

Computing Generic Causes of Revelation of the Quranic Verses Using Machine Learning Techniques

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Abstract

Because many verses of the holy Quran are similar, there is high probability that, similar verses addressing same issues share same generic causes of revelation.

In this study, machine learning techniques have been employed in order to automatically derive causes of revelation of Quranic verses.

The derivation of the causes of revelation is viewed as a classification problem. Initially the categories are based on the verses with known causes of revelation, and the testing set consists of the remaining verses. Based on a computed threshold value, a naïve Bayesian classifier is used to categorize some verses.

After that, using a decision tree classifier the remaining uncategorized verses are separated into verses that contain indicators (resultative connectors, causative expressions...), and those that do not.

As for those verses having indicators, each one is segmented into its constituent clauses by identification of the linking indicators. Then a dominant clause is extracted and considered either as the cause of revelation, or post-processed by adding or subtracting some terms to form a causal clause that constitutes the cause of revelation.

Concerning remaining unclassified verses without indicators, a naïve Bayesian classifier is again used to assign each one of them to one of the existing classes based on features and topics similarity. As for verses that could not be classified so far, manual classification was made by considering each verse as a category on its own.

Additionally benefits of estimating causes of revelation of Quranic verses are also discussed.

The result obtained in this study is encouraging, and shows that automatic derivation of Quranic verses' generic causes of revelation is achievable, and reasonably reliable for understanding and implementing the teachings of the Quran.

Keywords: Text mining, Statistical classifiers, Text segmentation, Causes of revelation, Quran

1. Introduction

The holy Quran consists of 6236 verses divided into 114 unequal chapters. According to Muslims some verses were revealed as direct responses to some events, incidents, or questions that took place, while others were revealed for appeasing, strengthening, and governing Muslims in their belief. So far, determination of the causes of revelation of Quranic verses has been carried out manually. Some Islamic scholars such as [2] have collected some hadiths and other Islamic materials that mention causes of revelation of some verses. However no one has found so far written documents left by the Prophet or his companions containing causes of revelation of every verse.

Based on careful observation and analysis of the Quranic verses, it has been found that many verses do actually suggest their causes of revelation.

Knowledge of the verses' causes of revelation would be helpful for understanding the Quran, as well as for properly applying its teachings in our daily life.

Moreover causes of revelation could contribute in the determination of places and dates of revelation of the verses. In fact Islamic history has shown that events, circumstances, and problems encountered by the Prophet and Muslims were time and space dependent. For instance in Mecca most of the verses were related to the oneness of God, the Day of Judgment, and issues related mainly to belief. While in Medina the verses narrate about a formation of a Muslim community that needs laws regarding social life, worshipping rituals and so on.

Additionally knowing that some Islamic scholars support the idea of verses' abrogation in the Quran, determination of causes of revelation could assist identification of abrogated and abrogating verses.

In this study, computational methods are used to automatically suggest possible generic causes of revelation of each verse, through analysis of verses' topical and semantic similarities, and segmentation techniques.

The derivation of the causes of revelation is viewed as a classification problem. Initially the categories are based on the verses with known causes of revelation as reported by [2], and the testing set consists of the remaining verses. Based on a threshold value, a naïve Bayesian classifier is used to categorize some verses of the testing set.

After that, using a decision tree classifier the remaining uncategorized verses are separated into verses that contain indicators (resultative connectors, causative expressions...), and those that do not. As for those verses having indicators, each one is segmented into its constituent clauses by identification of linking indicators and cues. Then a dominant clause is extracted and considered either as the cause of revelation, or adjusted accordingly to generate the cause of revelation.

Concerning remaining unclassified verses without indicators, a naïve Bayesian classifier is reapplied to assign each one of them to one of the classified verses based on the similarity of their topics and keywords. Finally verses that could not be classified so far, manual classification was made by considering each verse as a category on its own.

Finding causes of revelation of Quranic verses could also be understood as explaining Quran with Quran. In fact some verses explain others, which suggest that the explaining verses were caused to be revealed by the explained ones.

It is important to mention that, the verification of the historical correctness of the causes of revelation reported by [2] is out of the scope of this study.

2. Related Work

Apart from very few traditional Islamic books compiled manually such as [2], to the best of my knowledge, I have not so far encountered any report on automatic derivation of causes of revelation of Quranic verses using machine learning techniques. The author of [2] has collected some hadiths (sayings and practices) of Prophet Mohammad pertaining to causes and circumstances of the revelations of some 585 verses.

However there are numerous research papers on methods for extracting causal relation in sentences [1, 8], which might be useful for this study. Sentences segmentation techniques could be applied to Quranic verses, in order to partition the verses into clauses, which would be used for figuring out possible causes of revelation of the verses.

The difference between derivation of causes of revelation of the Quranic verses and the extraction of causal relation in text is that, causal relation extraction is limited to discovering relationships between clauses in sentences. Those relationships could be in form of cause and effect, and so on. The derivation of causes of revelation of the Quranic verses goes one step ahead by trying to figure out the reasons why the verses exist.

3. Background

3.1 Definition and Types of Causes of Revelation

The cause of revelation of a verse is materialized through the events, incidents, and circumstances (possibly directly or indirectly identifiable from the verse) that took place before the revelation of the verse. In other words the revealed verse is a direct response or consequence to those occurrences.

Basically there are three types of causes of revelation:

1. Revelations to answer queries, events, or any other action requiring a clarification, decision...etc.
2. Revelations to explain verses already revealed
3. Revelations for general information about life on earth and hereafter, that are necessary for appeasing believers' hearts...etc. This type of revelation is usually connected to our most hidden thoughts, meditations and so on.

3.2 Justification of the Existence of Causes of Revelation

At the time of Islam's birth, people believing in Abrahamic religions e.g. Judaism and Christianity were living in Mecca and Medina, where Islam started and developed.

The Quran itself says in verse (27:76), that it narrates sufficiently about the Old and New Testaments, which is visible through the similarities between the Quran and the Bible.

This fact suggests that some verses' causes of revelation might be found in the verses of the Bible.

Moreover the fact that Ismail the son of Abraham grew up and married among the Arabs, shows that some of the Abrahamic practices must have been in one way or the other kept by all the Arab tribes. For instance the word "ALLAH" is used for the name of God, circumambulating the mosque of Kaaba, or sacrificing animals for rituals to mention but a few. Therefore it is acceptable to argue that Jews, Christians, and Arabs pagans

were having in common some aspects of the religion of Abraham. In other words all the inhabitants of Arabic peninsula were aware of some aspects of the practices of monotheistic religions.

Based on this fact, I think that every verse of the Quran might have had a cause of revelation to answer or explain queries and wonderings of all the inhabitants of the peninsula, and beyond. In verse (25:33) Allah says that there is no similitude or example put forward by disbelievers that He does not bring a clear and better explanation about the subject matter.

According to these verses (42:13, 3:67-68), Islam has brought back and perfected the religion of Noah, Abraham, Moses, Jesus, and all the other prophets of ALLAH.

3.3 Relationship between Cause of Revelation, Topic, and Purpose of a Verse

The cause of revelation of a verse is the reason for which the verse was revealed, meaning the reason for the existence of the verse.

The topic of a verse is the subject of the verse. It is the main idea contained in the verse. Topic of every verse might be computed from the verse itself using lexical frequencies and semantics.

But causes of revelation of every verse cannot be inferred from the semantics and syntaxes of the verses. However the topic of a verse could lead to the determination of its cause of revelation.

The purpose of a verse is the combination or fusion of the cause of revelation and the topic discussed by the verse. In other words the purpose of a verse is to bring a complete solution to a situation that needs to be dealt with.

In order to explicitly show the relationship between these three concepts, I am going to use the verse 2:44:

"Enjoin ye righteousness upon mankind while ye yourselves forget (to practise it?)".

The generic cause of revelation of this verse could be expressed as follows:

Some people advise or recommend others to perform some actions e.g righteous act, while they themselves do not.

The topic of the verse could be termed as: hypocrisy meaning disbelief, lying, and mockery.

The purpose of the verse is: to recommend people do what they say, and avoid hypocrisy, mockery, and lying because these mischief are the causes of their bad behavior.

4. Data

The Quranic text used in this study was obtained from [5], and the transliteration version was downloaded from [6]. The causes of revelation of the Quranic verses were retrieved from [2], and the verses relatedness from [4].

These data were practically obtained using screen scrapping technique as explained in [3]. The transliteration version was pre-processed through character adaptation and stemming process as described in [7].

5. Problem Statement

The problem can be summarized as follows: Can machine learning techniques be applied to the Quranic text, in order to automatically derive generic causes of revelations of its verses?

6. Approach

The basic idea is to use verses with known causes of revelation, and verses containing indicators (resultative connectors, causative expressions) as categories to which sufficiently similar remaining verses could be assigned to.

Because many verses of the Quran are similar, there is high probability that similar verses might share same causes of revelation. Many verses are some sort of paraphrases and clarifications to others. For instance, verses that contain other verses could be considered as explanation and complement of the contained verses.

Based on this similarity fact, it is possible to use machine learning techniques in order to automatically derive generic causes of revelation of the verses.

In this research, it is hypothesized that two verses might have same generic causes of revelation if they address the same issue, and have some similar features.

This hypothesis is easily verifiable using some examples of Quranic verses. For instance, verses pertaining to the prohibition of alcohol (2:219, 4:43, and 5:90) do all share the same topic which is "alcohol prohibition". But they do not have same causes of revelation. Examining the keywords of the three verses, one can realize that they share very few or zero similar keywords, hence the condition of imposing acceptable similarity of features.

It is obvious that for long verses encompassing several topics (when considering details of the verses), several causes of revelation might be assigned to them e.g. verse 4:43.

Before starting the classification process, the causes of revelation reported by [2] have to be converted to generic causes of revelation by summarizing and replacing named entities with third person pronoun and so on. And the training and testing set for each step have to be determined.

6.1 Determination of Training and Testing Sets

6.1.1 Verses with known causes of revelation from the hadiths of the Prophet

There are about 585 verses having causes of revelation reported by [2]. So out of 6236 of the Quranic verses, 5651 verses need to be analyzed and interpreted for generating their causes of revelation.

Moreover 98 verses are repeated 181 times, it is assumed that the generic causes of revelation of these verses are same independently of their location in the Quran.

It is important to mention that, the verification of the historical correctness of the causes of revelation reported by [2] is out of

the scope of this study. It is planned to devote a whole paper on this issue in the near future.

6.1.2 Verses whose causes of revelation are derived from the verses' semantics and syntaxes

The approach is to segment each verse into clauses based on some indicators (resultative connectors, causative expressions), and then select one of the clauses as the cause of revelation. The selected clause is considered as the principal clause of the verse, which might be emended to generate an exact causative clause if required.

Sometimes it might happen that the clause is exactly the cause of revelation, and sometimes it might simply suggest what could have been the causes of revelation.

Causal knowledge acquisition from the Quranic text could be done by enumerating verbs (causal verbs) pertaining to questions such as: ask, think, pretend, interrogate, investigate, query, request, catechize... etc.

Table 1 is an attempt to list some indicators that suggest causes of revelation of the verses that contain them.

It is expected to discover that, verses containing named entities could have probably been revealed because of enquiries or information about those entities.

The aim of suggesting causes of revelation of the verses from their semantics is to support active and reflective learning, which I think could effectively assist understanding the meaning and application of the Quranic verses.

6.1.3 Verses whose causes of revelation are computed through measurement of proximity with verses of group (6.1.1) & (6.1.2)

The approach is to use information extraction technique (screen scrapping) to find related verses according to Tafsir of Ibn Kathir as presented by [4]. After that filter out related verses that do not share some keywords with corresponding verse having known causes of revelation.

7. Classifiers

There are several types of classifiers with each one having its own method of categorizing documents or objects. Among them we find statistical, functional, neural, decision trees, and fuzzy classifiers. The most widely used classifiers are the statistical ones such as the Bayesian and distance-based classifiers. However some functional classifiers such as K-Nearest Neighbor (KNN) and Support Vector Machines (SVM) are also intensively researched.

For this study, a naïve Bayesian and decision tree classifiers as explained in [7] have been selected because of their simplicity and effectiveness.

8. Classification Methodology

Combination of decision tree and naïve Bayesian classifiers was used to compute similarity between verses, and assign same causes of revelation to verses that share an acceptable degree of features similarity. A threshold fixing the minimum degree of similarity between verses was made adjustable, in order to compensate for verses length.

8.1 Classification Algorithm

Step1: Read all the 6236 Quranic verses into a vector (say verses_All)
Step2: Get verses with known causes of revelation reported by [2], and store them in a vector (say verses_A)
Step3: For each verse in verse_A Do
 Begin
 Step3.1: Find related verses using tafsir Ibn Kathir as presented in [4], and store them in a vector (say verses_AA)
 Step3.2: From verses_AA select verses that share some keywords similarity, and store them in vector (say verses_B)
 Step3.3: Assign same causes of revelation to every verse of verses_B
 End
Step4: Subtract verses of verses_A and verses_B from verses_All, and store the result in a vector (say verses_C)
Step5: Classify verses in verses_C into:
 i. Verses that contain indicators (resultative connectors or causative expressions), and save them in a vector (say presentCausesofRevelation)
 ii. Verses without indicators (resultative connectors or causative expressions), and save them in a vector (say notpresentCausesofRevelation)
Step6: For each verse in presentCausesofRevelation Do
 Begin
 Step6.1: Locate indicator
 Step6.2: Depending on the type of indicator, consider one of the following options:
 i. The causes of revelation are the clause that starts after the indicator
 a. If named entity is present in the clause, then causes of revelation are probably the named

- entity.
- b. If not present, then causes are the whole clause
- ii. The causes of revelation are the clause that starts after the indicator with addition or deletion of some terms.

End

Step7: For each verse in notpresentCausesofRevelation Do
 Begin
 Step7.1: Find related verses using [4]
 Step7.2: Select verses having causes of revelation containing indicators
 Step7.3: For each selected verse Do
 Begin
 Step7.3.1 Compute similarity with verse Step7
 And store in a vector (say verses_D)
 End
 Step7.4 Select verse with highest similarity, and assign Same causes of revelation to verse Step7
 End
Step8: If there are still verses without causes of revelation
 Step8.1: For each verse Do
 Begin
 Step8.1.1: Set a threshold value for similarity measure
 Step8.1.2: Compare the verse with every verse having causes of revelation
 i. If the similarity measure is above the threshold, then assign same causes of revelation to the verse
 ii. Else store the verse in a vector (say verses_E)
 End
Step9: For each verse in verses_E Do
 Begin
 Manually assign causes of revelation
 End

Remark:

The option of considering similarity and relatedness of chapters, and indirect relatedness of verses is currently being exploited, in order to eliminate or reduce manual assignment of causes of revelation.

It might also be important to mention that, the verses relatedness as presented by [4] does not however specify the topic that related verses cover. However it guarantees that related verses do have some thematic connections, which is sufficient for the present study.

For this reason, a study on automatic computation of the topic of Quranic verses is currently undertaken. Already [9] has carried out some studies on this issue, but for two chapters only.

9. Selection of Indicators

The features considered in this study are described in table 1. They were manually created.

Indicator	Explanation	Example
سَأَلُواكَ	Indicates that causes of revelation are words after the indicator	They ask you (ex: 8:1)
أَعُوذُ بِ	Causes of revelations are threats, attacks against Muslims	I seek refuge with the Lord (ex: 114:1)
وَيَقُولُونَ مَتَىٰ	Suggests that causes of revelation are words after the indicator	They ask: When will (ex: 67:25)
قُلْ هُوَ	Indicates that causes of revelation are denial, opposition to the verse's teaching	Say: He is (ex: 112:1)
يَا قُلِ	Indicates that causes of revelation are sayings, deeds of the words after the indicator	Say: O ye (ex: 109:1)
أَرَأَيْتَ	Shows that causes of revelation are words after the indicator, and what people do/say	Seest thou (ex: 107:1)
أَلَمْ تَرَ	Indicates that causes of revelation are words after the indicator, and mischief that disbelievers intend to do	Seest thou not (ex: 105:1)
اذْكُرْ	Shows that causes of revelation are (inquiries or ingratitude) words after the indicator	Remember ... (ex:35:3)
حَسِبْ	Shows that causes of revelation words after the indicator, or even following verses	Thinking that (ex: 104:3)
مِنْ قَبْلِ	Shows that causes of revelation are to be determined from the words afterwards	Before there (ex: 71:1)
لِمَ	Shows that causes of revelation are words after the indicator, and what people do/say	Why do you forbid that which... (ex: 66:1)
ضَرَبَ اللَّهُ مَثَلًا	Shows that causes of revelation are (inquiries or ingratitude) words after the indicator	Allah sets forth, for an example (ex: 16:75)
فَلَمَّا	Shows that causes of revelation are words after the indicator	But when... (ex: 17:67)
إِذَا	Shows that causes of revelation are inquiries about words after the indicator	When ... (ex:2:282)
وَلَقَدْ	Shows that causes of revelation are to be determined from the words after the indicator (i.e request/demand about the aim of the following clause)	And there already.... (ex: 2:99)
إِنَّمَا	Shows that causes of revelation are denial or confirmation of words after the indicator	It is only...(or to the contrary...) (ex 4:10)
وَإِن	Shows that causes of revelation are words after the indicator	And if ... (ex: 2:23)
كُلَّمَا	Shows that causes of revelation are to be determined from the words after the indicator	Every time... (ex: 4:56)
وَلَئِن	Shows that causes of revelation are the words after the indicator	And if ... (2:145)
بِأَنَّ ذَٰلِكَ	Shows that causes of revelation are to be determined from the words afterwards	That is because... (ex: 5:58)
لَيْسَ	Shows that causes of revelation are words after the indicator	It is not...but... (ex: 2:177)
وَلَكِنَّ	Shows that causes of revelation are to be determined from the words after the indicator	But (nay)... (ex: 2:13)
وَمَا لَكُمْ أَلَّا	Shows that causes of revelation are to be determined from the words afterwards	Why should ye not (ex: 6:19)
إِنَّ رَبَّكُمْ	Shows that causes of revelation are denial of Allah's attributes e.g Oneness, Almightyness, Generosity...	Indeed Your Lord... (ex: 7:54)
أَكَانَ	Shows that causes of revelation are denial of words after the indicator mostly starting from اَنْ	Is it a matter of wonderment ... (ex: 10:2)
وَإِذْ قَالَ	Shows that causes of revelation are to be determined from the words afterwards	And remember when... (ex: 2:30) [20 times]
أَلَمْ يَرَوْا	Shows that causes of revelation are words after the indicator	Don't they see... (ex: 17:99)
فَأَمَّا	Shows that causes of revelation are words afterwards	As for ... (ex:2:26)
لَنْ	Shows that causes of revelation are inquiries about or attempt to implement words afterwards	Never ... (ex: 2:55)
الْأَلِ	Shows that causes of revelation are words after the indicator	Of surety... (ex: 2:12)

Table1. Quranic terms indicating causes of revelation

10. Implementation of the Classification Algorithm

It was implemented using PHP, Javascript, HTML, and CSS.

11. Results and Discussion

Based on Ibn Kathir as presented by [4], it is found that some 768 verses are directly related to 234 verses out of the 530 verses having known causes of revelation. Therefore 296 verses (e.g. 2:21, 2:80...285...etc) reported by [2] do not have directly related verses according to [4].

This might be further investigated in order to find out whether manual or chapter based relatedness could solve the problem.

Verses of a chapter that have single cause of revelation have been excluded for this computation, because causes of revelation of a whole chapter cannot be assigned to a single verse in another chapter. In fact some individual verses of chapters having a single cause of revelation might have some related verses in other chapters.

Out of the 768 verses, about half of them have been assigned same causes of revelation of their respective related verses. As mentioned previously the assignment of causes of revelation requires similarity of topics as well as some common keywords.

In fact causes of revelation are not necessarily linked to topic or message conveyed by a verse.

In [4] indirectly related verses are also mentioned, which have not been included in this study. However it is planned to further investigate those verses that might have some keywords similarity, and possibly include them in the assignment process.

The classification process based on identification of indicators was able to categorize about 1200 verses.

Table 1 could be extended by including more indicators. In other words using the root or stem of these indicators whenever possible would increase the number of verses, whose causes of revelation could be determined from their semantics and syntaxes.

Precedence among indicators needs to be made, because some verses contain several indicators at a time for instance (9:65).

So determining with certainty which indicator to consider for suggesting the causes of revelation requires a little bit more analysis, which is currently being tackled.

About 3000 verses have been categorized based on the similarity of their most frequent keywords with verses having so far known causes of revelation, and on the basis of their relatedness as presented by [4].

And about 800 verses have seen (still under consideration) their causes of revelation attributed manually.

It is important to note that the computed causes of revelation might be complemented with the knowledge of some hadiths that discuss indirectly about same topics. It is

hoped that, the knowledge of those hadiths (Sahih Bukhari, Muslim, Muwatta of Malik...) would assist the process of acquiring a deeper view of the subject discussed by the verse under consideration.

12. Evaluation

The evaluation of the method developed in this study was mainly done manually through expert reading and verification. This step is still going on, and might require the participation of several Quranic scholars once the computed data are made available online.

However, the technique presented in this paper is affordably understandable, and could be practically investigated using the classification algorithm, the Quranic text, and the verses relatedness as presented in [4].

The classifier has been found effective and yielded useable results, since it has categorized over 3000 verses out of 4000 that did neither have known causes of revelation nor indicators.

13. Benefits of Knowing Causes of Revelation of the Holy Quranic Verses

The advantages of knowing the causes of revelation of the Quranic verses are as follows:

- I. The knowledge of the Quranic verses' causes of revelation would improve understanding, and facilitate effective implementation of the teachings contained in the verses in our daily life. In fact having this knowledge could support active learning of the Holy Quran.
- II. Moreover this knowledge could contribute in the determination of dates of revelation of the chapters and verses. For instance types of questions that were posed to the Prophet at Mecca (period 610-622 AD) were different to those in Medina (period 622-632 AD). This could help solve the problem of verses abrogation, since some Muslims support this idea.
- III. Finally this could be used in comparative religious studies. In fact Prophet Mohammad said he was not innovating an unknown religion to the people of Middle East, to the contrary he was sent to complete and perfect the religion followed by Abraham, Moses, and Jesus. Moreover the Quran itself says in verse 27:76, that it narrates sufficiently about the Old and New Testaments.

So the question is, could we link every verse of the Quran to some verses of the Old and New Testaments?

Following points could be investigated:

- How many of the Quranic verses are considerably similar to the verses of the Bible?
- How many of the Quranic verses are alterations (could be improvements or not) of the Biblical verses?

- How many of the Quranic verses are contradicting Biblical verses?

The above mentioned points cannot be perfectly answered without knowing the causes of revelation of the Quranic verses. In fact causes of revelation throw light on the context of verses revelation.

14. Conclusion and Scope of the Future

Using the verses having known causes of revelation as reported in [2], and the verses relatedness from Ibn Kathir as presented in [4], along with statistical classifiers, this study shows that, the method proposed and implemented works, and could be considered as a reliable technique of automatically deriving generic causes of revelation of the Quranic verses.

Benefits of estimating causes of revelation of the Quranic verses have also been mentioned.

A list of some indicators consisting of resultative connectors and causative expressions has been constructed, which needs to be further extended and thoroughly analyzed. The list is an attempt to collect terms and expressions in the Quranic text that might in advance assist reflective learning.

Some indicators do not straight forward suggest causes of revelation, hence developing an automatic method of extracting and emending the most significant clause of a verse (particularly a long one) would be part of the future work.

Manual verification of the result obtained in this research is one of the main tasks being currently under consideration.

Moreover application of other machine learning algorithms such as Support Vector Machine could further contribute in the validation and verification of the result achieved in this study.

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