Arabic also very small number of tagset had been built, El-Kareh S, Al-Ansary [1] described the tagset they classifying the words into three main classes, Verbs are sub classified into 3 subclasses; Nouns into 46 subclasses and Particles into 23 subclasses. Shereen Khoja [7] described more detail tagset. Her tagset contains 177 tags, 57 Verbs, 103 Nouns, 9 Particles, 7 residual and 1 punctuation.

3.2 Proposed Arabic Tagset: Analysis

It is necessary to have a model of the language to create the linguistic categories of a tagset. An ideal approach would be to derive this model from the grammatical description of the language.

Since the grammar of Arabic has been standardized for centuries, it is logical to derive our morphosyntactic Arabic tagset from this grammatical tradition that has been used for around fourteen centuries by all students of Arabic.
Arabic grammarians and linguists have always used the Arabic system of inflectional morphology called "الإعراب" when teaching Arabic grammar to students. For example, given the sentence "لعب الولد" "the boy played", students would have to say that the first word is the indeclinable, indicative, perfect verb, while the second word is the nominative subject[7][3].

The proposed Arabic tagset in this paper is based on the inflectional morphology system. Arabic grammarians traditionally analyses all Arabic words into three main parts-of-speech. These parts-of-speech are further sub-categorised into more detailed parts-of-speech which collectively cover the whole of the Arabic language [4]. These are:

- **Noun:** A noun in Arabic is a name or a describing-word for a person, a thing or an idea. This includes not only the English equivalent of a noun, but also adjectives, proper nouns and pronouns.
- **Verb:** Verb: Verbs are the same in Arabic as they are in English in that they denote actions.
- **Particle:** Particles include prepositions, conjunctions, Exceptions, Vocative, Annulment, Subjunctive, and Jussive.

### 3.2.1 Noun

A noun in Arabic indicates a meaning by itself without being connected with the notion of time and refers to a person, place, thing, event, substance or quality. Nouns are also divided into the following types: (Common, Demonstrative, Relative, Personal, Adverb, Diminutive, Instrument, Conjunctive, Interrogative, Proper, and Adjective).

The linguistic attributes of nouns that have been used in this tagset are:

- **Case:** Arabic nouns have three cases: nominative, accusative and genitive. For example, the words "الدرس" "الدرس، الدرس" which mean "the lesson", indicate the above three cases respectively.

Without the case marker associated with the last letter of the above words (e.g short vowels), it’s difficult to determine the case of that word.

- **State:** Arabic nouns are marked for definiteness and indefiniteness. Definiteness is marked by the article "ال", which means "the". For example, the words "الكتاب" and "كتاب" which mean "the book", "a book" indicate definiteness/indefiniteness respectively.

- **Number:** Arabic has three numbers: singular, dual, and plural.

For example, the words "ولد" and "ولدان" which mean "a boy ", "two boys " and "boys " indicate singular, dual, and plural respectively.

- **Gender:** Arabic nouns have three genders: masculine, feminine and neuter. Most common noun ends with "Tanween". Most feminine singular nouns end with a round Ta (marbuta). For example, the words "كَرَمَة" and "مَلْك", which mean "a king", "a plane" and "group of people" indicate masculine, feminine and neuter respectively.

- **Person:** Arabic nouns have three persons: the speaker (First person), the individual spoken to (Second person), and individual spoken of (third person). For example, the personal noun and "أَتَّبَع" which mean "I ", "You " and "He " indicate First, Second, and third person respectively.

### 3.2.2 Verb

Arabic verbs are deficient in tenses. Moreover, these tenses do not have accurate time significances as in Indo-European languages [6].

The verb in the Arabic language implies a state or action and a notion of time combined with them and has several aspects: Perfect, Imperfect and Imperative. The Perfect verb indicates a state or a fact in the past. For example, the word "أَتَّبَع" which means "He wrote". The Imperfect verb expresses an action still unfinished at the time to which reference is being made. For example, the word "يَلَكَ" which means "He is writing".

The Imperative verb indicates an action demanded to be carried out in the future. For example, the word "أَكْتَب" which means "you write".

The linguistic attributes of Verbs that have been used in this tagset are:

- **Mood:** Arabic Verbs have three moods: Indicative, Subjunctive and Jussive. In Verbs, the words "أَكْتَب", "عَرَف" which mean "He wrote", "I wrote " and " You wrote " indicate Indicative, Subjunctive, Jussive mood respectively.

- **Number:** Arabic has three numbers: singular, dual, and plural. For example, the words "يَقرأ", "يَقرَأان" and "يَقرأوا" which mean "He read ", " (two people) read ", and " they read " indicate singular, dual, and plural number respectively.
• Gender: Arabic verbs have two genders: masculine, feminine. For example, the words "كتب" and "كتبت" which mean "He wrote" and "She wrote".

• Person: Arabic verbs have three persons: the speaker (First person), the individual spoken to (Second person), and individual spoken of (third person). For example, the words which mean the words "كتب", "كتبت" which mean "He wrote", "I wrote" and "You wrote" indicate First, Second, and third person respectively.

3.2.3 Particle
In Arabic, particles are classified as one of the three main categories as part of speech, some of the particles used with Verbs and effective the mood of verb when precedes the Verb word. For example, the particles "الم", "ال" (Jussive), "ال" (Subjunctive), some of them used with Nouns. For example, the particles "لف" (Preposition), "لى" (Exception), and some used with both the noun and the verb. For example, the particle "و" (Conjunction).

3.3 Proposed Arabic Tagset: Hierarchy
We have based our Arabic tagset on inflectional morphology system. The traditional description of Arabic grammarians consider as a base to create the linguistic categories of Arabic tagset. Arabic grammarians describe Arabic as being derived from three main categories: noun, verb and particle. Figure 1 shows the tagset hierarchy.

The tagset has the following main formula: 

\[ \{ T, S, G, N, P, M, C, F \} \]

Where:

- T (Type) = \{Verb, Noun, Particle\}
- S = Sub-Class \{Common, Demonstrative, Relative, Personal, Adverb, Diminutive, Instrument, Conjunctive, Interrogative, Proper and Adjective\}
- G (gender) = \{Masculine, Feminine, Neuter\}
- N (Number) = \{Singular, Plural, Dual\}
- P (Person) = \{First, Second, Third\}
- M (Mood) = \{Indicative, Subjunctive, Jussive\}
- C (Case) = \{Nominative, Accusative, Genitive\}
- F (State) = \{Definite, Indefinite\}

Figure 2 shows the Abbreviations which was used to define the words in our tagset.

A sample of our tagset shown in Table 2.

<table>
<thead>
<tr>
<th>Word</th>
<th>Abb</th>
<th>Word</th>
<th>Abb</th>
</tr>
</thead>
<tbody>
<tr>
<td>Verb</td>
<td>Ve</td>
<td>Annulment</td>
<td>An</td>
</tr>
<tr>
<td>Noun</td>
<td>Nu</td>
<td>Subjunctive</td>
<td>Sb</td>
</tr>
<tr>
<td>Particle</td>
<td>Pr</td>
<td>Masculine</td>
<td>Ma</td>
</tr>
<tr>
<td>Perfect</td>
<td>Pe</td>
<td>Feminine</td>
<td>Fe</td>
</tr>
<tr>
<td>Imperfect</td>
<td>Pi</td>
<td>Neuter</td>
<td>Ne</td>
</tr>
<tr>
<td>Imperative</td>
<td>Pn</td>
<td>Singular</td>
<td>Sn</td>
</tr>
<tr>
<td>Common</td>
<td>Ca</td>
<td>Plural</td>
<td>Fl</td>
</tr>
<tr>
<td>Adjective</td>
<td>Aj</td>
<td>Dual</td>
<td>Du</td>
</tr>
<tr>
<td>Demonstrative</td>
<td>De</td>
<td>First</td>
<td>Fs</td>
</tr>
<tr>
<td>Relative</td>
<td>Re</td>
<td>Second</td>
<td>Sc</td>
</tr>
<tr>
<td>Person</td>
<td>Ps</td>
<td>Third</td>
<td>Th</td>
</tr>
<tr>
<td>Diminutive</td>
<td>Dm</td>
<td>Indicative</td>
<td>Dc</td>
</tr>
<tr>
<td>Instrument</td>
<td>Ir</td>
<td>Subjunctive</td>
<td>Sj</td>
</tr>
<tr>
<td>Proper</td>
<td>Pr</td>
<td>Jussive</td>
<td>Js</td>
</tr>
<tr>
<td>Adverb</td>
<td>Ad</td>
<td>Nominative</td>
<td>Nu</td>
</tr>
<tr>
<td>Interrogative</td>
<td>In</td>
<td>Accusative</td>
<td>Ac</td>
</tr>
<tr>
<td>Conjunction</td>
<td>Cj</td>
<td>Genitive</td>
<td>Ge</td>
</tr>
<tr>
<td>Preposition</td>
<td>Pp</td>
<td>Definite</td>
<td>Df</td>
</tr>
<tr>
<td>Vocative</td>
<td>Vo</td>
<td>Indefinite</td>
<td>Id</td>
</tr>
</tbody>
</table>

Fig. 2: Tagset Abbreviations

Let us try to explain the symbols of the tagset formula for a moment.

The symbols \{ T, S, G, N, P, M \} consider as linguistic attributes for class Verb, while the symbols \{ T, S, G, N, P, C, F \} consider as linguistic attributes for class Noun. For example, the word "كتب" which means "He wrote" has the following tag \[ VePeMaSnThSj \], which means \{Perfect Verb, Masculine Gender, Singular Number, Third Person, Subjunctive Mood\}.

Fig. 1: Tagset Hierarchy.
4 Conclusion and Future Work
In this paper, we described a morphosyntactic tagset that is derived from the ancient Arabic grammar, which is based on Arabic system of inflectional morphology. The tagset represent an early stage for use in a word-class based automated tagging system that is underdevelopment by the author. The tagset does not follow the traditional Indo-European tagset that is based on Latin but is instead based on the Semitic tradition of analyzing language.
These tags contain a large amount of information and add more linguistic attributes to the word. Also, we are currently expanding our tagset to cover most categories word in Arabic.

<table>
<thead>
<tr>
<th>Tag</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>VePeMaSnThSj</td>
<td>Verb, Perfect, Masculine, Singular, Third Person, Subjunctive</td>
</tr>
<tr>
<td>VePeMaSnFsDc</td>
<td>Verb, Perfect, Masculine, Singular, First Person, Indicative</td>
</tr>
<tr>
<td>VePeMaSnSeSj</td>
<td>Verb, Perfect, Masculine, Singular, First Person, Subjunctive</td>
</tr>
<tr>
<td>VePeFeSnSeJs</td>
<td>Verb, Perfect, Feminine, Singular, Second Person, Jussive</td>
</tr>
<tr>
<td>VePeFeSnThJs</td>
<td>Verb, Perfect, Feminine, Singular, Third Person, Jussive</td>
</tr>
<tr>
<td>VePeNeDuSeSj</td>
<td>Verb, Perfect, Neuter, Dual, Second Person, Subjunctive</td>
</tr>
<tr>
<td>VePeMaDuThSj</td>
<td>Verb, Perfect, Masculine, Dual, Third Person, Jussive</td>
</tr>
<tr>
<td>VePeFeDuThSj</td>
<td>Verb, Perfect, Feminine, Dual, Third Person, Jussive</td>
</tr>
<tr>
<td>VePeMaPIFsSj</td>
<td>Verb, Perfect, Masculine, Plural, First Person, Subjunctive</td>
</tr>
<tr>
<td>VePeMaPISeSj</td>
<td>Verb, Perfect, Masculine, Plural, Second Person, Subjunctive</td>
</tr>
<tr>
<td>VePeFePISeSj</td>
<td>Verb, Perfect, Feminine, Plural, Second Person, Subjunctive</td>
</tr>
<tr>
<td>VePeFePIThJs</td>
<td>Verb, Perfect, Feminine, Plural, Third Person, Subjunctive</td>
</tr>
<tr>
<td>VePeMaPIThDc</td>
<td>Verb, Perfect, Masculine, Plural, Third Person, Accusative</td>
</tr>
<tr>
<td>VePiMaSnThDc</td>
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<tr>
<td>VePiFeSnThDc</td>
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</tr>
<tr>
<td>VePiNePFLsDc</td>
<td>Verb, Imperfect, Neuter, Plural, First Person, Indicative</td>
</tr>
<tr>
<td>NuAjMsSnNmId</td>
<td>Adjective Noun, Masculine, Singular, Nominative, Indefinite</td>
</tr>
<tr>
<td>NuAjMsSnAcId</td>
<td>Adjective Noun, Masculine, Singular, Accusative, Indefinite</td>
</tr>
<tr>
<td>NuAjMsSnGeId</td>
<td>Adjective Noun, Masculine, Singular, Genitive, Indefinite</td>
</tr>
<tr>
<td>NuAjMsSnNmDf</td>
<td>Adjective Noun, Masculine, Singular, Nominative, Definite</td>
</tr>
<tr>
<td>NuAjMsSnAcDf</td>
<td>Adjective Noun, Masculine, Singular, Accusative, Definite</td>
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<tr>
<td>NuAjFeSnAcId</td>
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<td>NuAjFeDuGeDf</td>
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<tr>
<td>NuAjMaPIMlId</td>
<td>Adjective Noun, Masculine, Plural, Nominative, Indefinite</td>
</tr>
</tbody>
</table>
Table 2: Sample of Arabic Tagset

<table>
<thead>
<tr>
<th>Code</th>
<th>Description</th>
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<td>NuAjMaPlNmDf</td>
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Reference: