

Interpreting Contents in Social Network using Some Generic Rules with Abstract Propositions

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ABSTRACT

Content interpretation is a cognitive ability which is mostly concerned with understanding the intention of the person who has created or narrated the content. Narrator is also important since his/ her specific intention, which is inevitable in media like a social network, may change the reality of a created content. Here, the focal point is a sort of transformation with the aim of yielding the class of a message behind the content. In this paper, we propose a rule-based framework for interpreting contents in a social network that has the ability to perform such a transformation through using some generic rules with propositions at high abstraction level. The reason for selecting abstract propositions is their ability in covering wide range of facts occurring in the real world situation. Our suggested framework is in reality able to determine the class of a message indicating the possible intention of either a content's creator or its narrator, such as whether a narrator is seeking honesty/justice toward the others, is after respect for the people, cares for compassion/ mercy, emphasizes a significance of knowing/ thinking in life, or is after self-upgradation to conduct a healthy life. These classes of message are determined according to both philosophical and psychological aspects which do exist behind the cognitive, emotional and ethical faculties in human being. Results of some experiments show that the generic rules proposed in this paper, which are structured on the ground of abstract propositions, have enough ability to respond successfully to the issue of interpretation in a social network with the characteristics already mentioned. Also, these results approve the fact that such an abstraction is able enough to handle the possible facts hidden in the contents showing up in social network.

Keywords— Social Network, Content, Interpretation, Generic Rule, Abstract Proposition.


1. Introduction

Interpreting a content is in general a crucial cognitive ability which manifests well in a wide range of issues such as understanding the intention as well as the sentiment of the person who has created or narrated it. Here, the focal point is a sort of transformation with regard to a number of semantic entities with the aim of yielding the class of the message in a content. As possible classes of content, one may mention whether a narrator is seeking honesty/justice toward the others, is after respect for the people, cares for compassion/mercy, emphasizes a significance of knowing/ thinking in life, or is after self-upgradation to conduct a healthy life. These are examples for some classes which make sense in a social network in many cases.

Obviously, based upon the complexity of a content and the subject overriding this content, results of interpretation may become more complicated. Such a transformation is supported by a variety of operators each being responsible for transforming a number of semantic entities as the input into a class of message as the result. What we are concerned about at the first place is to set a framework for justifying the process of semantic transformation with no particular emphasis on the uniqueness of its result. This means that

based upon the context within which a content has been narrated and also the major propositions embedded in it as well as the prosodic of the narrator one's perception toward the class of a message in a content may change. Here, our major presupposition is that, when certain semantic entities are exposed to a user, he/she may end up with a new semantic structure holding a new message. The important thing at the first place is to show that such a transformation can occur under activation of certain operators. In our approach these operators are believed to be some generic rules including propositions at high abstraction level. In this manner, the main goal behind interpreting contents would be capturing the class (or classes) of the messages in the contents shared by human users.

This paper is structured as follows: We firstly provide a literature review in "Related work" section. In "Proposed approach" section basic idea, constitution of the rules and some examples are discussed. Fourth section is devoted to presenting the "Validating the approach & assessing the experimental results". Finally, "Concluding remarks" section includes the conclusion and future works.

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2. Related Work

Interpretation is a cognitive faculty which is responsible for transforming an initial content into a new content that contains classes of message with regard to this initial content in some way [1-4]. A content can in general be a data, a text [5-7], a speech, an image [8], or a combination of these items. All types of background information associated with these items can affect the process of interpretation in some way. Having a glance at the nature of interpretation one may see that it is an extended type of the conventional classification / recognition according to which a pattern is to be mapped onto a combination of classes instead of only a unique class. From the reasoning viewpoint, interpretation can be regarded as a process of abduction according to which certain classes are to be speculated that can justify the present situation [9].

As far as interpreting something is concerned, all if-then type rules, cases, schemas, frames, scripts and purpose-specific ontology type structures can be used as means for representing the required knowledge.

- Rules are mostly responsible for attaining the final classes of message [4, 10] based on some semantic entities as input.
- Cases have the ability to consider the previous experiences in deriving the final class based on the logic of analogical reasoning [11, 12].
- Schemas, according to their innate nature, have the ability to observe whether the related class of message can be consistent for a source content or not [13, 14].
- Frames and scripts, which are structured in nature, have the ability to conduct the entire process of interpretation in a structured / hierarchical manner such that the entities in the source content could be checked step by step [15-18].
- Ontology type structures are able to make step by step transition on the entities in a source content up to the stage that some entities existing in them can meet the existing constraints of the desired interpretation problem. This is called ontology-driven reasoning which has a wide range of applications in different types of recognition as well as interpretation type problems [19-22].

It should be noted that, besides all the methods discussed above, neural networks are also able to perform tasks like classification and interpretation based on their activation functions as well as the learning formats devised for them [23]. With regard to this perspective, deep neural nets have been shown to be capable of performing classification as well as interpretation in a cost-effective and time-efficient manner [24].

What we emphasize in this paper is applying rules to interpreting a content in social networks. Within this scope we believe that there are some salient features in contents that can lead us to particular classes of message in them.

3. The Proposed Approach

It should be noticed that many contents may in general be ambiguous in their nature to the extent that a unique combination of classes can be hardly conceivable for them.

Such an ambiguity and / or inadequacy is mostly due to the complex nature of the propositions and semantic entities in a content, as well as the variation of the words' usage in it. Taking this point into account, we should count on a framework for interpretation which offers the opportunity to bring about a set of different class combinations based on the existing possibilities for the roles of words as well as the types of background knowledge and the expected perspectives that fit the related interpretation problem. In our approach, we make use of if-then type rules with abstract propositions to achieve the above- mentioned goal. The reason for selecting abstract propositions is their ability in covering wide range of facts occurring in the real world situation. Having taken this point into account, we would be able to describe the desired rules with limited number of propositions in the condition part, which in reality would facilitate the process of matching the rules against the ongoing contents.

From research methodology viewpoint the proposed process of content interpretation can be regarded as a kind of pattern recognition process according to which a pre-processing in terms of feature extraction and next to that a post- processing in terms of classification are to be taken into account. In our approach features are those belonging to the context within which a content is narrated, specific propositions included in a content and finally the prosodic behind narrating that content. Taking this point into account, the proposed content interpretation process can be described in terms of the following phases: 1) identifying the prosodic of the content's narrator as well as the ongoing context regarding the source of propagating the content, and also time, space and situation within which the content has been raised, 2) extracting specific propositions giving identity to the content, 3) identifying those rules which can be matched against the propositions obtained from the previous phases to classify the content's message, 4) announcing appropriate classes for the content's message, and 5) announcing the results obtained in the previous phase from the viewpoint of the required considerations.

3.1. Basic Idea

Going back to what mentioned above, it would be necessary to make use of some rules within which the condition part comprises a set of semantic propositions with high abstraction level. It is obvious that the action part of this rule would stand for a class of message which indicates the status of a content against these propositions. Now the question is how these semantic propositions come into existence; what are the main factors in forming the connotative message of a content. These factors can be summarized as follows:

- 1) The context within which a content is propagated, mainly addressing the fact that the corresponding content has been propagated in what "time", in what "place", in what "situation" or by what "source".
- 2) Prosodic of the contents' narrator, mainly standing for the intention of the narrator behind forming a text, an image, a video, or a combination of these items.

Such an intention covers a range of modalities like: acknowledgement / persuasion / encouragement / propaganda / etc. or on the contrary: protest /

complaint / critic / sarcasm / insult / etc. Here, we should pay attention to the fact that there are generally two types of narrations at two different levels. The first type of narration is the one for which the prosodic gains a significance and the second type is the narration embedded in the text of a content through the channel of a real person or an institution. What we are mostly concerned about is the first type of narration.

- 3) Specific propositions which clarify the text of a content from the viewpoint of the message to be conveyed to the users.

3.2. Constitution of the Rules

If-then type rules comprise two parts; condition and action. We already discussed in 3.1 that the condition part of our desired rules consists of “context”, “prosodic of contents’ narrator” and “specific propositions”. With regard to the action part, we are concerned with the class of message consistent for a content. But let us see what particular concepts have the ability to conduct us to the role of a content, so that based on that, we may become capable of deriving a certain conclusion from both social and cultural perspectives. To approach such concepts in a systematic way, let’s first refer to the well-known trilogy of mind: Cognition, Affection and Conation [25]. Based on this trilogy, a number of corresponding tripartite classifications [26, 27], such as the ones represented in Figure 1 can be concluded. Here, it is seen that, at a concrete level, concepts such as “wisdom”, “kindness” and “faith” can be propounded as suitable alternatives for the main roots in the ontology of “Thematic Classes” required for describing the action part of the interpretation rules. It is worth knowing that these concepts, are frequently observed in philosophical and literary works of the ancient thinkers (from Plato and Aristotle to Alfarabius and Avicenna) as well.

Based on this idea, and through investigating a variety of subjects in the domain of social and cultural ethics, we came to the conclusion that five classes of: “compassion / mercy (or the opposite)”, “shame / respect (or the opposite)”, “honesty / justice (or the opposite)”, “knowing / thinking (or the opposite)” and finally “self-up gradation (or the opposite)”, can be highly significant (Figure 2). It is interesting to notice that when human being (such a participant in social network) is compiling a content with the purpose of conveying a message to the others at some levels, he/she is in reality and from a psychological viewpoint, following such classes. As explained by [28] and mentioned in Figure 3, “Consciousness / Conscience” arises as an emergent property from organized “Sapience - Sentience” interaction; Sentience enables emotional information and experience that is applied to the phenomenal consciousness, just as Sapience enables awareness through cognitive information and experience that it delivers to consciousness. It can be argued the cognitive and affective intelligence strength are reflected in amount of “Wisdom” and “Kindness”, and the values result from their complex interaction, constitute beliefs and wills appearing in “Faith”.

Some of the rules developed in our approach for interpreting the contents are shown in Table 1.

3.3. Some Examples

To have a better insight over the way the suggested approach to interpreting contents works, the following content narrated by a citizen is taken into consideration:

Content: I wonder how it may happen that a person with a high social position/ reputation and also a good educational background, grants this right to him/herself to throw rubbish out of his/her car and sprinkle the water gathered by the street. Do you think it is fair to ignore so easily one’s responsibility toward the other citizens?...

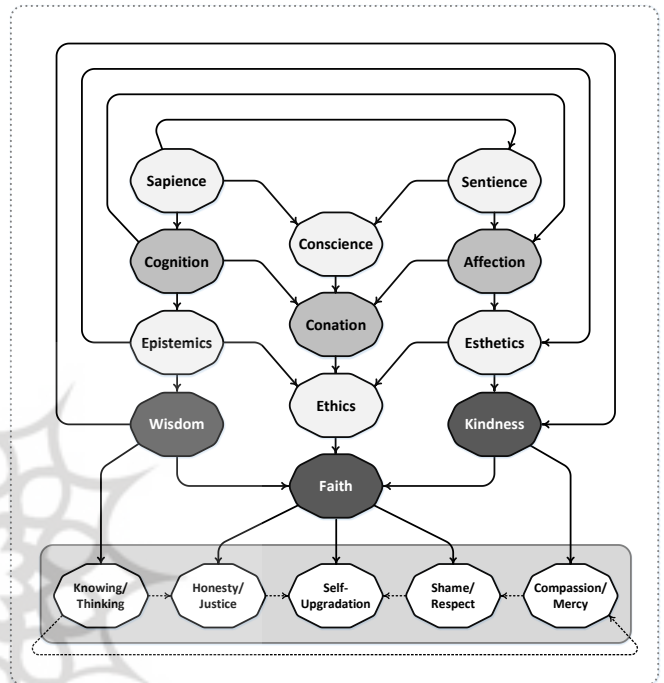


Figure. 1. The main roots in the ontology of “Thematic Classes” required for describing the action part of the interpretation rules

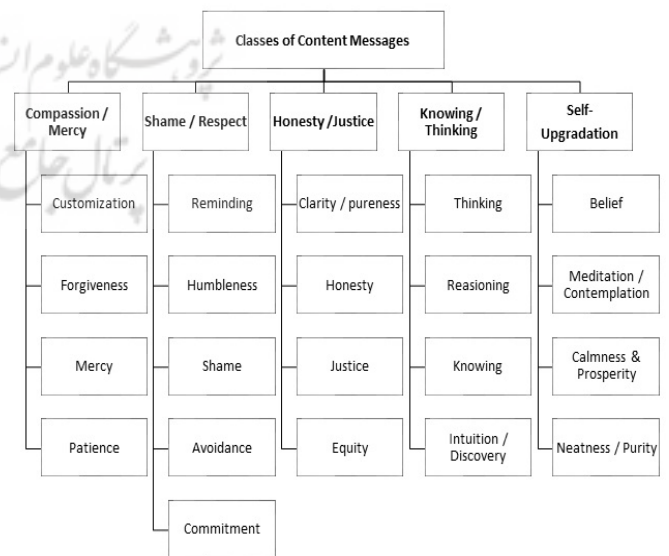


Figure. 2. The hierarchy with respect to classes of content messages

Table 1. Some of the Rules Developed in Our Approach for Interpreting Contents

Rule's Condition	Rule's Action (Class of the Content)
IF the prosodic of the contents' narrator indicates a kind of protest / complaint / irony about the violation of something important and vital (provided that the violating element is acting unintentionally/ involuntarily)	THEN the narrator is seeking honesty and justice .
IF the prosodic of the contents' narrator indicates the type of appreciation / encouragement / propaganda toward the violation of something important and vital (provided that the violating element is acting unintentionally/ involuntarily)	THEN the narrator seeks to disregard honesty and justice .
IF the prosodic of the contents' narrator indicates a kind of protest / complaint / irony toward the violation of something important and vital (provided that the violating element is acting consciously/ voluntarily)	THEN the narrator is seeking shame and respect .
IF the prosodic of the contents' narrator indicates a kind of appreciation / encouragement / propaganda about the violation of something important and vital (provided that the violating element is acting consciously/ voluntarily)	THEN the narrator seeks to disregard shame and respect .
IF the prosodic of the contents' narrator indicates a kind of protest / complaint / irony toward the presence of some kind of help and assistance to non-hostile people	THEN the narrator is disregarding compassion / mercy .
IF the prosodic of the contents' narrator indicates a kind of appreciation / encouragement / propaganda toward the presence of knowing and thinking	THEN the narrator is emphasizing the significance of knowing and thinking .
IF the prosodic of the contents' narrator indicates a kind of protest / complaint / irony toward the presence of knowing and thinking	THEN the narrator disregards the significance of knowing and thinking .
IF the prosodic of the contents' narrator indicates a kind of protest / complaint / irony toward the violation of the transcendence of human values and spiritual aspects	THEN the narrator is seeking self-up gradation .
IF the prosodic of the contents' narrator indicates a kind of appreciation / encouragement / propaganda toward the presence of the transcendence of human values and spiritual aspects	THEN the narrator is emphasizing the significance of self-up gradation .

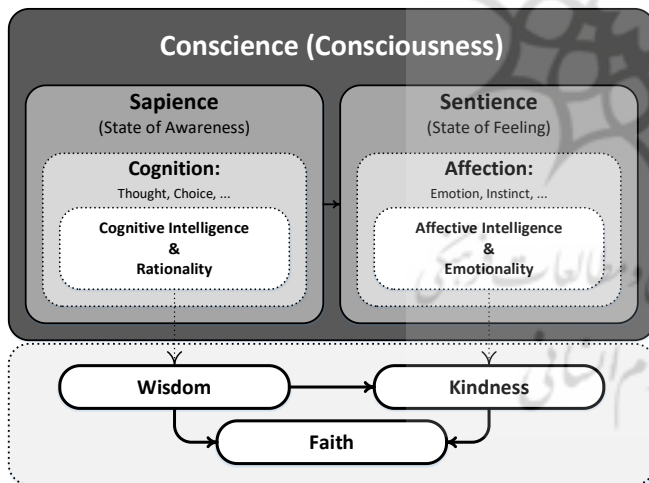


Figure. 3. Ontology map for the concept of "Consciousness", defined through the ontological entities of "Sapience and Sentience" [28] and their correspondence to the "Wisdom, Kindness and Faith" tripartite

Suppose that, the person narrating this content is honest in what he/she says (or in other words no evidence exists which may show that he/she is dishonest). What we may perceive from this content is that the "prosodic of the contents' narrator" is "protest", and the "specific propositions" included stand for "the violation of something important and vital (provided that the violating element is acting consciously/ voluntarily)" or "the absence of knowing and thinking". We therefore according to the following rules may

conclude that the narrator is seeking "shame and respect or knowing and thinking".

- IF the prosodic of the contents' narrator indicates a kind of **protest / complaint / irony** to the violation of something important and vital (provided that the violating element is acting consciously/ voluntarily), THEN the narrator is seeking **shame and respect**.
- IF the prosodic of the contents' narrator indicates a kind of **protest / complaint / irony** to the absence of knowing and thinking, THEN the narrator is seeking to **know and think**.

On the contrary, suppose that, with respect to the same content, through some channels we have got to know that the narrator is not an honest person. In this case what we may conclude from the entire content is that, despite the fact that the narrated content stands for "protest", "complaint", or "irony" against the violation of something important and vital, we however should conclude that the narrator is **disregarding honesty/ justice**. From the above discussion, it becomes quite clear that the information regarding the narrator itself can achieve a significant role in interpreting a content to the extent that it may even reverse the result of interpreting the narrated content. Let us say it is quite important to know by whom and in what circumstances (as a part of **context**) a content has been narrated.

As another example, suppose that there is a content narrated by a young physician who has had a hard extra-

program activity in treating poor children with "malnutrition syndrome" while receiving no reward.

Content: When I treat a child threatened by malnutrition, the first thing coming to my mind is how to design an environment wherein the parents of these children can receive some extra money to afford providing the nutrients which are essential to compensating for this syndrome. Moreover, I am thinking of the possibility of establishing some special food shops which can make this opportunity for the poor people to access the foods with cheap price. I myself am determined to spend voluntarily a part of my time on running such a shop...

What we may perceive from this content, provided that the narrator is talking honestly, is that "the prosodic of the contents' narrator" is " **appreciation / encouragement / propaganda**" and "specific propositions" stand for "**absence of a kind of help and assistance to non-hostile people**". We therefore according to one of the rules can conclude that the narrator is seeking **compassion / mercy**.

With regard to the first content, it is seen that "to avoid sprinkling water in a public place" is a fact that can be regarded as an exemplar for "observing citizen's rights" which itself can be propounded as a "principle for living together". Observing "principles for living together" can also be regarded as an "important & vital matter". With regard to the second content, it is observed that "helping/ assisting non-hostile people" can be considered as an exemplar for both the entities of "observing principles for living together" and "observing self-promotion/ flourishing" which themselves can be propounded as an "important & vital matter". In this way, we notice that the specific proposition in this content can be systematically connected to "important & vital matter" as a generic proposition with high abstraction level which has been shown in the condition part of the interpretation rules of Table 1. Figure 4 illustrates the ontology-type structure regarding the above discussion. Here, the question is how such an ontology-type structure can be built up. The first point is that, based on the previous experiences of expert users in facing different contents, a variety of trajectories can be built up showing how the related propositions can be connected to the entity namely "important & vital matter" by passing through the entities such as "fundamental needs", "self-promotion/ flourishing", or any other entity with high abstraction levels that can be regarded as the cases for "important & vital matter". In this way an ontology-type structure can be shaped gradually based on the previous experiences of the human experts. It is however possible that a top-down study on the nature of "important & vital matter" can also lead us to the significant entities which can support it pragmatically.

4. Validating the Approach & Assessing the Experimental Results

4.1. Validating the Approach

To validate the proposed interpretative approach to classifying the contents shared by users, we decided to check whether the very different specialists trained to make use of the corresponding rules, had attained similar results or not.

In this regard, both gender and educational background have been considered as the essential factors for differentiating the specialists, according to which a female

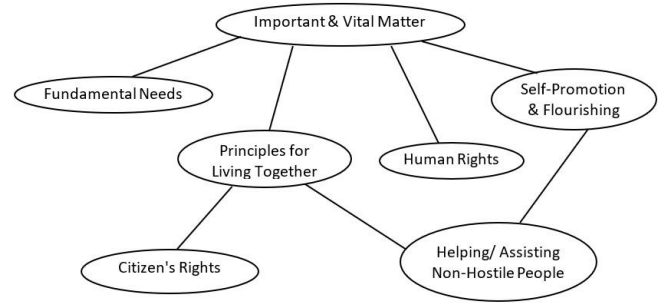


Figure. 4. An ontology-type structure for important & vital matter

(from the domain of engineering science) and a male (from the domain of social sciences) were selected to take the responsibility of tagging the same set of contents. The reason for considering these factors is to see how far the mind-set of a specialist, influenced by his/her physiological conditions as well as his/her experience of handling intellectual items, may affect the very mechanisms which are essential to realizing the "prosodic of the narrator", "specific propositions", and "context" (as the conditions in a rule) on the one side and "class of a content" (as the action in a rule) on the other side.

According to the results of tagging, the difference between the two specialists from the viewpoint of realizing "prosodic of the narrator", "specific propositions" and "context", was found to be less than 3 percent in case of 200 contents (shared by the users of well-known social networks and media), while this difference was realized to be less than 8 percent from the viewpoint of classifying these contents. It is obvious that, the more amount of experience and expertise in the specialists, a less amount of difference would be expected with regard to their classification results. It is also noticeable that the differences observed, are mostly in relation with the specialists' preference, which in reality leads them to choosing certain classes in comparison with the other classes. Such type of difference occurs particularly in the cases where a content includes multiple classes, and accordingly, if a specialist is asked to classify a content with such a characteristic, it would be expectable that the difference between the specialists' opinions would greatly be decreased. Another test was also performed to figure out to what extent the ontological structures partially developed to help the specialists perform matching against the condition parts of the considered protocols, may function properly. In this respect, 2000 contents shared by the users of well-known social networks and media were tagged by 5 specialists in a separate manner. Results of the test amazingly demonstrate the fact that the five classes of content suggested in this paper have the ability to respond satisfactory to these contents (particularly those with non-narrative nature). In other words, no particular content was found that might not belong to one of these classes. Of course, as mentioned before, some contents may consist of different classes, highlighting the point that as far as human psycho-mental attitude is considered, there are occasionally some attitudes that include a combination of classes. This point is not problematic, since based on the degree of experience and expertise in a specialist, all the relevant classes can become subject to identification. Another point which was clarified through this test is the adequacy of the very propositions that have been considered in the condition parts of the rules. In this regard, the local ontological structures developed for such a purpose

were capable enough to correctly assign the related propositions to these propositions. This means that, the propositions considered for the rules are general enough to cover all the possible propositions in the daily contents shared by the human users.

4.2. Assessing the Experimental Results

As mentioned before, the main purpose of this article is to classify the message of a content. In this section, we assess the experimental results obtained through applying the developed rules to a variety of contents shared by the users.

To perform the experiments, about two hundreds of contents were selected and analysed from different perspectives. As mentioned in Section 3 out of the selected contents, 41% belonged to Instagram, 35% to Twitter and 24% to Telegram. These contents were firstly labelled (by a professional expert) in terms of the 5 classes including self-up gradation, compassion / mercy, shame / respect, knowing / thinking, and honesty / justice. The classification result was considered as the ground-truth. Contents were then tagged by a specialist using the proposed corresponding generic rules.

Table 2 shows the comparison between the ground-truth and the predicted classes in form of a Confusion Matrix. Note that, although the number of annotated contents is about 200, but the number of labels assigned to the contents is more than 200. This is because the message in some contents is related to more than one class. Classification Metrics including Precision, Recall and F1 value for each class are also shown in Table 3. Based on the results, accuracy of the proposed approach for interpreting the contents was found to be about 97.5%.

4.3. Some Remarks on Increasing the Performance of Interpretation Process

Since “context” (time, place, situation and source of propagation), “prosodic of the narrator” and “specific propositions” (that reflects a message of a content) are the main items which are to be considered in rule matching, any discrepancy in identifying these items can end up with a sort of mistake or bad performance with regard to the class of the content. It is therefore significant to see which of these items is vulnerable from the viewpoint of identification.

As discussed before, since those propositions in a rule’s condition which stand for a content’s message are generic and hold a high abstraction level, it is therefore expected (as also demonstrated by the experiments) that the specific propositions in a content can be identified in a proper manner. With regards to “prosodic of the narrator”, since it is being identified by a human expert, who is supposed to have adequate knowledge of linguistics, it would then be expectable as well that the entire process of identification can take place with no mistake. However, if we have the process performed in an automated manner making use of artificial intelligence techniques, possibility would exit in this situation that the “prosodic” may also be misidentified. Finally, regarding “context”, one should notice that there are a variety of parameters which may lead to its misidentification. Let us say, source of propagation (either an individual, a group, an organization or an institution) is an entity which has its own complications, ambiguities, unclarities as well as discrepancies regarding the way the ultimate message of a

Table 2. Confusion Matrix

		Actual Class				
		Compassion / Mercy	Shame/ Respect	Honest/ Justice	Knowing/ Thinking	Self- Upgradation
Predicted Class	Compassion / Mercy	27	0	0	0	0
	Shame/ Respect	2	60	0	0	0
	Honesty/ Justice	0	0	36	0	0
	Knowing/ Thinking	0	0	2	40	0
	Self- Upgradation	0	0	1	1	75

Table 3. Classification Metrics

	Precision	Recall	F1 value
Compassion / Mercy	1.0000	0.9310	0.9643
Shame / Respect	0.9677	1.0000	0.9836
Honesty / Justice	1.0000	0.9231	0.9600
Knowing / Thinking	0.9524	0.9756	0.9639
Self-Upgradation	0.9740	1.0000	0.9868

content is to be determined. In this way, it is quite crucial to take into account a wide range of parameters characterizing a context (with particular emphasis on “source of propagation”) in order to make the final interpretation as sound as possible.

5. Concluding Remarks

In the paper we showed that how using rules with abstract propositions can lead to interpreting contents shown up in social networks. Within this scope, we demonstrated that abstract propositions have the ability to cover a wide range of specific propositions which are consistent for classes with particular messages. We also showed that, an ontology-type structure which makes connection between the propositions in a content and a generic proposition in the condition part of a rule, helps classification be performed in a systematic manner. It is obvious that, such an ontology-type structure, should be evolved through the gradual observations from the past contents in order to become workable for future cases. This is partially important for the situations where the final objective is to develop an intelligent program that can handle the issue in an automatic way. As argued in the paper, besides the specific proposition, the prosodic of the person who narrates a content is of particular significance as well. Let us say, a specific proposition may convey quite different messages under different prosodics. This is because a prosodic in its nature tries to have a kind of reflection over a proposition demonstrating in what way this proposition can make sense. So far, in our research work the process of extracting the prosodic has in practice been performed by the

human expert in social network, as he/ she has the ability to figure out a prosodic in an intuitive way. However, it's quite possible that a manual extraction of prosodics may not necessarily be convenient in some particular situations where a narrator decides to express him/herself in a fluent way. Such a possibility urges us to think of developing a program that can extract prosodics in an intelligent way. Developing such a program can be considered as a part of our future research work. It should be noticed that a peculiar aspect of novelty in our approach could be seen in the way propositional logic is able to handle the crucial issue of interpreting contents in social networks. This is quite important since the ongoing presumption for achieving this goal is to make use of modal logic which is supposed to be capable of handling the modality existing in the textual information of a content while considering issues such as possibility and necessity. However we could demonstrate in the paper that considering a particular set of propositions like those belonging to the context and prosodic enables us not to ignore this modality. Therefore, as a final point, we may expect that an extensive work on rule-based interpretation of contents in social networks with emphasis on the types of propositions in the condition part, can help complicated contents be interpreted in social networks.

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Authors' contributions

MTM: Study design, acquisition of data, interpretation of the results, statistical analysis, drafting the manuscript

PA: Study design, acquisition of data, interpretation of the results, statistical analysis, drafting the manuscript

AY: Study design, acquisition of data, interpretation of the results, statistical analysis, drafting the manuscript, revision of the manuscript

KB: Study design, acquisition of data, interpretation of the results, statistical analysis, drafting the manuscript, revision of the manuscript

Conflict of interest

The authors declare that no conflicts of interest exist.

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