

Al Usouly: An expert system in the origins of Islamic jurisprudence domain

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ABSTRACT

The provisions of Islamic Sharia need to be understood by a specialist in the rich field of Islamic laws. This is a very complicated process that usually needs a mufti who is responsible for interpreting authentic revelations from the words of Allah the Almighty in the Holy Quran, and the teachings of the Prophet Mohammed, Peace Be Upon Him (PBUH), that refer to the Sunnah, as well as the knowledge of unanimity (Ijma'a) cases. The Arabic language is rich in terminology may have more than one meaning, adding a new dimension of complications. Following this complicated interpretation process, a Fatwa or Islamic verdict is issued. This paper describes the design and implementation of a knowledge-based expert system (Al-Usouly) to automate this process under restricted constraints by applying the origins of the Islamic jurisprudence domain (*Usoul Al-fiqh*) to Quranic evidence alone. This prototype will cover the extraction of religious text only, with no transitive relationships to other texts related to scripture. The system is designed to understand the terms contained in the Islamic Sharia evidence (authentic rules from revelations) and to consider the intended meaning of a term in the specified area by using question and answer sessions. The expert system will then apply the rules of origins of Islamic jurisprudence science to conclude or suggest the correct interpretation of the Islamic jurisprudence from that Quranic verse. The system showed very impressive results of 96% correct judgment when compared to human experts in the field of Islamic jurisprudence.

Keywords: Expert system; jurisprudence; knowledge base system, Usouly.

INTRODUCTION

Islam is a religion practiced by over a billion people from all races, nationalities, and cultures across the globe. Although the word "Islam" means "submission" and comes from the root word that means "peace," Islam is a complete way of life that is based on worship of Allah (God Almighty) alone (monotheism) and the avoidance of all forms of polytheism. Islam's followers offer complete submission to God Almighty as gratitude for being given life and innumerable blessings. Islam guides Muslims in all sorts of life situations, and each Muslim is

supposed to be guided by the teachings of Islam in all life-deeds, words, and behaviors. That is why Muslims must always refer to the main sources of Islam, which are the Holy Quran, the Sunnah-the teachings of the Prophet (PBUH), and Ijma'a (unanimity of Muslim authentic scholars). The Quran is the word of Allah, God the Almighty, as it was revealed to the Prophet Mohammad (PBUH) fourteen centuries ago. Whereas the Sunnah is the words and actions of the Prophet Mohammad (PBUH) and was documented after his death in the form of chained narrations (Hadeeth), Ijma'a is the agreement of authentic Muslim scholars after the death of the Prophet (PBUH) on such issues (Muhammad, 2003).

The provisions of Islamic Sharia need to be interpreted by a specialist in the field of Islamic laws. Therefore, the guidance of a mufti are required (a mufti is the person responsible for considering the evidence used to devise such provisions). As a result of this process, a mufti can issue a *Fatwa*, an Islamic verdict. Since the advisory process (*Ifa'a*) is very important, not just any person can be a mufti. A person must meet many conditions in order to become a mufti: be a follower of Islam, have reached puberty, be able to apply reason and justice, be able to apply diligence (*Ijtehad*), be able to extract rules from interpreted scripts and sayings of the prophet (PBUH), and know the places of unanimity (*Ijma'a*) (AlZuhaily, 1999).

Among the many advantages to having an automated process for issuing a Fatwa are the increased availability of Islamic Fatwa on selected topic domains to Muslims, better understanding of holy manuscripts, justifying Fatwa issued by Sharia scholars, as well as other academic purposes. Knowledge-based systems are suitable for capturing and maintaining the knowledge of human experts and perhaps combining the knowledge of multiple human experts. Having such a system provides a better mixture of information and makes this available in case of the absence or death of the human expert. Furthermore, because of the rapid growth of globalization, involving Information Technology (IT) in the Islamic Sharia domain is crucial.

The rest of this paper is organized as follows: a literature review is discussed in the following section, and background on Islamic jurisprudence is provided next. Al-Usooly expert system implementation is then explained, followed by analysis of the results. Finally, conclusions and future work are discussed.

LITERATURE REVIEW

Although many researchers have used expert systems for the application of law to support lawyers and produce legal advice (Hafner & Berman 2002; Cardenosa & Lasala, 1996) only a little work has been done on the domain of Islamic Sharia. This is due to the complexity of the topic. Many cases need to be

considered, and rules are heavily dependent on words that might have different meanings in different contexts and may be affected by companion conditions that may be associated directly or indirectly with the resulting Fatwa. One of the few existing systems is the *El Bayane* system (Nouaouria *et al.*, 2006), which uses case-based reasoning (CBR) to assist the human mufti in generating Fatwas for new situations by using the Fatwas issued in past situations. The *El Bayane* system is not able to generate new Fatwas, but reuses previous Fatwas by imitating the logical inferences of a scholar mufti. An evolutionary approach to CBR was used to better investigate neighboring solutions. Researchers are currently studying implementing the *El Bayane* system on the Worldwide Web (Nouaouria *et al.*, 2005).

ISLAMIC JURISPRUDENCE BACKGROUND

Islamic jurisprudence science

Usūl al-Fiqh (in Arabic: أصول الفقه). *Usoul* is the plural of *Asl*, which is a term that literally means “the roots” and refers to the study of the origins of Islamic law, its sources, and the practice of Islamic jurisprudence (*Fiqh*). Therefore, *Usoul* is the methodology, and the *Fiqh* is the product.

Al-Usoul deals with the primary sources of Islamic law, the Quran, and the Sunnah, which means that *Usoul* discusses the characteristics of the Quran and the Sunnah and the methods of deducing law from the Quran and the Sunnah. In so doing, *Usoul* discusses various particular words used in the Quran and the Sunnah (known as *Khas*) and the Arabic language in general (known as *Amm*). Words with unconditional translations are called *Mutlaq* and those with conditional translations are known as *Muqayad*; literal and metaphorical words are called *Haqiqi* and *Majazi*. In addition, there are various types of clear words and unclear words (AlZuhaily, 1999; Abdul Hannan, 2006).

Methods of deduction from the legal verses of the Quran and the Sunnah are known by Islamic jurists (*Fuqaha*) as *Ibarat al Nass* (عجارة النص). Islamic rules are derived (1) from the obvious words and sentences themselves, *Isharat al Nass* (إشارة النص); (2) from signs and indications inherent in the text, *Dalalat al Nass* (دلالة النص); (3) from the spirit and rationale of a legal text, *Iqtida'a al Nass* (اقتضاء النص); and (4) as a requirement of the provision of the text though the text is silent on the issue (Abdul Hannan, 2006).

Importance of *Usoul Al-Fiqh*

The benefits of the study of *Usoul al Fiqh* are countless. One learns to interpret the Quran and the Sunnah, as well as all the secondary sources of Islamic law,

the views on Usoul of major scholars of the past and present, the rules and methods of diligence (*Ijtehad*), and the history of the development of Islamic law and legal theory. Because so many sources exist, people who study Usoul are cautious in their approach to Islamic law. They develop respect for the methodology of past masters and become aware of the need to follow rules in deducing new rules of Islamic law. They avoid careless utterances and actions. Muslims can produce great *mujtahid* (those who have the ability to apply diligence) only by studying Usoul in addition to other sciences. The principal objective of Usoul is to regulate *Ijtehad* and guide the jurist in his efforts at deducing the law from the sources (Abdul Hannan, 2006).

The emergence of *Usoul Al-Fiqh*

Imam Shafi'e is considered to be the father of the science of Usoul because he was the first to develop a systematic treatment of the principles of *Usoul al Fiqh*. Before the time of Imam Shafie, the jurists certainly followed some principles in the deduction of law, but these principles were not integrated and systematized. Many other scholars have contributed to the study of Usoul, and the most famous are Abul Hasan Al Basri, Imam al Haramayn al Juwayni, Abu Hamid al Gazali, Fakhruddin al Razi, Saifuddin Al Amidi, Abul Hasan Al Karkhi, Fakhruddin Al Bazdawi, Abu Bakr Al Jassas, Sadr Al Shariah, and Tajuddin Al Subki, among others (Abdul Hannan, 2006).

Initially, there were two approaches to studying *Usoul*: the theoretical and the deductive. The theoretical approach was developed by Imam Shafi'e, who enacted a set of principles that should be followed in the formulation of *Fiqh*. The early and later Hanafi scholars developed a deductive approach known as the Islamic Jurists' Approach. They looked into the details of law given in the Quran and the Sunnah and derived legal rules or Usoul principles. Our expert system that is named Al-Usouly follows this approach. However, very recently scholars have started combining the two approaches (Abdul Hannan, 2006).

Types of Islamic laws

Islamic law (*fiqh*) covers two main areas: rules related to actions and rules related to circumstances surrounding actions.

Rules related to actions (*Ahkam Amaliyya*: أحكام عملية) include (1) Obligation (*Wajeb*: واجب), (2) Recommendation (*Mandoob*: مندوب), (3) Permissibility (*Mubah*: مباح), (4) Not Recommended (*Makrooh*: مكروه), (5) Prohibition (*Haram*: حرام). Rules related to circumstances (*Ahkam Wade'ia*: أحكام وضعية) include: (1) Condition (*Shart*: شرط), Cause (*Sabab*: سبب), (2) Preventor (*Mani*: مانع), (3) Permit/Enforce (*Rukhsah, Azeemah*: رخصة/عزيمة), (4) Valid/Corrupt/Invalid

(*Sahih, Fasid, Batil* : صحيح/فاسد/باطل), and (5) In time/Debt/Repeat (*Adaa, Al-qadaa, Eada* : أداء/قضاء/إعادة) (Al-Namlah, 2003).

The Al-Usouly expert system focuses on the five rules related to actions and takes into consideration the methods of deduction based on the text from the Quranic verses-Ibarat al Nass (عبارة النص)-which are mentioned above.

AL-USOULY EXPERT SYSTEM IMPLEMENTATION

An expert system (ES) is a computer system that emulates the decision-making ability of a human expert in a restricted domain (Giarratano & Riley, 1998). Expert systems can be very effective tools for fast, high-quality decision-making but cannot fully replace humans and cannot solve non-standard situations (Zalis, 2004).

Scope and constraints

The Al-Usouly expert system is intended to serve Sharia scholars who are not specialists in the field of *Usoul Al-Fiqh*, students in the *Usoul Al-Fiqh* field, or Muslims interested in knowing the intended meaning of evidence in order to understand a Fatwa. It may also be a tool or decision support system for a mufti who generates Fatwas from *Isteqra* or for extrapolation, which determines the hidden relationships and associations among incidents.

Notably, most books related to this field contain no classifications of terminologies or words, but instead contain the rulings of a judge. Therefore, to gather evidence, a researcher must take the time to read and understand the concepts in order to reach the intended meaning of a rule.

Unlike other systems such as the El-Bayane (Nouaouria, 2006) that can only be applied to the field of drinking, the Al-Usouly system can be applied to any field in the Islamic Sharia. Since the Arabic language is rich in terminology and has many synonyms and antonyms, words may contain more than one meaning. Therefore, some evidence based on such words cited from the Quran or the Sunnah can be interpreted in many ways, and consulting an expert in the origins of Islamic jurisprudence is necessary. Such an expert is called an *Usouly*, which refers to the *Usoul Al-Fiqh* science.

The system works simply by giving evidence or an argument from the Quran, and the expert system will determine the intended meaning of this argument following a series of question/answer sessions. For example, the word “no” probably has two meanings, namely dislikable or forbidden, and the expert system should select the appropriate interpretation based on other information provided in the question/answer session. An expert system is designed and

implemented to understand the terms contained in the Islamic Sharia Quranic evidence. The system considers the intended meaning of a term in a particular context as a standalone piece of evidence.

Stages of AI-Usouly expert system development

Several general approaches are available in the literature for developing Expert Systems. The AI-Usouly Expert System was developed using the approach that contains the following 5 stages as shown in Figure 1: (1) Identification, (2) Conceptualization, (3) Formalization, (4) Implementation, and (5) Testing (Waterman, 1986).

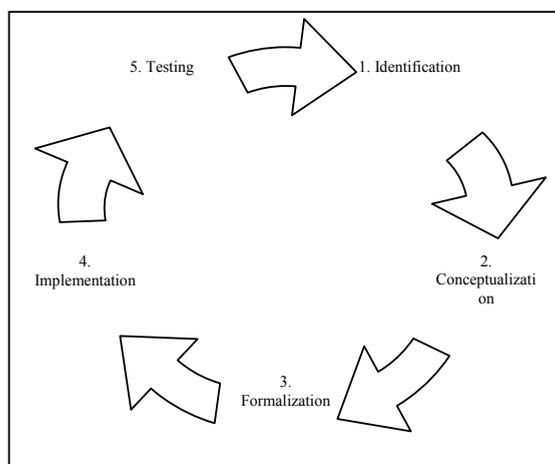


Fig. 1. Waterman Expert System Development stages.

In the Identification stage, a full requirement analysis was conducted to determine appropriate legitimate domain experts in the subject, targeted end users, the scope of the problem to be solved, and the objectives needed to be satisfied. In the Conceptualization stage, key concepts are collected, and relationships between objects and process are determined (see Fig. 2 as an example for conceptualizing part of an order rule). In the Formalization stage, key concepts are organized, a formal representation of the information flow is built, and the program logic is specified (see a formal representation of the rules depicted in Fig. 3). The formalized knowledge is coded into the framework using Flex language in the Implementation stage (see a sample of the Flex code depicted in Fig. 4 and Fig. 5), as well as a user interface suitable for the targeted users (see the user interface in Figs. 6, 7 and 8). Finally, there is the testing phase, where verification of individual relationships and validation of program output is conducted (see Table 2 and Table 3), as well as end-user feedback assessment is given (see Tables 4 and Table 5).

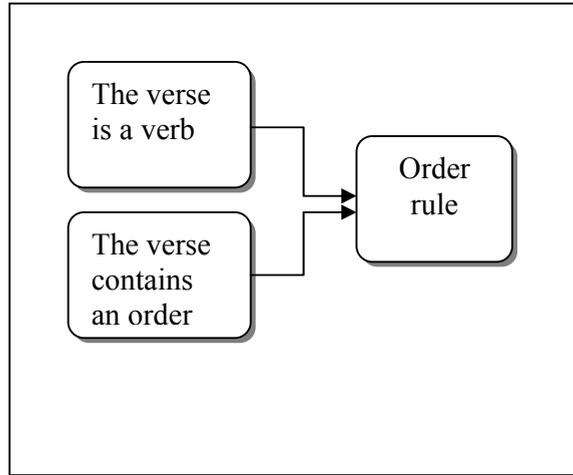


Fig. 2. Conceptualizing an order rule to be applied on the given verse.

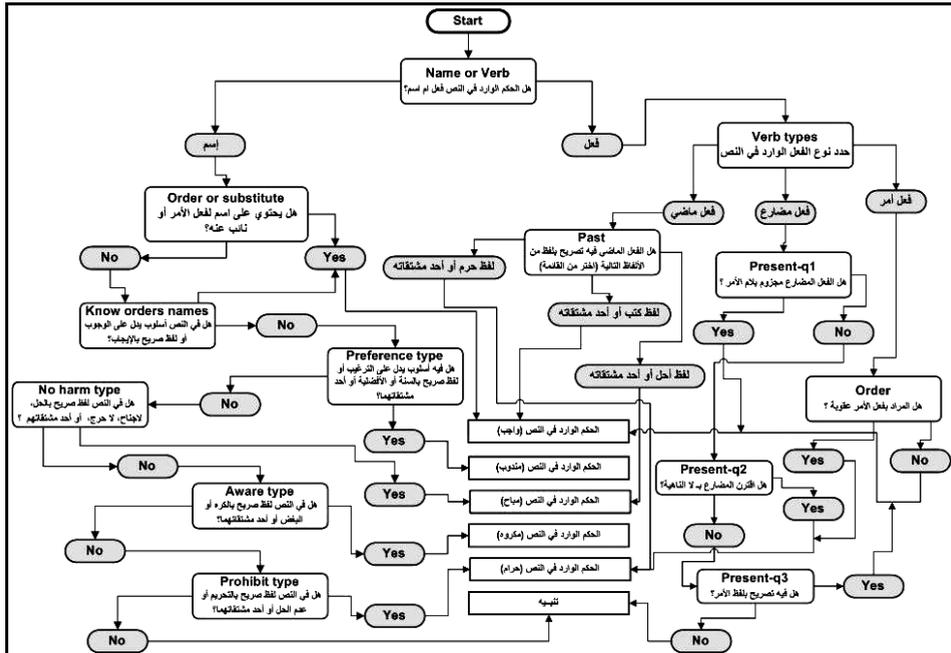


Fig. 3. AI-Usool Knowledge formal rule representation

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relation 'q_verb types'( Conclusion ) if
  the answer to 'verb types' is _ and
  check( 'verb types', =, 'فعل ماضي' ) and
  q_past( Conclusion ) .

relation 'q_verb types'( Conclusion ) if
  the answer to 'verb types' is _ and
  check( 'verb types', =, 'فعل مضارع' ) and
  'q_present-q1'( Conclusion ) .

relation 'q_verb types'( Conclusion ) if
  the answer to 'verb types' is _ and
  check( 'verb types', =, 'فعل أمر' ) and
  q_Amr( Conclusion ) .

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Fig. 4. Flex code implementation of the relation that determines the verb type

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group group3
  'فعل ماضي', 'فعل مضارع', 'فعل أمر' .

question 'verb types'
  'حدد نوع الفعل الوارد في النص' ;
  choose one of group3
  because فعل الأمر على وزن افعل أو افعلوا كقوله تعالى (أقيموا) ، فعل
  ، فعل مضارع على وزن يفعل أو يفعلون كقوله تعالى (ليطوفوا) ، فعل
  . ماضي على وزن فَعَلَ أو فَعَلُوا كقوله تعالى (أحل) .

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Fig. 5. Example using groups and explanations



Fig. 6. A snapshot of Al-Usouly user interface in one question/answer session.



Fig. 7. Al-Usouly judgment at the end of the question/answer session followed by any comments if exist.



Fig. 8. Once the user presses the 'Explain' button, the system will further explain the topic under consideration.

Al-Usouly inference engine

Expert systems are generally employed by applying an inference engine to a knowledge base. Two popular reasoning methods used in expert systems are “forward chaining” and “backward chaining.”

Forward chaining refers to the process of testing rules against known facts in a knowledge base. A rule consists of one or more conditions and an action. If the conditions are met, the inference engine may trigger the rule. Forward chaining is a very effective and widely used strategy. Integration of a wide variety of systems and sources of information allow access to large knowledge bases, increasing the power of forward chaining. However, large knowledge bases and rule sets increase the need for improved computational power and organization. Forward chaining is not effective in solving all problems. Some problems, such as diagnostics, are more suitably solved using backward chaining (Joseph, 2007).

In backward chaining (or backward reasoning), the inference engine selects a goal or list of goals (or hypotheses) and works backward from the consequent

“then” clause to the antecedent “if” clause to see if data is available that will support any of these “consequents”. “Consequents” are the second half of a hypothetical proposition, while antecedents are the first half. (For example, in a rule presented in the form of "if A, then B," A is the antecedent and B is the consequent.). Using backward chaining, the inference engine will search the inference rules until it finds one that has a consequent that matches a desired goal. If the antecedent of that rule is not known to be true, then it is added to the list of goals. (In order to confirm the goal, the user must also provide data that confirm this new rule.) Hence backward chaining is considered to be goal-driven, while forward chaining is a data-driven strategy. In other words, forward chaining will work well if a researcher knows some initial facts and has no idea about what the conclusion might be. In this case, the system will keep firing all matching rules until there are no more rules to be fired, and the system is likely to do a lot of irrelevant work. On the other hand, backward chaining works perfectly if one knows what the conclusion might be or has a small set of conclusions to check. Programming languages such as Prolog support backward chaining within their inference engines (Bratko, 2000), Flex, on the other hand, supports both backward and forward chaining.

Backward chaining was used in the Al-Usooly expert system since the knowledge based system is very similar to the diagnostic systems that have many hypotheses and work backwards with “if” statements. The Al-Usooly expert system was built using hypotheses that are dependent upon some divisions in the Usoul references that use Arabic terms in Quranic verses classified into the rules related to actions (Al-Namlah, 2003). For example, when any request for a verb is found in any verse of the rules in relation to action verses, and it is not linked with any punishment, this means that the meaning of this verb in this verse is obligation (*Wajeb*). Muslims must do it, unless it is accompanied by anything that distracts from the real meaning, which *Al-Usool* calls “*Qarrena Sarefa*” (accompanying distraction).

RESULTS AND ANALYSIS

Most expert system implementations were done on PC computers in the last two decades, and 45% of these implementations used expert system shells (Durkia 1994). The Al-Usooly expert system is also implemented in a PC environment using an LPA FLEX shell that is running on top of LPA-PROLOG language. In our implementation, we designed the knowledge base using LPA VisiRule, a graphical GUI that generates Flex rules and relations. We published the application on the net using a server-side Web application, namely LPA WebFlex that is only accessed via an intranet, but the interface webpage can be accessed via a general internet address (Mutawa, 2010) (see Figure 9).

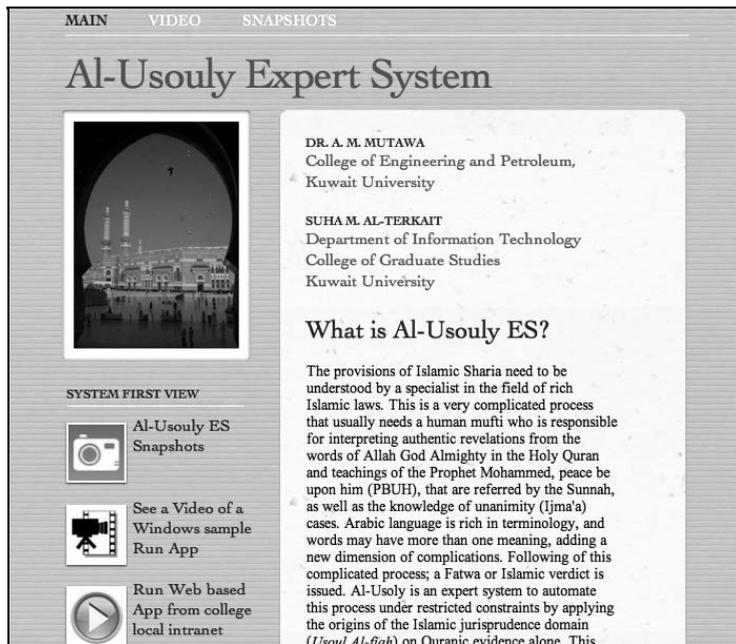


Fig. 9. Web interface of Al-Usouly web site at <http://bit.ly/usoulyArabic> Abstract

LPA Flex is an expressive and powerful expert system shell that supports frame-based reasoning with inheritance, rule-based programming and data-driven procedures fully integrated within a logic programming environment, and contains its own English-like Knowledge Specification Language (KSL).

VisiRule is a tool for creating decision-support software by drawing flowcharts. VisiRule consists primarily of a chaining inference engine reflected through a graphical user interface. VisiRule will automatically generate a Flex code that can be executed directly on the Flex shell.

WebFlex is an Internet-enabled version of the flex expert system toolkit that is used to run the application on the Web.

The implemented system was not restricted to a certain field of Fiqh as the case was with Al-Bayane system, but considered the application of Usoul rules on any general Quranic verse. One of the system restrictions is that the system accepts only Quranic verses as evidence. Another restriction is that the implemented system does not link other Quranic evidence related to the topic under consideration when applying the rules of Usoul, and only implements the rules on the verse in isolation from other related evidence.

Fifty verses from the Holy Quran were randomly selected from a list of Quranic verses that have rules in action from *Rawaye Albayan Tafseer Ayat Alahkam* (AISabouny, 1980). As shown in Table 1, each verse has a rule embedded in it that the system should recognize when applying the rules of *Usoul Al-Fiqh*.

Table 1. Selected verses from the Holy Quran and the rules related to each of them.

Sample Evidence Number	Chapter, Sura, and Verse numbers from Holy Quran	Quramic verse in Arabic text	English Translation (Yusufali 2009)	Part of the intended text (Arabic)	Translation of intended text	Rule required
SE01	2, 2, 158	إِنَّ الصَّفَا وَالْمَرْوَةَ مِنْ شَعَائِرِ اللَّهِ فَمَنْ حَجَّ الْبَيْتَ أَوْ اعْتَمَرَ فَلَا جُنَاحَ عَلَيْهِ أَنْ يَطُوفَ بِهِمَا.. (..)	"Behold! Safa and Marwa are among the Symbols of Allah. So if those who visit the House in the Season or at other times, should compass them round, it is no sin in them.."	فَلَا جُنَاحَ عَلَيْهِ أَنْ يَطُوفَ	Should compass them round, it is no sin in them	The rule of the going between Safa and Marwah in Hajj or Umrah
SE02	2, 2, 183	يَا أَيُّهَا الَّذِينَ آمَنُوا كُتِبَ عَلَيْكُمُ الصِّيَامُ كَمَا كُتِبَ عَلَى الَّذِينَ مِنْ قَبْلِكُمْ لَعَلَّكُمْ تَتَّقُونَ	"O ye who believe! Fasting is prescribed to you as it was prescribed to those before you, that ye may (learn) self-restraint!"	كُتِبَ عَلَيْكُمُ الصِّيَامُ	Fasting is prescribed to you	The rule of fasting
SE03	4, 3, 97	(..) وَلَهُ عَلَى النَّاسِ حِجُّ الْبَيْتِ مِنْ اسْتِطَاعِ إِيَّاهُ سَبِيلاً وَمَنْ كَفَرَ فَإِنَّ اللَّهَ غَنِيٌّ عَنِ الْعَالَمِينَ	"Pilgrimage thereto is a duty men owe to Allah,- those who can afford the journey; but if any deny faith, Allah stands not in need of any of His creatures"	لَهُ عَلَى النَّاسِ حِجُّ الْبَيْتِ	Pilgrimage thereto is a duty men owe to Allah	The rule of the Hajj
SE04	4, 4, 3	وَلَنْ خِفْتُمْ إِلَّا تَقْضُوا فِي الْيَتَامَى فَانكحروا ما طلب لكم من النساء مثنى وثلاث ورباع فإن خفتم إلا تعدلوا فواحدة أو ما ملكت أيمانكم ذلك أدنى ألا تعدلوا	"If ye fear that ye shall not be able to deal justly with the orphans, marry women of your choice, two or three or four, but if ye fear that ye shall not be able to deal justly (with them), then only one, or (a captive) that your right hands possess, that will be more suitable, to prevent you from doing injustice."	فانكحروا ما طلب لكم من النساء مثنى وثلاث ورباع فإن خفتم إلا تعدلوا فواحدة	Marry women of your choice, two or three or four, but if ye fear that ye shall not be able to deal justly (with them), then only one, or (a captive) that your right hands possess, that will be more suitable, to prevent you from doing injustice."	The multi-marriage rule
SE05	2, 2, 144	قَدْ نَرَى تَقَلُّبَ وَجْهِكَ فِي السَّمَاءِ فَلَنُوَلِّيَنَّكَ قِبْلَةً تَرْضَاهَا فَوَلِّ وَجْهَكَ شَطْرَ الْمَسْجِدِ الْحَرَامِ وَحَيْثُ مَا كُنْتُمْ فَوَلُّوا وُجُوهَكُمْ شَطْرَهُ.. (..)	"We see the turning of thy face for guidance to the heavens; now shall We turn thee to a Qibla that shall please thee. Turn then thy face in the direction of the sacred Mosque. Wherever ye are, turn your faces in that direction."	قَوْلٌ وَجْهَكَ شَطْرَ الْمَسْجِدِ الْحَرَامِ	Turn then thy face in the direction of the sacred Mosque	Facing Kaaba in prayer
SE06	2, 2, 159	إِنَّ الَّذِينَ يَكْتُمُونَ مَا أَنْزَلْنَا مِنَ الْبَيِّنَاتِ وَالْهُدَى مِنْ بَدِّ مَا أَنْزَلْنَا فِي الْكِتَابِ تُولِّتُ بِأُيُوتِكُمْ لِيَعْتَمِدُوا اللَّهُ وَيَلْعَنَهُمُ اللَّهُ لَبِئْسَ مَا كَانُوا يَفْعَلُونَ (الاعنون)	"Those who conceal the clear (Signs) We have sent down, and the Guidance, after We have made it clear for the people in the Book,-on them shall be Allah's curse, and the curse of those entitled to curse."	يَكْتُمُونَ مَا أَنْزَلْنَا مِنَ الْبَيِّنَاتِ وَالْهُدَى	Those who conceal the clear (Signs) We have sent down, and the Guidance	The rule of concealment of the forensics science
SE07	2, 2, 219	يَسْأَلُونَكَ عَنِ الْخَمْرِ وَالْمَيْسِرِ قُلْ فِيهِمَا إِثْمٌ كَبِيرٌ وَمَنَافِعُ لِلنَّاسِ وَإِثْمُهُمَا أَكْبَرُ مِنْ نَفْعِهِمَا.. (..)	"They ask thee concerning wine and gambling. Say: "In them is great sin, and some profit, for men, but the sin is greater than the profit."	قُلْ فِيهِمَا إِثْمٌ كَبِيرٌ وَمَنَافِعُ لِلنَّاسِ وَإِثْمُهُمَا أَكْبَرُ مِنْ نَفْعِهِمَا	Say: In them is great sin, and some profit, for men, but the sin is greater than the profit"	The rule of alcohol and gambling

Cont. Table 1. Selected verses from the Holy Quran and the rules related to each of them.

Sample Evidence Number	Chapter, Sura, and Verse numbers from Holy Quran	Quranic verse in Arabic text	English Translation (Yusufali 2009)	Part of the intended text (Arabic)	Translation of intended text	Rule required
SE08	26, 47, 33	(يا ايها الذين آمنوا اطيعوا الله واطيعوا الرسول ولا تعجلوا امصالحكم)	"O ye who believe! Obey Allah, and obey the apostle, and make not vain your deeds!"	"لا تعجلوا امصالحكم"	And make not vain your deeds	The rule of leaving the work after the beginning of it
SE09	27, 56, 79	(انه لقراّن كريم# في كتاب مكنون# لا يمسه الا المطهرون)	"That this is indeed a Qur'an Most Honourable In Book well-guarded, which none shall touch but those who are clean."	"لا يمسه الا المطهرون"	None shall touch but those who are clean	The rule of touching the Holy Quran without Purity
SE10	28, 62, 9	(يا ايها الذين آمنوا اذا نودي الى الصلاة من يوم الجمعة فاسعوا الى ذكر الله وذروا البيع لكم خير لكم ان كنتم تعلمون)	"O ye who believe! When the call is proclaimed to prayer on Friday (the Day of Assembly), hasten earnestly to the Remembrance of Allah, and leave off business (and traffic): That is best for you if ye but knew!"	"ذروا البيع"	Leave off business	The rule of the selling at the time of Friday prayers
SE11	28, 62, 10	(فانما قضيت الصلاة فانتشروا في الارض ولتعرفوا من فضل الله واتكروا الله كثيرا لعلكم تفلحون)	"And when the Prayer is finished, then may ye disperse through the land, and seek of the Bounty of Allah and celebrate the Praises of Allah often (and without stint): that ye may prosper."	"انتشروا"	Then may ye disperse through the land	The rule of seeking out after Friday prayers
SE12	26, 49, 6	(يا ايها الذين آمنوا ان جاءكم فاسق بنبأ فتبينوا ان تصيبوا قوما بجهالة فتصبحوا على ما فعلتم نادمين)	"O ye who believe! If a wicked person comes to you with any news, ascertain the truth, lest ye harm people unwittingly, and afterwards become full of repentance for what ye have done."	"فتبينوا"	Ascertain the truth	To establish the rule in the News
SE13	22, 33, 56	(ان الله وملائكته يصلون على النبي يا ايها الذين آمنوا صلوا عليه وسلموا تسليما)	"Allah and His angels send blessings on the Prophet: O ye that believe! Send ye blessings on him, and salute him with all respect."	"صلوا عليه"	Send ye blessings on him	The rule of the prayers for the Prophet
SE14	18, 24, 32	(واتكفروا الايامى منكم والصالحين من عبادكم وامالكم)	"Marry those among you who are single, or the virtuous ones among yourselves."	"النكوا"	Marry	The rule of marriage
SE15	18, 24, 58	(يا ايها الذين آمنوا الاستاذنكم الذين ملكت ايديكم والذين لم يبلغوا الحلم منكم ثلاث مرات ..)	"O ye who believe! Let those whom your right hands possess, and the (children) among you who have not come of age ask your permission (before they come to your presence), on three occasions."	"الاستاذنكم"	Ask your permission	The rule of taking a permission in times of privacy
SE16	2, 2, 178	(يا ايها الذين آمنوا كتب عليكم القصاص في القتلى الحر بالحر والعبد بالعبد والايتى بالايتى ..)	"O ye who believe! The law of equality is prescribed to you in cases of murder: the free for the free, the slave for the slave, the woman for the woman."	"كتب عليكم القصاص"	The law of equality is prescribed	The rule of retribution in killing people

Cont. Table 1. Selected verses from the Holy Quran and the rules related to each of them.

Sample Evidence Number	Chapter, Sura, and Verse numbers from Holy Quran	Quranic verse in Arabic text	English Translation (Yusufali 2009)	Part of the intended text (Arabic)	Translation of intended text	Rule required
SE17	2, 2, 233	والوالدات يرضعن أولادهن حولين كاملين لمن أراد أن يتم الرضاعة وعلى المولود له رزقهن وكسوتهن بالمعروف..)	"The mothers shall give suck to their children for two whole years, if the father desires to complete the term. But he shall bear the cost of their food and clothing on equitable terms."	"الوالدات يرضعن"	The mothers shall give suck to their children	The rule of breastfeeding
SE18	2, 2, 225	لا يؤاخذكم الله باللغو في أيمانكم ولكن يؤاخذكم بما كسبت قلوبكم والله غفور حلِيم)	"Allah will not call you to account for thoughtlessness in your oaths, but for the intention in your hearts, and He is Oft-forgiving, Most Forbearing."	"لا يؤاخذكم الله"	Allah will not call you to account	The rule of frivolous oaths
SE19	2, 2, 235	ولا جناح عليكم فيما عرضتم به من خطبة النساء أو أكنتم في أنفسكم علم الله أنكم ستذكرونهن ولكن لا تواعدوهن سرا إلا أن تقولوا قولا معروفا..)	"There is no blame on you if ye make an offer of betrothal or hold it in your hearts. Allah knows that ye cherish them in your hearts: But do not make a secret contract with them except in Honorable terms."	"ولا جناح عليكم"	There is no blame on you	The rule of women engagement
SE20	6, 5, 1	يا أيها الذين آمنوا أوفوا بالعقود..)	"O ye who believe! Fulfill (all) obligations."	"أوفوا"	Fulfill	The rule of fulfilling contracts
SE21	18,24,2	الزانية والزاني فاجلدوا كل واحد منهما مائة جلدة)	"The woman and the man guilty of adultery or fornication, flog each of them with a hundred stripes"	"فاجلدوا"	Flog	The rule of adultery
SE22	18,24,2	وليشهد عليهما طائفة من المؤمنين)	"And let a party of the Believers witness their punishment"	"وليشهد"	witness	The rule of witness on adultery
SE23	18,24,2	الزاني لا ينكح إلا زانية أو مشركة..)	"Let no man guilty of adultery or fornication marry and but a woman similarly guilty, or an Unbeliever"	"لا ينكح"	No man... marry	The rule of Adulterer marriage
SE24	18,24,4	والذين يردون المحصنات لم يتأوا بربيمة شهاده فاجلدوهم ثمانين جلدة..)	"And those who launch a charge against chaste women, and produce not four witnesses (to support their allegations), flog them with eighty stripes"	"فاجلدوهم"	Flog them	The rule of launch a charge against chaste women
SE25	18,24,4	.. ولا تقبلوا لهم شهادة أبدا وأولئك هم الفاسقون)	"And reject their evidence ever after"	"لا تقبلوا"	Reject	The rule of acceptance of witness on the charge against chaste women
SE26	18,24,27	يا أيها الذين آمنوا لا تدخلوا بيوتا غير بيوتكم حتى تستأذوا وتسلموا على أهلها..)	"O ye who believe! enter not houses other than your own, until ye have asked permission and saluted those in them"	"لا تدخلوا"	Don't Enter	The rule of taking permission before entering others' houses

Cont. Table 1. Selected verses from the Holy Quran and the rules related to each of them.

Sample Evidence Number	Chapter, Sura, and Verse numbers from Holy Quran	Quranic verse in Arabic text	English Translation (Yusufali 2009)	Part of the intended text (Arabic)	Translation of intended text	Rule required
SE27	18,24,29	ليس عليكم جناح أن تدخلوا بيوتا غير مسكونة فيها متاع لكم ..)	"It is no fault on your part to enter houses not used for living in, which serve some (other) use for you"	"ليس عليكم جناح"	No fault on your part	The rule of entering houses not used for living which serve some other use
SE28	18,24,30	قل للمؤمنين يغضوا من أبصارهم ويحفظوا فروجهم ذلك أزكى لهم ..)	"Say to the believing men that they should lower their gaze and guard their modesty"	"يغضوا"	Should lower their gaze	The rule of lower the gaze for men
SE29	18,24,31	ولا يبدين زينتهن إلا ما ظهر منها ..)	"That they should not display their beauty and ornaments except what (must ordinarily) appear thereof"	"لا يبدين زينتهن"	Should not display their beauty	The rule of display beauty of Women
SE30	18,24,31	وليضربن بخمرهن على جيوبهن ..)	"They should draw their veils over their bosoms"	"وليضربن"	Draw	The rule of veils for women
SE31	18,24,31	ولا يضررن بأرجلهن ليعلم ما يخفين من زينتهن)	"And that they should not strike their feet in order to draw attention to their hidden ornaments"	"ولا يضررن بأرجلهن"	Strike their feet	The rule of striking women feet in order to draw attention to their hidden ornaments
SE32	18,24,33	وليستغف الذين لا يجدون تكلماً حتى يغفهم الله من فضله ..)	"Let those who find not the wherewithal for marriage keep themselves chaste"	"وليستغف"	Keep chaste	The rule of chastity for non married
SE33	18,24,33	ولا تكسروا فتاككم على البغاء ..)	"But force not your maids to prostitution when they desire chastity"	"ولا تكسروا"	Don't force	The rule of forcing maids to prostitution
SE34	18,24,58	يا أيها الذين آمنوا استأذنوا الذين ملكت أيمانكم والذين لم يبلغوا الحلم ..)	"O ye who believe! let those whom your right hands possess, and the (children) among you who have not come of age ask your permission (before they come to your presence)"	"استأذنوا"	Ask your permission	The rule of taking permission by whom your right hands possess from children
SE35	18,24,59	وإن بلغ الأطفال منكم الحلم فليستأذوا كما استأذن الذين من قبلهم ..)	"But when the children among you come of age, let them (also) ask for permission, as do those senior to them (in age)"	"فليستأذوا"	Ask for permission	The rule of taking permission by Adults

Cont. Table 1. Selected verses from the Holy Quran and the rules related to each of them.

Sample Evidence Number	Chapter, Sura, and Verse numbers from Holy Quran	Quranic verse in Arabic text	English Translation (Yusufali 2009)	Part of the intended text (Arabic)	Translation of intended text	Rule required
SE36	18,24,60	والقواعد من النساء اللاتي لا يرجون نكاحاً فليس عليهن جناح أن يضعن ثيابهن غير متبرجات بزينة وأن يستعففن خير لهن	"Such elderly women as are past the prospect of marriage, there is no blame on them if they lay aside their (outer) garments, provided they make not a wanton display of their beauty: but it is best for them to be modest"	"فليس عليهن جناح"	No Blame on them	The rule of veils for elderly women
SE37	18,24,61	ليس على الأعمى حرج ولا على الأعرج حرج ولا على المريض حرج ولا على النفسك أن تأكلوا من بيوتكم أو بيوت آبائكم..)	"It is no fault in the blind nor in one born lame, nor in one afflicted with illness, nor in yourselves, that ye should eat in your own houses, or those of your fathers"	"ليس على الأعمى حرج"	No fault	The rule of eating
SE38	31,21,13	وإذ قال لقمان لابنه وهو يعظه يا بني لا تشرك بالله إن الشرك لظلم عظيم)	"Behold, Luqman said to his son by way of instruction: 'O my son! join not in worship (others) with Allah, for false worship is indeed the highest wrong-doing"	"لا تشرك"	Don't join others in Allah worship	The rule of Joining others with Allah in worship
SE39	31,21,15	وان جاهدك على أن تشرك بي ما ليس لك به علم فلا تطعهما وصاحبهما في الدنيا معروفا)	"But if they strive to make thee join in worship with Me things of which thou hast no knowledge, obey them not; yet bear them company in this life with justice (and consideration)"	"فلا تطعهما"	Don't obey them	The rule of obedience to parents in things that God not agree with
SE40	21,31,15	وصاحبهما في الدنيا معروفا..)	"Bear them company in this life with justice (and consideration)"	"صاحبهما"	Bear them	The rule of The good Treating the parents even if they are not Muslims
SE41	21,31,15	واتبع سبيل من أتى الي..)	"follow the way of those who turn to me (in love)"	"اتبع"	Follow	The rule of Follow Muslims path
SE42	21,33, 5	..وليس عليكم جناح فيما اخطأتم به ولكن ما تعمدت قلوبكم ..)	"But there is no blame on you if ye make a mistake therein: (what counts is) the intention of your hearts"	"ليس عليكم جناح"	No blame on you	The rule of non-deliberate false reclaiming of adopted children to other than their original fathers
SE43	4,4,5	ولا تأتوا النساء أموالكم التي جعل الله لكم قياماً وارزقوهم فيها ..)	"To those weak of understanding Make not over your property, which Allah hath made a means of support for you, but feed and clothe them therewith"	"لا تأتوا"	Don't give	The rule of put the weak understanding people over your properties

Cont. Table 1. Selected verses from the Holy Quran and the rules related to each of them.

Sample Evidence Number	Chapter, Sura, and Verse numbers from Holy Quran	Quranic verse in Arabic text	English Translation (Yusufali 2009)	Part of the intended text (Arabic)	Translation of intended text	Rule required
SE44	6, 5, 1	..أحل لكم بهيمة الأنعام إلا ما يتلى عليكم غير مطهي الصيد وأنتم حرم ..)	“Lawful unto you (for food) are all four-footed animals, with the exceptions named: But animals of the chase are forbidden while ye are in the sacred precincts or in pilgrim garb”	"أحلّت"	Permit	The rule of eating four-footed animals
SE45	6, 5, 2	..يا أيها الذين آمنوا لا تحلوا لشعائر الله ولا الثهور الحرام ولا الهدي ولا القلائد ..)	“O ye who believe! Violate not the sanctity of the symbols of Allah, nor of the sacred month, nor of the animals brought for sacrifice, nor the garlands that mark out such animals”	"لا تحلوا"	Don't permit	Not respecting the symbols of the rule of God
SE46	6, 5, 3	..حرمت عليكم الميتة والدم ولحم الخنزير ..)	“Forbidden to you (for food) are: dead meat, blood, the flesh of swine”	"حرمت"	Forbid	The rule of eating dead meat, blood, and flesh of swine
SE47	6, 5, 4	..فكلوا مما أمسكن عليكم وانكروا اسم الله عليه ..)	“eat what they catch for you, but pronounce the name of Allah over it”	"وانكروا"	Pronounce	The rule of pronounce the name of Allah When slaughtering
SE48	6, 5, 6	..يا أيها الذين آمنوا إنا قد قمنا إلى الصلاة فأفسلوا وجوهكم ..)	“O ye who believe! when ye prepare for prayer, wash your faces”	"فأفسلوا"	Wash	The rule of washing face in ablutions
SE49	6, 5, 6	..فلم تجدوا ماء فتيمموا صعيدا طيبا ..)	“and ye find no water, then take for yourselves clean sand or earth, and rub therewith your faces and hands”	"فتيمموا"	Take clean sand or earth	The rule of using sand if there is no water for ablutions
SE50	6, 5, 6	..فامسحوا برؤوسكم ..)	“Rub your heads (with water)”	"فامسحوا"	Rub	The rule of rub the head in ablutions

The first 20 verses of the same list were sent to three experts in different countries who are well known in the field of *Usoul Al-Fiqh*, namely:

- Dr. Abdussalam AlHussayen, Al-Ihsa University, Saudi Arabia
- Sheikh Talha Al-Jaghabeer, President of Ketab wa Sunnah College, Jordan.
- Dr. Mohammed Al-Humud Al-Najdi, Head of Shari'a Consultant and Academic Committee of the Islamic Heritage Cooperative, Kuwait.

The human experts' results were compared with results produced by Al-Usouly expert system with the following interesting results:

- 1 - The system was able to match the decisions of a human expert for 19 of the 20 verses. That is a 95% correct judgment rate under the constraints mentioned in the methodology section above, which is a very promising rate that encourages further system enhancements and releases researchers from applying some of the constraints in future work.
- 2 - Since verses were randomly selected, some did not have enough evidence to stand alone as an example of isolated evidence using Ibarat al Nass. They are SE07, SE17, and SE18, as shown in Table 2.
- 3 - Human experts (HE) disagreed among themselves on four of the cases (SE08, SE09, SE17, and SE19). They were using the given evidence as a standalone text in three of these cases (SE08, SE17, and SE19), even though the expert system results matched the majority decisions of the human experts.
- 4 - Columns 6, 7, and 8 in Table 2 show the final opinion of the human experts on the selected sample evidence with respect to other evidence based on their experience in the field. Differences in experts' opinion are obvious. There are six cases in which human experts rendered different final opinions. Thus, they agreed on 70% of the given sample cases, which is normal in real life cases, since scholars usually disagree because they have different interpretations of verses as well as different backgrounds and different supporting evidence.

All 50 verses were tested by a graduate student of Shari'a in the field of Fiqh, and the results are as shown in Table 3; the expert system matched 96% of the human expert judgment.

The system was also tested by 51 non-expert end-users who are not specialists in the field of Sharia, and were able to easily identify the expert system opinion on three different verses. They followed the question/answer sessions, using the "explain" feature that is implemented at every stage in the session to better explain the intended meaning of the question for non-specialized users, as shown in Figure 8.

Table 2. AI-Usouly Expert system output compared with three human experts judging evidence.

SE#	AI-Usouly Expert System Judgment	HE 1	HE 2	HE 3	HE 1	HE 2	HE 3	HE Judgment consistency compared with other evidences	AI-Usouly output matching with HE?
		Judgment on given evidence only	Judgment on given evidence only	Judgment on given evidence only	Judgment with other supporting evidences	Judgment with other supporting evidences	Judgment with other supporting evidences		
SE01	Permissibility	Permissibility	Permissibility	Permissibility	Obligation	Obligation	Obligation	No	Yes
SE02	Obligation	Obligation	Obligation	Obligation	Obligation	Obligation	Obligation	Yes	Yes
SE03	Obligation	Obligation for who can	Obligation	Obligation	Obligation for who can	Obligation	Obligation	Yes	Yes
SE04	Obligation	Permissibility	Permissibility	Permissibility	N/A	Permissibility	Permissibility	Yes	No
SE05	Obligation	Obligation	Obligation	Obligation	Obligation	Obligation	Obligation	Yes	Yes
SE06	Prohibition	Prohibition	Prohibition	Prohibition	N/A	Prohibition	Prohibition	Yes	Yes
SE07	N/A	N/A	N/A	N/A	Prohibition	Prohibition	Prohibition	No	Yes
SE08	Prohibition	Prohibition	Prohibition	N/A	N/A	Prohibition	Not recommended	No	Yes
SE09	Prohibition	N/A	Prohibition	N/A	Prohibition	Prohibition	N/A	Yes	Yes
SE10	Prohibition	Prohibition	Prohibition	Prohibition	Prohibition	Prohibition	Prohibition	Yes	Yes
SE11	Obligation	Obligation	Obligation	Obligation	Permissibility	Permissibility	Permissibility	No	Yes
SE12	Obligation	Obligation	Obligation	Obligation	Obligation	Obligation	Obligation	Yes	Yes
SE13	Obligation	Obligation	Obligation	Obligation	Obligation	N/A	Obligation	Yes	Yes
SE14	Obligation	Obligation	Obligation	Obligation	Recommendation	Obligation	Obligation	No	Yes
SE15	Obligation	Obligation	Obligation	Obligation	Obligation	Obligation	Obligation	Yes	Yes
SE16	Obligation	Obligation	Obligation	Obligation	N/A	Obligation	Obligation	No	Yes
SE17	N/A	N/A	N/A	Obligation	Obligation	N/A	Obligation	Yes	Yes
SE18	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Yes	Yes
SE19	Permissibility	N/A	Permissibility	Permissibility	N/A	Permissibility	Permissibility	Yes	Yes
SE20	Obligation	Obligation	Obligation	Obligation	Obligation	Obligation	Obligation	Yes	Yes

Table 3. AI-Usouly expert system judgment compared with the human expert 4 judgments.

SE#	AI-Usouly	HE 4 Judgment	AI-Usouly	SE#	AI-Usouly	HE 4 Judgment	AI-Usouly
	Expert System	on given	output		Expert System	on given	output
	Judgment	evidence only	matching		Judgment	evidence only	matching
			with HE?				with HE?
SE01	Permissibility	Permissibility	YES	SE26	Prohibition	Prohibition	YES
SE02	Obligation	Obligation	YES	SE27	Permissibility	Permissibility	YES
SE03	Obligation	Obligation	YES	SE28	Obligation	Obligation	YES
SE04	Obligation	Obligation	YES	SE29	Prohibition	Prohibition	YES
SE05	Obligation	Obligation	YES	SE30	Obligation	Obligation	YES
SE06	Prohibition	Prohibition	YES	SE31	Prohibition	Prohibition	YES
SE07	N/A	N/A	YES	SE32	Obligation	Obligation	YES
SE08	Prohibition	Prohibition	YES	SE33	Prohibition	Prohibition	YES
SE09	Prohibition	Prohibition	YES	SE34	Obligation	Obligation	YES
SE10	Prohibition	Prohibition	YES	SE35	Obligation	Obligation	YES
SE11	Obligation	Obligation	YES	SE36	Permissibility	Permissibility	YES
SE12	Obligation	Obligation	YES	SE37	Permissibility	Permissibility	YES
SE13	Obligation	Obligation	YES	SE38	Prohibition	Prohibition	YES
SE14	Obligation	Obligation	YES	SE39	Prohibition	Prohibition	YES
SE15	Obligation	Obligation	YES	SE40	Obligation	Obligation	YES
SE16	Obligation	Obligation	YES	SE41	Obligation	Obligation	YES
SE17	N/A	Permissibility	NO	SE42	Permissibility	Permissibility	YES
SE18	N/A	Permissibility	NO	SE43	Prohibition	Prohibition	YES
SE19	Permissibility	Permissibility	YES	SE44	Permissibility	Permissibility	YES
SE20	Obligation	Obligation	YES	SE45	Prohibition	Prohibition	YES
SE21	Prohibition	Prohibition	YES	SE46	Prohibition	Prohibition	YES
SE22	Obligation	Obligation	YES	SE47	Obligation	Obligation	YES
SE23	Prohibition	Prohibition	YES	SE48	Obligation	Obligation	YES
SE24	Obligation	Obligation	YES	SE49	Obligation	Obligation	YES
SE25	Prohibition	Prohibition	YES	SE50	Obligation	Obligation	YES

Table 4. The results of AI-Usouly expert system used by non-experts to find the judgment of three different verses.

Test #	Chapter, Sura,		English Translate	Obl.	Rec.	Perm	Not Rec.	Proh	Alert
	and Verse #	Quranic verse							
1	6,5,1	أوفو بالعقود	Fulfill contracts	100%	0%	0%	0%	0%	0%
2	2, 2, 178	كتب عليكم القصاص	The law of equality is prescribed	98%	2%	0%	0%	0%	0%
3	2, 2, 158	فلا جناح أن يطوف بهما	Should compass them round, it is no sin in them	34%	24%	34%	0%	2%	6%

All 51 users were given the same three verses that are shown in Table 3. The majority of users could have the expert system find the correct judgment for the first two verses, but for the third verse, only 34% got it right; it was a bit difficult

for users to categorize the special nominal sentence due to a weakness in Arabic grammar.

An exit survey is collected from all 51 users who were of different ages (from 19-45), different educational backgrounds, and both genders (25 males, 26 females). As shown in Table 4, 70% of all the sample users think the program was easy to use, 56% think the program’s judgment is correct since they are not specialists in the field, and only 53% trust this way of getting judgment on Quranic verses. Nevertheless, 78% of the sample agreed that the expert system saved them time and effort that would have been spent searching for the answers or contacting a scholar, and hence 83% think this program is useful. Finally, only 11% are not willing to use the program if it becomes available to the public in the future.

Table 5. The results of a survey given to 51 non-experts that used Al-Usouly expert system on three different verses.

Question #	The Question	Totally Agree	Agree	Don't Know	disagree	Totally Disagree
1	The program was easy to use	13%	57%	11%	13%	6%
2	The program’s judgment is correct	13%	43%	38%	6%	0%
3	I will trust this kind of program in the future	10%	43%	24%	22%	2%
4	The ES saved time in finding the answer	14%	64%	16%	4%	2%
5	This program is useful	36%	47%	16%	2%	0%
6	I will use this program if it is available to the public on the net in the future	13%	51%	24%	7%	4%

CONCLUSION AND FUTURE WORK

The system was able to match the decisions made by a human expert regarding 48 out of the 50 randomly chosen generic verses, which is a 96% correct judgment rate under the constraints mentioned earlier. This is a very promising initial set of results. The system needs the inclusion of more rules to cover other types of evidence.

In the era of the Prophet Mohammad (PBUH), codification of Islamic rules was unnecessary since Muslims drew the provisions of the Holy Quran and the Sunnah directly from the nation’s envoy. Islamic rules of codification in the *Al-Fiqh* field need to be examined, and then the researcher needs to work backwards and use some general rules and basics to collect, group, and classify the whole *Fiqh* science in the proper way.

Imam Shafie, the first one to write about the field of *Usoul* approximately 1,200 years ago, is honored for his achievements regarding *Usoul Alfiqh*, and many scholars followed him. This science has many details, divisions, and minor

branches. Therefore, to apply a knowledge-based system to some part of it may require years of work with human experts who are completely convinced of the importance of this idea, have the technological awareness to understand what is needed from them, and are free to continue working on the project until it is completed.

Knowledge acquisition was one of the most difficult parts of developing the system, especially when it required consulting with famous scholars who might not always have the time to respond to all questions or review the knowledge base, rules and the results.

The following are some ideas about future work for those who have the desire to further investigate this project. Because many starting points exist, expanding the scope of this project to include more verses is highly recommended. For future work, the expert system can be enhanced by applying the general and public rules (*Amm and Khass*) using the copier and abrogated rules (*Nasekh and Mansoukh*). Rules that relate to circumstances (conditions, causes, etc.: see previous section on *Types of Islamic laws*) can also be added to enhance the system. The system should include the verses that are related to rules by their meanings, not only by the text itself, and also should include the Sunnah as the second main source of Islam Sharia'. An added benefit would be if the system adopted verses that are accompanied by other meanings (i.e., adding a knowledge base for these exceptions). Finally, even though the system has many restrictions, getting a 96% correct rate is a very promising result. It will be challenging to tackle other parts of this ancient field to further resolve the other constraints in the system.

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Submitted : 14/5/2009

Revised : 25/4/2010

Accepted : 22/9/2010

الأصولي: نظام خبير في أصول الفقه الإسلامي

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خلاصة

إن استنباط الأحكام الشرعية من أدلتها التفصيلية تحتاج إلى اختصاصي في مجال أصول الفقه، لأن عملية استنباط الأحكام الشرعية من النصوص عملية معقدة جدا وتحتاج عادة إلى مفتي تتوفر فيه صفات منها معرفة قوانين أصول الفقه وملماً بأحكام الشريعة عالماً بالقرآن وتفسيره وحافظاً لأحاديث الرسول صلى الله عليه وسلم وعالماً بمسائل الإجماع، عالماً باللغة العربية، إن اللغة العربية غنية بالمفردات مما قد تعطي أكثر من معنى لنفس الكلمة مما يزيد من المسألة تعقيداً عند استنباط الأحكام الشرعية، في هذا البحث يتم أتمة هذه العملية بتصميم وتطبيق نظام خبير أطلق عليه اسم "الأصولي" يستنبط الأحكام الشرعية من الأدلة القرآنية فقط في ظل قيود محدودة بالحكم على النص لذاته بالنظر إلى عبارة النص من خلال جلسات سؤال وجواب بين النظام الخبير والمستخدم. قد أظهرت النتائج الأولية عند تجربة النظام على 50 نص قرآني من نصوص الأحكام تم اختيارهم عشوائياً على نتائج مشجعة وصلت إلى 96٪ عند مقارنتها مع أحكام الخبير البشري على نفس النصوص.