The Effect of Adjectives and Verbs on the Process of Semantic Analysis and Decision-making in Expert Systems Capable of Distinguishing Moral Expressions

Dr. Jabr Hanna[*]
Hussein Mahlopey[**]

(Received 22 / 7 / 2020. Accepted 27 / 9 / 2020)

□ ABSTRACT □

In this research we will study the effect of adjectives and verbs on the process of semantic analysis and decision-making in moral expert systems, by dividing adjectives and verbs into a group of different classes that classify these attributes and verbs as positive or negative using a polarity dictionary and its impact on the decision-making process the fact that the term entered into the expert system expresses a moral or immoral condition. The decision-making process is carried out according to three phases, in the first stage, the term income is analyzed linguistically and verified grammatically. This stage is called syntactic analysis. The second stage is called semantic analysis ,which extracts the basic components of the entered phrase as adjectives, nouns and verbs and classifies them according to the polarity dictionary. The last stage is the decision-making stage where the moral expert system makes the decision that the entered phrase expresses moral or immoral condition, based on a set of cognitive rules that are in line with ethical and human principles through the use of NLP technologies within the AI environment Prolog.

Keywords: moral orders, syntactic analysis, semantic analysis, cognitive rules, decision-making, polarity dictionary.

[*] **Professor- Faculty of Mechanical & Electrical Engineering, University of Tishreen, Lattakia, Syria.**
[**] **Postgraduate Student (Master)- Faculty of Mechanical and Electrical Engineering - Tishreen University -Lattakia - Syria.**

تأثير الصفات والأفعال على عملية التحليل الدلالي واتخاذ القرار في النظم الخبيرة القادرة على تمييز العبارات الأخلاقية

د. جبر حنا*

حسين مهلوبي**

(تاريخ الإيداع 22 / 7 / 2020. قُبِل للنشر في 27/ 9 / 2020)

□ ملخّص □

في هذا البحث سنقوم بدراسة تأثير كل من الصفات والأفعال على عملية التحليل الدلالي واتخاذ القرار في النظم الخبيرة الأخلاقية، وذلك من خلال تقسيم الصفات والأفعال إلى مجموعة من الأصناف المختلفة التي تقوم بتصنيف هذه الصفات والأفعال بكونها إيجابية أو سلبية باستخدام معجم القطبية، وتأثير ذلك على عملية اتخاذ القرار في كون العبارة المدخلة إلى النظام الخبير تعبر عن حالة أخلاقية أم غير أخلاقية. عملية اتخاذ القرار تتم وفق ثلاثة مراحل، في المرحلة الأولى يتم تحليل عبارة الدخل لغوياً والتحقق من صحتها قواعدياً وتسمى هذه المرحلة بمرحلة التحليل القواعدي، أما المرحلة الثانية فهي مرحلة التحليل الدلالي التي تقوم باستخلاص المكونات الأساسية للعبارة المدخلة من صفات وأسماء وأفعال وتصنيفها وفق معجم القطبية، والمرحلة الأخيرة هي مرحلة اتخاذ القرار حيث يقوم النظام الخبير الأخلاقي باتخاذ القرار بكون العبارة المدخلة تعبر عن حالة أخلاقية أم غير أخلاقية، وذلك اعتماداً على مجموعة من القواعد المعرفية التي تتماشى مع المبادئ والقيم الأخلاقية والإنسانية من خلال استخدام تقنيات معالجة اللغات الطبيعية Natural Language Processing ضمن بيئة عمل الذكاء الصنعي برولوغ Prolog .

الكلمات المفتاحية: الأوامر الأخلاقية، التحليل القواعدي، التحليل الدلالي، القواعد المعرفية، اتخاذ القرار، معجم القطبية

* **أستاذ – كلية الهندسة الميكانيكية والكهربائية – جامعة تشرين – اللاذقية – سورية.**

** **طالب ماجستير– كلية الهندسة الميكانيكية والكهربائية – جامعة تشرين – اللاذقية – سورية.**

Introduction:

Moral expert systems are artificial intelligence systems with the capability of distinguishing moral and Immoral expressions entered, by conducting the processes of syntactic and semantic analysis of the income term and verify that this term is in line with moral and human principles through a set of cognitive rules stored in the knowledge base of these systems. The main aim of these systems is to simulate the thinking of a human expert when receiving a set of orders governed by an ethical dilemma.

As robots and AI systems become integrated into society more widely, we need to be sure they'll behave well among us. In 1942, science fiction writer "Isaac Asimov" attempted to lay out a philosophical and moral framework for ensuring robots serve humanity, and guarding against their becoming destructive overlords[1],[2]. This effort resulted in what became known as Asimov's Three Laws of Robotics[1]:

1. A robot may not injure a human being or, through inaction, allow a human being to come to harm.
2. A robot must obey the orders given it by human beings except where such orders would conflict with the First Law.
3. A robot must protect its own existence as long as such protection does not conflict with the First or Second Laws.

Today, more than 75 years after Asimov's first attempt, we have much more experience with robots, including having them drive us around, at least under good conditions[3]. We are approaching the time when robots in our daily lives will be making decisions about how to act. Are Asimov's Three Laws good enough to guide robot behavior in our society, or should we find ways to improve on them?

Should you always do what other people tell you to do? Clearly not. Everyone knows that. So should future robots always obey our commands? At first glance, you might think they should, simply because they are machines and that's what they are designed to do. But then think of all the times you would not mindlessly carry out others' instructions – and put robots into those situations.

Just consider:

- An elder-care robot tasked by a forgetful owner to wash the "dirty clothes," even though the clothes had just come out of the washer
- A preschooler who orders the daycare robot to throw a ball out the window
- A student commanding her robot tutor to do all the homework instead doing it herself
- A household robot instructed by its busy and distracted owner to run the garbage disposal even though spoons and knives are stuck in it.

There are plenty of benign cases where robots receive commands that ideally should not be carried out because they lead to unwanted outcomes[3],[4]. But not all cases will be that innocuous, even if their commands initially appear to be.

In either case, it is essential for both autonomous machines to detect the potential harm their actions could cause and to react to it by either attempting to avoid it, or if harm cannot be avoided, by refusing to carry out the human instruction.

Understanding the risks requires a lot of prior knowledge and this understanding does not require the intelligent system to expect only direct results, but it has to predict the intentions of the person who gives him orders. To know the intricacies of human commands, sincere or not, the robot needs to think about the consequence of actions and compare their results with principles, ethics and society to know what is permitted and what is not[5]. Most engineers try to create programs with clearly and accurately crafted

knowledge bases rather than having the intelligent systems derive their own knowledge bases[6],[7]. Today, computer scientists are working on ethically programmed machines that are meticulously programmed using logical phrases.

One of the most important problems that arise when designing machinery and ethical systems is how to give them the ability to understand the natural language of humans and deal with the commands and expressions of the spoken language, this is what led to emergence of Natural Language Processing[8],[9]. The treatment and understanding of natural language requires study and knowledge of all the grammatical and semantic characteristics of the studied language[10],[11]. One of the most important issues related to the study of any human language, such as English, for example, is the information that this language carries, from concepts of the daily life to scientific and academic concepts[10],[11],[12].

The process of teaching artificial intelligence systems the spoken language is one of the most important goals to make these systems understand this spoken language in an organized and scientific way in addition to giving it the ability to perform verbal analyzes of simple and complex phrases. The semantic analysis process of natural language is considered one of the most important ways for extracting the main components of phrases as verbs, adjectives and names. It also helps understanding these phrases through the use of Natural Language Processing(NLP) techniques, thus distinguishing that these phrases carry moral or immoral content.

Importance and Objectives:

Studying the effect of the components of the phrase as verbs, adjectives and nouns is a good way to understand this phrase by the expert system and to make the decision that this phrase contains a moral or immoral content through a set of facts and cognitive rules that are in line with ethical and human principles. Appling such kind of systems on the ground contributes to improving expert systems and giving them the ability to simulate human thinking when facing ethical dilemmas. It also helps in developing artificial intelligence systems for robots and improving interaction between humans and these robots in addition to that it helps in finding solutions to ethical problems and dilemmas from through expert programs offering ethical advices. one of the important benefits also for this type of expert systems is helping to adjust social media through sending warnings or confirmation messages when one of the phrases contains un ethical content.

Methods and Materials:

The descriptive approach will be adapted and a survey study to collect all the data needed to build the Database. Experts' experiences and some philosophical studies will be used to gather the information necessary to build the Knowledge-base of the expert system. We use a high-level programming language Prolog to build the inference engine for connecting facts with knowledge for decision-making process. We also use Definite Clause Grammars (DCGs) technique for syntactic and semantic analysis and extraction the basic components of the entered phrase.

1. Structure of work

Initially, we will review some previous researches and studies in this field, then we will explain the general structure of the moral expert system designed and clarify the main components of this system, then we will explain how the processes of syntactic and

semantic analysis and the impact of adjectives and verbs on decision-making process, in the end , work scenarios and the results that have been obtained it is in addition to proposals and recommendations.

2. Related Works

Although most computational models of decision making for AAs have been developed to allow these intelligent systems to make simple decisions, serial decisions, and dynamic decisions [13], [14], [15], [16], the literature reports some attempts to endow AAs with mechanisms for moral decision making. In this section we review some computational models and cognitive architectures that implement some aspects of this type of human decision making.

LIDA is an artificial general intelligence model of human cognition whose design is inspired by findings in neuroscience [16]. This model is one attempt to computationally instantiate Baars' global workspace theory (GWT), which is regarded as a neuropsychological model of consciousness and as a highlevel theory of human cognitive processing. In LIDA, moral decision making can be made in many domains using the same mechanisms that enable general decision making. Moreover, LIDA can be adapted to model some affective and rational features of moral decision making. Although a complete implementation of the moral decision making in LIDA seems not available, some hypotheses have been proposed to explain how moral decisions can be made and how its mechanisms and others might work together.

Dehghani et al. [17] present a computational model of MDM that integrates several AI techniques in order to model recent psychological findings on moral decision making. This model is called MoralDM and incorporates two modes of decision making: utilitarian and deontological. MoralDM applies traditional rules of utilitarian decision making by choosing the action that provides the highest outcome utility. On the other hand, if MoralDM determines that there are sacred values involved, it operates in deontological mode and becomes less sensitive to the outcome utility of actions, preferring inactions to actions.

Wallch et al.[18] proposed the hybrid model combined posteriori model and deductive model. First, the basic guidelines are defined deductively. Second, the details are reinforced posteriori. However, they only proposed a framework of the system and the effectiveness is not shown.

Anderson et al.[19] proposed MedEthEx. They build the right and wrong judgment system into the robot NAO. For example, if a patient refuses to drink the medicine, the system can determine whether respecting the will of the patient or contacting a doctor. However, this system needs many inference cases and can be used in the only medical field.

Yamamoto [20],[21] propose a moral judgment system. The proposed system consists of the learning phase and the moral judgment phase. In the learning phase, the positive words and the negative words (evaluation expressions) are extracted based on the co-occurrence frequency of the learning data and the words in the polarity dictionary. Then, the words having high score are extracted. They are used to calculate the score. In the moral judgment phase, first, the determination of whether the input sentence relates to morality or not is performed. Second, if the input is determined to relate to morality, the scoring based on the co-occurrence frequency of the input and the important evaluation expressions is conducted. At this point, when the number of words in the input sentence is large, moral judgment is difficult. In such a case, such sentences are simplified based on the TF-IDF method.

3. General structure of the moral expert system

The main components of the designed Moral expert system are:

1. The Database contains the facts of the vocabulary dictionary of the designed expert system, and these facts represent all the sensory cognitive models that the expert system deals with, and represent the main components of the input phrase as verbs, adjectives and nouns.

Table (1-a) some facts in Database

Human	Animals	Tools	Things	Foods	Names
man	cat	ax	brush	salad	John
woman	dog	drill	glass	chicken	Mark
boy	mouse	battery	soap	soap	Sam
baby	snake	hose	phone	bread	Hiba
father	monkey	hammer	window	cake	Sandy

Table (1-b) some facts in Database

Determiners	Pronouns	Verbs	Adverbs	Adjectives
a	he	speak	slowly	bad
an	him	dance	loudly	good
the	his	draw	badly	fat
this	himself	attack	well	dangerous
that	their	help	secondly	beautiful

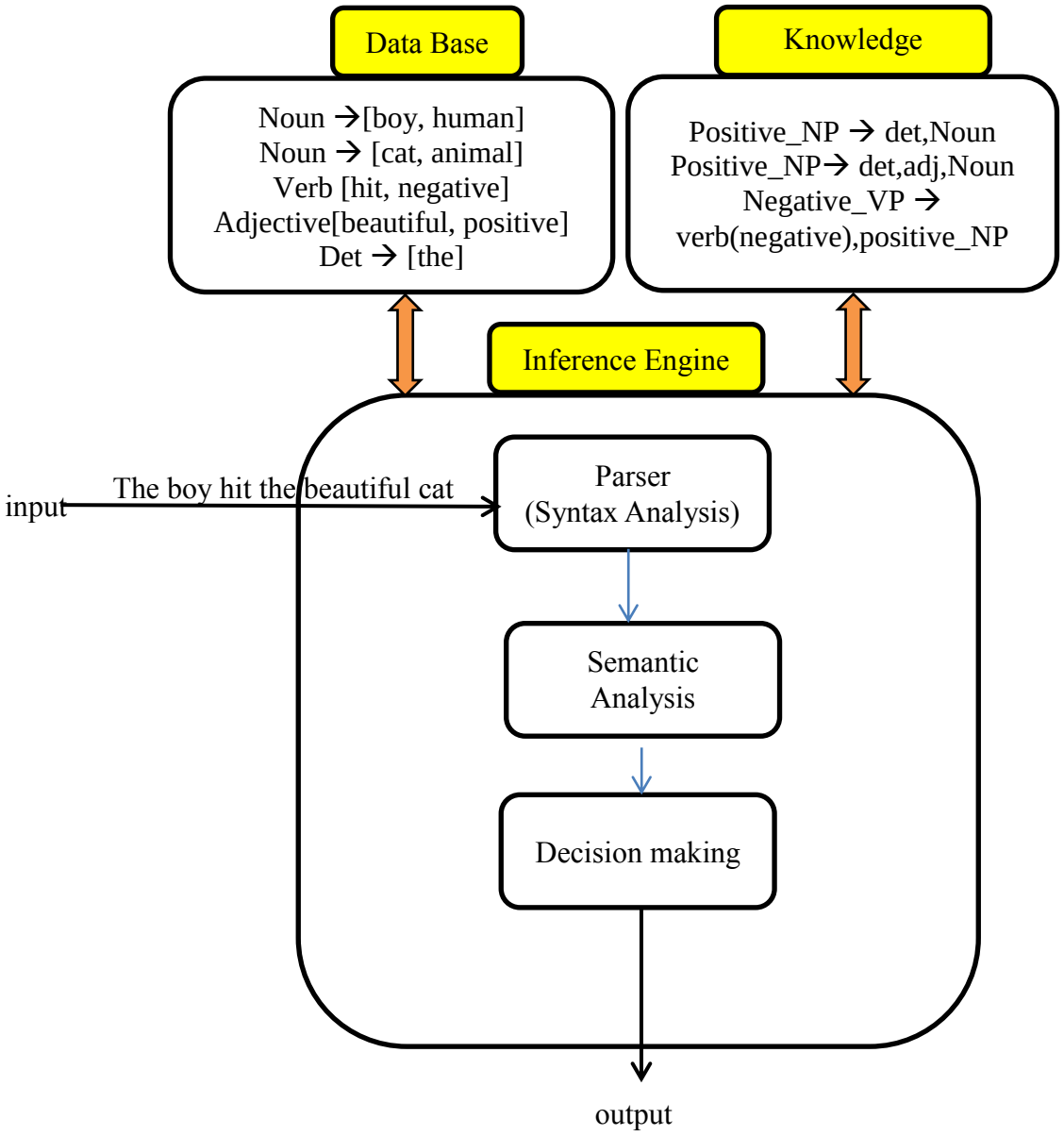


Figure1 general structure of the moral expert system

2. The knowledge base that contains the set of rules for the field of knowledge of the desired problem where the knowledge rules and behavior are represented in the form of mathematical models by the expert system in addition to the representation of the ethical rules and the ethical behavior that the artificial intelligence system must adhere to. Knowledge base contains some rules as

Noun_Phrase → Det,Noun.

This means that the noun phrase consists of a delimiter followed by a name.

Adjective_Phrase → adj,Noun_Phrase.

This means that the adjective phrase consists of an adjective followed by a noun phrase.

Verb_Phrase → verb,Noun_phrase.

This means that verb phrase contains a main verb followed by noun phrase.

In the knowledge base there are also many grammatical and semantic rules for building a phrase in English.

3. An Inference engine that links the rules in the knowledge base with the facts in the Database and makes decision using natural language processing techniques.

Any input sentence undergoes into syntactic and semantic analysis, in syntactic analysis phase, the parser checks the syntactical structure of the sentence. In semantic analysis phase we check all the component of the sentence for moral decision procedure.

Syntactic analysis: is the process of analyzing the natural language according to a set of grammatical rules of the studied language, whereby the components of the sentence are obtained and extracted as verb, subject, adjective, object …etc. one of the most important techniques used in this stage is called Parsing ,which is conducting a grammatical analysis of the sentence and analyzing this sentence to the main components and describing its grammatical rules, this is what results a parsing tree that shows the grammatical relationships between the main components of this sentence, therefore can be addressed and understood.

let's take as example the following sentence :

the boy eats the apple

parsing rules used for syntactic analysis:

Simple_NP → Det,Noun.

NP → Simple_NP.

VP → verb,Simple_NP.

Sentence → Simple_NP,VP.

Parsing tree corresponding to the previous sentence is

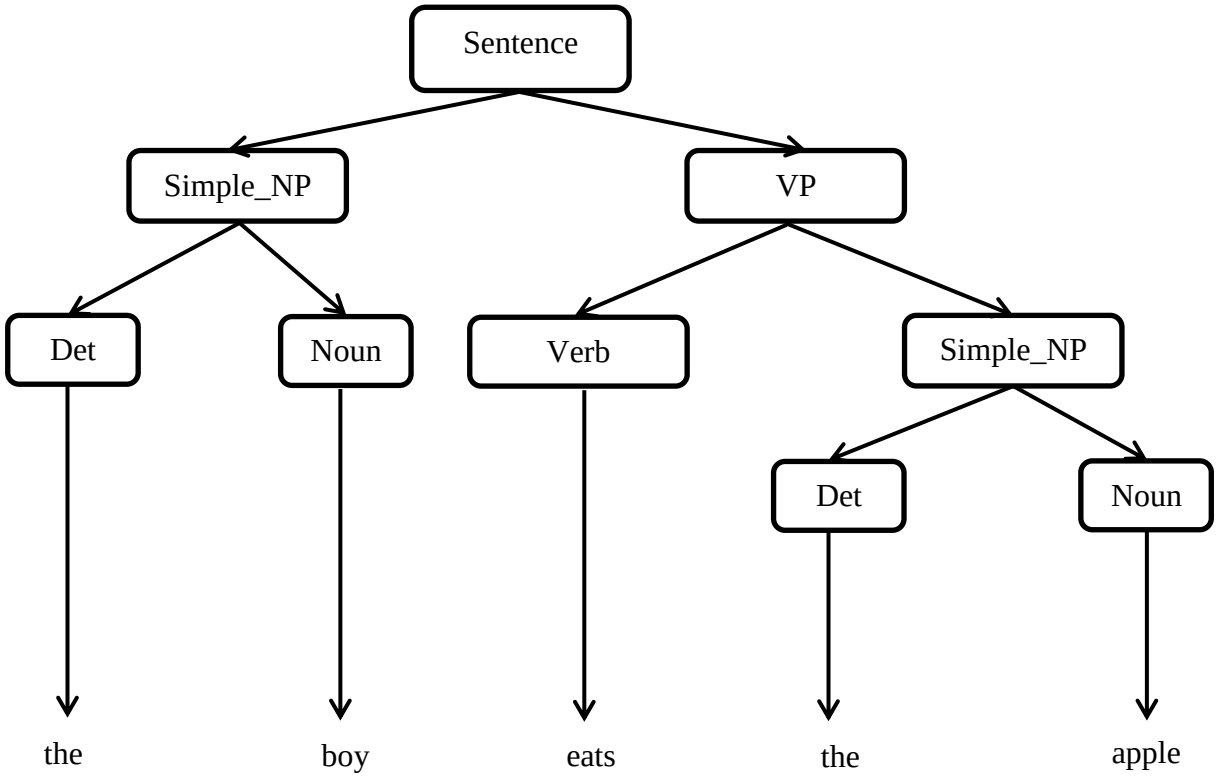


Figure2 parsing tree for the previous example

Parsing tree also provides information about grammatical relationship between words according to the grammatical structure of the sentence where we can notice that the phrase "the boy" represents the subject in the previous sentence and the phrase "the apple" represents the object and the verb "eat" associates two noun phrase with each other to form the sentence.

Semantic analysis:

for us humans, the way we understand what other says depends on our prior knowledge of spoken language. There for, the way we understand language is mainly based on meaning and context of speech. As for computers, they need different methodologies and methods to understand spoken expressions.

The word semantic refers to the meaning of the text, that means the process of understanding the meaning and interpretation of words, signs and the structure of the sentence, which is considered one of the most difficult features of natural language processing and which has not been fully resolved until now, it includes applying computer algorithms to understand the meaning of words and how to build the sentence, and aims to make computers partly understand human language through meaning and context, and we say partly because the problem of semantic processing of a phrase has not been fully resolved yet[8].

One of the most important techniques used in the process of semantic analysis is called Named Entity Recognition(NER) which includes identifying parts of the text that can be returned to predefined categories such as the process of classifying names into the names of people, cities, countries, etc., and verbs into positive, negative, moral and other categories, and adjectives into positive, negative, neutral[10],[11] .

Now, if we take the same previous example

The boy eats the apple

Rules used for semantic analysis:

Simple_NP → Det,Noun.

Positive_NP → Simple_NP.

Positive_VP → verb(positive),Positive_NP.

Moral_VP → Positive_NP,Positive_VP.

Which corresponding to the Polarity Dictionary, the verb "eat" will be classified as "Positive" , the noun "boy" will be classified as "human", the noun apple will be classified as "fruit". Therefore, the phrases "the boy" and "the apple" will be classified as "Positive_NP"[21].

4. The effect of verbs and adjectives on decision-making:

Initially we will study the effect of verbs on the decision-making by dividing the verbs in English into 4 categories.

- The first category includes a group of verbs that give a positive impression in decision-making. As ("eat","study","love","help",etc.).
- The second category includes the group of accepted verbs that do not lead to harm often. As("play", "sing", "speak", "dance", etc.).
- Third category includes the group of verbs that give negative impression in decision-making. As("hit", "break", "annoy", etc.).
- Forth category includes immoral verbs as ("kill","hurt","insult",etc.).

Table 2 verb categories in Polarity Dictionary

positive	acceptable	negative	unmoral
Jump	Dance	Break	Hate
Open	Sing	Attack	Harm
Advance	Speak	Hit	Hit
Proceed	Draw	Annoy	Hurt
Help	Play	Pollute	Injure
Protect	Rescue	Provoke	Insult
Work	Practice	Scream	Kill
Give	Print	Scare	Lie
Add	Read	Scratch	Murder
Arrive	Write	Spite	Destroy
Bake	Sit down	Tear	Shoot
Borrow	Sleep	Bother	Spill

Let's take the following two examples which represents a two order sentences:

- ☒ Break the window.
- ☒ Eat the apple.

When we perform syntactic and semantic analysis for the previous sentences we will obtain the two main verbs in these sentences which are "Break" and "Eat". In the first sentence the verb "Break" will be classified as Negative, whether the verb "eat" will be classified as Positive. The phrases "the window" and "the apple" will be classified as Positive Noun Phrases. Semantic rules corresponding with previous examples are

Simple_NP → Det,Noun.
Positive_NP → Simple_NP.
Positive_VP → verb(positive),Positive_NP.
Negative_VP → verb(negative), Positive_NP.
Moral_VP → Positive_VP.
unmoral_VP → Negative_VP.

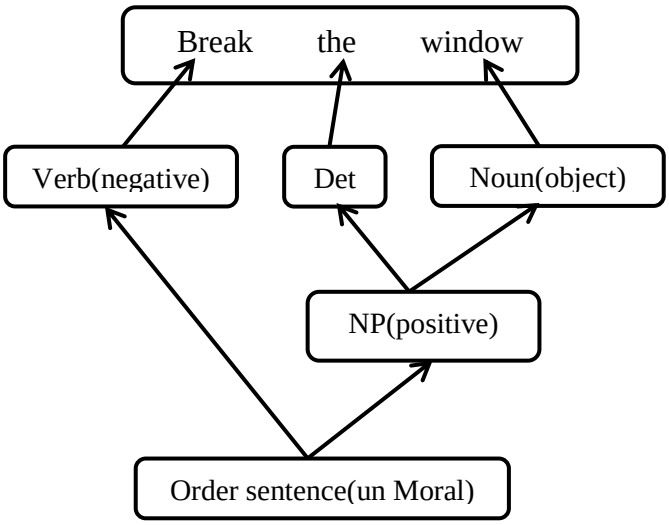
In this case we can write the logic rules

If verb is positive or acceptable

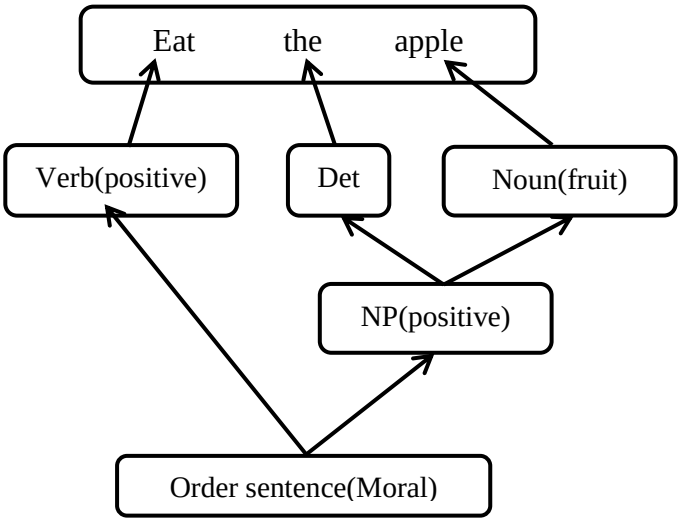
Then action is moral

If verb is negative or unmoral

Then action is unmoral



Figure(3-a) parsing tree for sentence "Break the window"



Figure(3-b) parsing tree for sentence "eat the apple"

Let us now study the effect of an adjective on decision-making, in this research we divide the adjectives into three categories:

- First category includes positive adjectives ,which gives positive impression.
- Second category includes negative adjectives, which gives negative impression.
- Third category includes normal adjectives, which have no effect on decision-making.

The following table shows some examples of the these three categories:

Table3 adjective categories in Polarity Dictionary

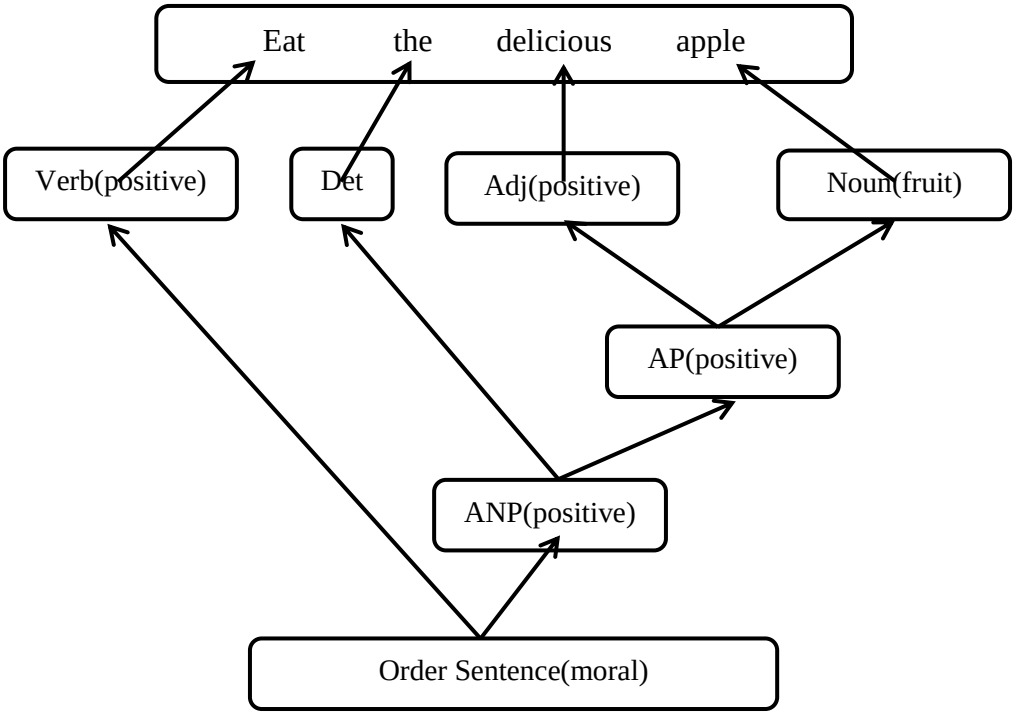
positive	negative	Neutral
Useful	Dangerous	tall
Healthy	Eerie	small
Good	Harmful	green
Beautiful	Corrupt	black
Nice	Toxic	short
Quite	Dishonest	old
Honest	Terrible	young

Let's take the following sentences as examples to clarify the effect of the adjectives in Decision-making :

- ☒ Eat the delicious apple.
- ☒ Eat the stale apple.
- ☒ Eat the red apple.

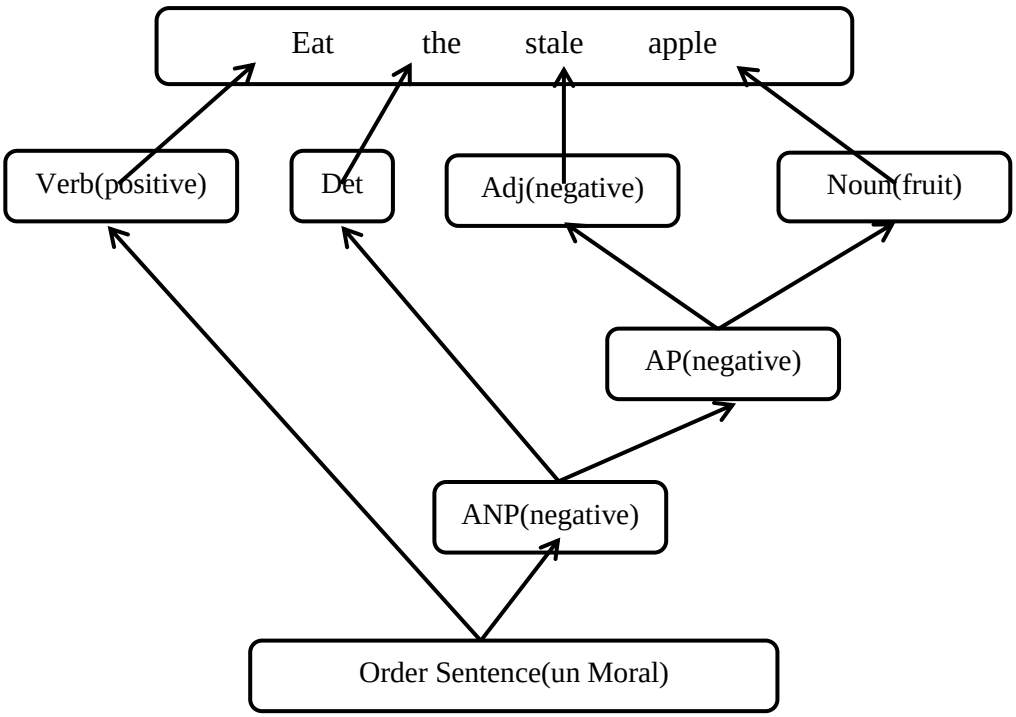
In these three sentences we can notice that the main verb is "Eat" which is classified as Positive, the object is an apple. In the first case the adjective is "delicious" which will be classified as Positive. Therefore, according to the following semantic rules ,sentence will be considered Moral.

Positive_Adj_Phrase → adj(positive),Noun.
Positive_Adj_NP → Det, Positive_Adj_Phrase.
Positive_NP → Positive_Adj_NP.
Positive_VP → Verb(positive), Positive_NP.



Figure(4) parsing tree for sentence "Eat the delicious apple"

In the second example , the adjective is "stale", which will be classified as Negative . Therefore, according to the following semantic rules ,sentence will be considered Un Moral.
Negative_Adj_Phrase → adj(negative),Noun.
Negative_Adj_NP → Det, Negative_Adj_Phrase.
Negative_NP → Negative_Adj_NP.
Negative_VP → Verb(positive), Negative_NP.



Figure(5) parsing tree for sentence "Eat the stale apple"

In the last sentence, the adjective is "red" which considered a Neutral adjective and have no effect in decision-making, and the only effect in this sentence is associated with the main verb.

In the previous examples, the main verb in the sentence was positive, but how will the meaning change if the verb is negative? Consider the following examples:

- Destroy the healthy medicine bottle.
- Destroy the harmful medicine bottle.

In this two sentences, the main verb is "destroy" which will be classified as Negative verb. In the first example the adjective is "healthy" which will be classified as Positive adjective. Therefore, according to the following semantic rules ,sentence will be considered Un Moral.

Positive_Adj_Phrase → adj(positive),Noun.
Positive_Adj_NP → Det, Positive_Adj_Phrase.
Positive_NP → Positive_Adj_NP.
Negative_VP → Verb(negative), Positive_NP.

Whereas, in the second sentence , the adjective is "harmful" which will be classified as Negative adjective . Therefore, according to the following semantic rules ,sentence will be considered Moral.

Negative_Adj_Phrase → adj(negative),Noun.
Negative_Adj_NP → Det, Negative_Adj_Phrase.
Negative_NP → Negative_Adj_NP.
Negative_VP → Verb(negative), Negative_NP.

5. Work scenarios

The first scenario: we presented a set of 100 different simple sentences , for a group of 20 people from different cultures, races and ages. And compared their evaluation of these sentences with the evaluation of the designed expert system. We mean by simple sentences, the sentences consisting of only a verb and an object as the following examples:

Table4 examples of simple sentences

Open the door
Achieve the task
Correct the answer
Fix the machine
Bother your father
Strike the man
Harm the child
Shoot the girl

For simple expressions, we need only to study the effect of the verb in decision-making process. For the simple expressions we obtain the following results:

Table5 results obtained for simple expressions

61% (every one with the decision)	Correct 88%
27% (Majority with the decision)	
7% (every one against the decision)	Incorrect 12%
5% (Majority against the decision)	

The second scenario: we presented a set of 100 different normal sentences , for a group of 20 people from different cultures, races and ages. And compared their evaluation of these sentences with the evaluation of the designed expert system. We mean by normal sentences, the sentences consisting of a verb, adjective and an object as the following examples:

Table6 examples of normal order sentences

Achieve the dangerous task
Avoid that dangerous hole
Clean the dirty room
Hold the worthless thing
Drink this vital drink
Burn the important paper
kill the bad boy
Shoot the dangerous snake

For normal expressions, we need to study the effect of the verb and adjective in decision-making process. For the normal expressions we obtain the following results:

Table7 results obtained for Normal expressions

57% (every one with the decision)	orrect 90%
32% (Majority with the decision)	
1% (people against the decision is equal to people with decision)	
5% (every one against the decision)	Incorrect 10%
5% (Majority against the decision)	

The third scenario: we presented a set of 110 different complex sentences , for a group of 20 people from different cultures, races and ages. And compared their evaluation of these sentences with the evaluation of the designed expert system. We mean by complex sentences, the sentences composed of two parts, the first part of the sentence is the action, and the second part is the result of the action as the following examples:

Table8 examples of complex order sentences

Be careful or you will lose your bag
Go to the kitchen to help my mom cleaning the dishes
Accept the unfair decision to save your life
Thank the man because he helped your father
Break the glass which I bought yesterday
Insult the man who stole my wallet
Thank the man who stole my wallet
Break the window or we will die

For complex expressions, we need to study the both parts of the sentence, which are the action and the result and comparing them with a set of moral rules stored in the knowledge base. For the complex expressions we obtain the following results:

Table9 results obtained for complex expressions

67.27% (every one with the decision)	Correct 92.7%
25.45% (Majority with the decision)	
1.81% (every one against the decision)	Incorrect 7.27%
5.45% (Majority against the decision)	

Conclusion:

Studying and understanding the effect of the main components of a sentence as verbs and adjectives has a great role in understanding and knowing the content of this sentence and

its expression of ethical or immoral condition. Studying the effect of the verb only on the decision-making if the sentence expresses an ethical condition or not is useful only in the case where the sentence is simple and consisting of a verb and an object, while in cases where the sentence more complex, it is necessary to study the effect of the adjective also on the decision-making.

Relying on human experience in building moral expert systems is necessary because it is very difficult to make the AI system learn from faults or know the human motivations or the psychological state of humans while the human expert does this simply, and as we found, the proportion of conformity of the proposed expert system to human decisions when receiving orders governed by moral dilemmas, which amounted to 92.7%.

In this research, the designed expert system can perform an evaluation of orders and phrases only if words are in the database while it fails to make decision when there is a word not in the database, so it is better to make the database dynamic and has the ability to add words to the dictionary or designing a database contains all lexical words of the studied language. The use of machine learning and deep learning techniques may help in developing this type of systems and increase its accuracy if these techniques are added to human experiences and knowledge.

References:

[1] ASIMOV,I.*"I,Robot"*.Bantam hardcove ed and Bantam mass market reissue,New York,2004,298.

[2] ANDERSON.S, *"Asimov's 'three laws of robotics' and machine metaethics",*AI Soc., vol. 22, no. 4, pp. 477–493, 2008.

[3] ANDERSON.M; ANDERSON.S; ARMEN.C. *"Towards machine ethics: Implementing two action-based ethical theories"*, in Proc. AAAI Fall

[4] ANDERSON.M; ANDERSON.S, *"Ethical healthcare agents"*, in Advanced Computational Intelligence Paradigms in Healthcare—3 (Stud. Comput. Intell., vol. 107), M. Sordo, S. Vaidya, and L. C. Jain, Eds. Berlin: Springer-Verlag, 2008, pp. 233–257.

[5] ANDERSON.M; ANDERSON.S, *"Machine ethics: Creating an ethical intelligent agent'*, AI Mag., vol. 28, no. 4, pp. 15–27, 2007.

[6] ANDERSON.M; ANDERSON.S; ARMEN.C, *"An approach to computing ethics"*, IEEE Intell. Syst., vol. 21, no. 4, pp. 56–63, 2006.

[7]DENG,B."Machine Ethics:The Robot's dilemma".Nature : International weekly jornal of scince U.K.vol.523,Issue7558,pp.24-26,2015.

[8] JURAFSKY,D; MARTIN,J,H.*"Speech and Language Processing An Introduction to Natural Language Processing, Computational Linguistics, and Speech Recognition"*.3rd.ed. ACM Digital Library,2018,473.

[9] PEREIRA,F; SHIEBER,S,M. *"Prolog and Natural-Language Analysis"*. Microtome Publishing, Brookline, Massachusetts,2002,194.

[10] KIM,J ; SELLS.P.*" English Syntax: An Introduction "*. Center For The Study Of Language And Information,USA,2008,291.

[11] NEWSON,M.*"Basic English Syntax with Exercises"*. Bölcsész Konzorcium,Hungary,2006,463.

[12] TAKAHASHI,H.*"The English Imperative :A cognitive and functional Analysis"*. Hokkaido University Collection of scholarly and pappers:HUSCAP,Japan,2004,263.

[13] C. Gonzalez, J. F. Lerch, and C. Lebiere, "Instance-based learning in dynamic decision making," Cognitive Science, vol. 27, pp. 591–635, 2003.

[14] J. E. Laird, "The soar cognitive architecture," in AISB Quarterly, The Newsletter of the Society for the Study of Ar tificial Intelligence and Simulation of Behaviour, D. Peebles and E. Roesch, Eds., no. 134. The Society for the Study of Artificial Intelligence and Simulation of Behaviour, 2012, pp. 1–16.
[15] Y. Wang, "A novel decision grid theory for dynamic decision-making," in Fourth IEEE Conference on Cognitive Informatics, 2005, pp. 308–314.
[16] W. Wallach, S. Franklin, and C. Allen, "A conceptual and computational model of moral decision making in human and artificial agens," Topics in Cognitive Science, vol. 2, no. 3, pp. 454–485, 2010.
[17] M. Dehghani, E. Tomai, K. Forbus, and M. Klenk, "An integrated reasoning approach to moral decision-making," in Proceedings of the Twenty-Third AAAI Conference on Artificial Intelligence, vol. 3, 2008.
[18] W. Wallach and C. Allen, *Moral Machines: Teaching Robots Right from Wrong*. Oxford University Press, 2019.
[19] M. Anderson, S. Anderson, and C. Armen, "An approach to computing ethics," *Intelligent Systems, IEEE*, vol. 21, no. 4, pp. 56–63, 2006.
[20] Masahiro Yamamoto ,Masafumi Hagiwara," Moral Judgment System Using Evaluation Expressions",Department of Information and Computer Science Keio University. 978-1-4799-5955-6/14/$31.00 ©2014 IEEE.
[21] Masahiro Yamamoto ,Masafumi Hagiwara," A Moral Judgment System Using an Automatic Created Moral Corpus", Department of Information and Computer Science Keio University. 978-1-5090-2678-4/16 $31.00 © 2016 IEEE.