

ROLE OF FRAME STRUCTURE IN THE DEVELOPMENT OF KRS FOR LEARNING DIALOGUES

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ABSTRACT

Dialogues are building blocks of tasks and non-tasks of communication, which happen between objects in the universe. Each dialogue is a source of linguistic knowledge within a natural language that explains and elaborates with frame structure in general. In this paper, it is noticed that various forms like (nouns, pronouns, yes-no questions and deletion) are essential part of each dialogue structure (DSS) in Chandan's work ਜੜਾਂ/Roots. With the help of frames, knowledge representation system (KRS) is prepared for such dialogues in Punjabi. On the other hand, it is argued that highest numbers of nouns are total 45 in DS2 and only 1 deletion case finds in DS3. While DS1 and DS2 both have similar number of 2-2 cases of yes-no questions. The overall evaluation is successfully matched with proposed an algorithm based on frames.

KEYWORDS

ਜੜਾਂ/Roots, KRS, Frames, Nouns, Pronouns, Deletion.

1. INTRODUCTION

The universe consists of number of objects and each one has not a particular form but also certain characteristics that are source of information and knowledge. In this context, it is assumed that natural language is a very complex object and it has many layers and levels of knowledge representation. By introducing frames, it means that they are best ways to serve such knowledge. In general, frames report stereotyped situations and are essential part of frame system (Minsky, 1974). They are complete package of information for an object/a concept in spoken and written discourse. They look like an individual type; an abstract type and also were prototypes and exemplars (Steels, 1978).

On the other hand, when an object comes with huge numbers and classes then it is called generic frame (Brachman and Levesque, 2004). Indeed, it is an important to structure information and knowledge with the help of mental models, semantic networks, scripts, plans and frames (Crowley, 2012). Based on Minsky's frames and Fillmore's frames and Schank's scripts, a probabilistic model has already been designed to define corpus related matters and coherent has also been increased (Ferraro and Durme, 2016). Also, it is noted down that frames oriented knowledge systems are functioning well in Google and Siri like platforms (Boroujerdi, 2018). At the textual level, it is also seen that knowledge is widely depended upon the context so that contextual study is as equally important. When the context is explored then it is useful for terminology in the text. For this purpose, frames help to understand terminology within one word to group of words and group of words to another higher category in the text (Faber and Cabezas-Garcia, 2019). Likewise text, spoken conversation is a set of dialogues, which sometimes consist of group of four, five words and sometimes more. But today, the dialogues are going to be systemized with frames for special tasks whether it belongs to a doctor who tries to manage bad news with a patient and in this way, both they share same information (Blache and Houles, 2021).

In this paper, it is tried to analysis yes-no questions, noun-to-pronoun shift and deletion like few cases in Punjabi with frames and also present knowledge representation system (KRS). There are total six sections. First section discusses frames and KRS for Punjabi. Second section focuses on historical studies of frame structure and recent works. Third section indicates aims and objectives. Fourth section describes methodology (type of data sets and arrangement). Fifth section presents results and shows an algorithm. Last section draws conclusion and gives direction to future work. In brief, knowledge representation system (KRS) for Chandan's work ਜੜਾਂ/Roots (2006) is shown in Fig. 1.

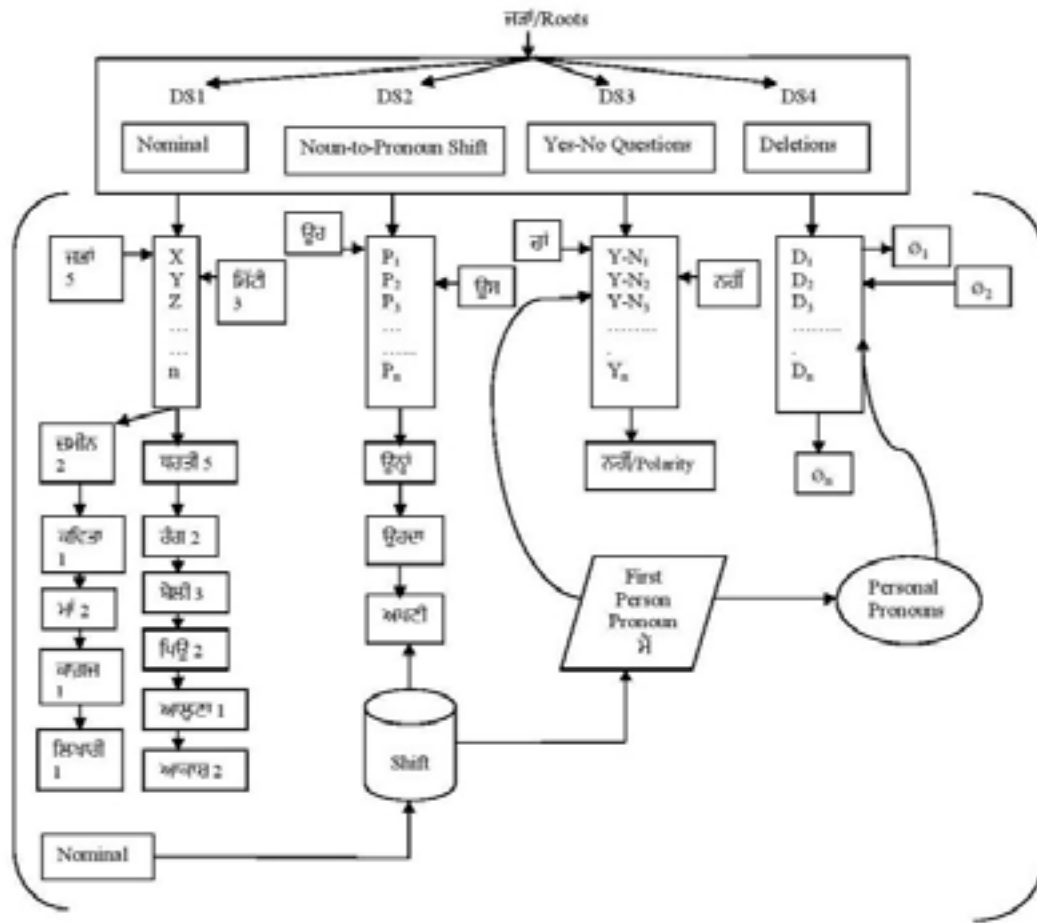


Fig. 1. KRS for dialogue structure.

Above fig. 1 shows that there are four dialogue structures where nominal contains ਜੜਾਂ/Roots, ਧਰਤੀ/earth, ਕਵਿਤਾ/poem, ਮਾਂ/mother, ਕਾਗਜ਼/paper, ਲਖਾਰੀ/writer, ਰੰਗ/colour etc in DS₁. Second DS₂ has ਉਹ/he, ਅਪਣਾ/his/her like third personal pronouns and reflexives respectively. Whereas, it seems that ਹਾਂ/yes and ਨਹੀਂ/no one word yes-no questions notice in DS₃. Similarly, personal pronouns such as ਉਹ/he, and ਅਪਣਾ/his/her like reflexives appear in omitted form in DS₃.

2. RELATED WORKS

Frames depict existed and flowing knowledge into dialogues and discourses (Thagard, 1984). Dialogues provide wonderful platform to discuss events, situations and tasks/non-tasks. Emotions within dialogues are captured by interface techniques (e.g. two tier mechanism) as suggested by (Ruttkay and Pelachaud, 2005). Spoken dialogue systems are performing well when they introduce with tasks/non-tasks (Jokinen and McTear, 2010).

On the other hand, it is said that the role of participants' impact on turns taking and maintains information flow within dialogue system (Thompson, 2013). Similarly, sets of phrases and small utterances of any dialogue can also be analyzed with frames (Khan, 2013). Frames are easily discharging knowledge through slots, values and so on. They are good source defining any particular domain in any corner of the world (Nazaruks and Osis, 2017). ASR and n-gram features are another way to track dialogue situations and they generalize dialogue contexts (Rudnicky et al., 2016). The use of ontology controls both users and robot to model dialogues (D'Haro, 2019).

Few factors like (the choice of word order, pause and frequency) also show personalities of characters' during dialogue processing (D'Haro, 2020). Based on dialogue or conversation between people or

people with objects, it is necessary to capture frame knowledge to develop modern technology where the route direction could be simple to improve the manufacturing work (Simonova and Kapitonova, 2019). The frame knowledge in the form of frame semantics has also been adopted to see the relatedness between lexemes and to check them appropriately (Verdaguer, 2020).

It seems that frames also help to understand dialogues, particularly ‘inner dialogues’ where the special focus is given upon speaker’s input and the mental state (Lopez-Soto, 2021). Regarding designing the set of conversation within a dialogue of any language, it is an essential to use linguistic knowledge in frames so that a dialogue can fully be represented in a systematic way (Chandrasegaran and Liyod and Akdag Salah, 2022). Followed by linguistics, it is realized that frames with their semantic knowledge, they become effective tool to organize dialogues in English and German for the purpose of detecting disasters for the society’s welfare. It has been argued that existing system “PAFIBERT” is again trained to improve the accuracy and so on (Skachkova and Kruijff-Korbyova, 2021).

Based on semantics, “framenet Brasil” has been introduced to improve contextual domain and generalizing sentences and texts computationally (Torrent et al., 2022). In this direction, “the research group of Düsseldorf” has presented the history of frames in relation to linguistics and cognitive science. It has been found that semantics and common sense knowledge are essential to develop linguistic frame model that covers word classes in natural language (Löbner, 2021). Frame knowledge has also been applied to discuss metaphors and it accurately mapping the metaphors in English (Stickles et al., 2014).

3. AIMS AND OBJECTIVES

To survey dialogue and knowledge representation system.

To find out nominal, noun to pronoun shift, yes-no question and deletion like cases into dialogue structures.

To analysis dialogue structures (DSs) through frames.

To present an algorithm based on KRS.

4. METHODOLOGY

It is declared that Chandan’s work *जड़/Roots* is selected to discuss few cases of nominal, shifting and etc. in dialogue structures (DSs). First, a single noun category is searched which is used to address, order and request against total no of nouns. Then pronouns, yes-no questions and deletion are selected one by one. In this procedure, it is suggested that each dialogue should be treated like a frame and it would be subject to an algorithm.

5. RESULTS

There are three dialogues like (*जड़/Roots*, *मार्ग/Instrument*, and *मोर/Peacock*) have been extracted from Chandan’s work *जड़/Roots*. In *जड़/Roots* (DS₁) total 26 nouns and 11 pronouns are found whereas noun-to-pronoun shift is commonly appeared. Only 02 cases find in yes-no questions. In *मार्ग/Instrument* (DS₂), total 45 nouns and 05 pronouns are searched. Likewise *जड़/Roots* (DS₁), again 2 cases notice in yes-no questions. Finally, in *मोर/Peacock* (DS₃), total 28 nouns and 02 pronouns (including 02 yes-no questions and 02 deletion cases) are found. Fig. 2. shows complete analysis for DS₁, DS₂ and DS₃.

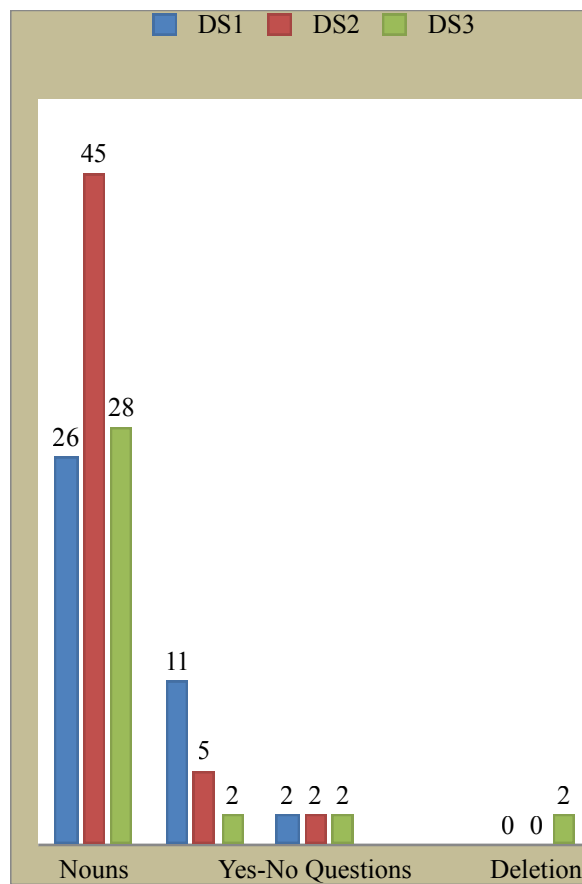


Fig. 2. Total no of four variables in dialogue structures.

According to Fig. 2 it is shown that deletion does not find in DS₁ and DS₂ except total 2 in DS₃. On the other hand, yes-no questions are total 3 find in DvS₁ and only 2-2 find in DS₂ and DS₃ respectively.

Here frame representation is significant to analysis above dialogue structures (DS₁, 2, 3) one by one.

5.1. NOUNS IN FRAME STRUCTURE

Nouns indicate towards person, place and thing in the universe. In general, common, proper and mass are kinds of nouns in natural language. Table 1 shows how frames are applied for nouns.

Table 1. Nouns in frames.

| Slot | Value | Type |
|------------------|--------------|-----------------------|
| (Dhreja) | | |
| Sex | Male | Human |
| Age | 36 yrs | Biological |
| Home | Place | Stay |
| (God) | | |
| Sex | Male | Spiritual |
| Age | Unimaginable | Non-Biological |
| Place | Everywhere | Stay |
| Religion | No | Belief and Trust |
| (Fire) | | |
| Sex | Male | Deity |
| Element | Cooking | Life and Death bearer |
| (Well) | | |
| Sex | Male | Non-Human |
| Item | Storage | Big/Small Size |
| Place | Somewhere | Village |
| (Peacock) | | |
| Sex | Male | Non-Human |
| Age | 20 yrs | Biological |
| Home | Rain forests | Stay |
| (Workers) | | |
| Sex | Male/Female | Human |
| Age | 40 yrs | Biological |
| Home | Place | Stay |

Table 1 shows that **(Dhreja), (God), (Fire), (Well), and (Workers)** are common nouns. Each example is a complete set of knowledge appearing with slot, value and type.

5.2. PRONOUNS IN FRAME STRUCTURE

Pronouns mostly stand against nouns in order to accomplish substitution tasks in natural language. Apart from personal pronouns, they are also called reflexives, reciprocals, zero and so on. However, only personal pronouns like (he), (it), (that) and (I) are found. The analysis for personal pronouns is mentioned in Table 2.

Table 2. Pronouns in frames.

| Slot | Value | Type |
|---------------|---------------|-------------------------|
| (He) | | |
| Sex | Male/Female | Human |
| Age | 16 yrs | Biological |
| Home | Place | Stay |
| (It) | | |
| Sex | Male/Female | Non-Human |
| Age | Not countable | Non-Biological |
| Use | Need based | Product (Pen, Book etc) |
| (That) | | |
| Sex | Male/Female | Human/Non-Human |
| Age | 32 yrs | Biological |
| Home | Place | Stay |
| (I) | | |
| Sex | Male/Female | Human |
| Age | 20 yrs | Biological |
| Home | Place | Stay |

Table 2 shows that frames explain **(he), (it), (that) and (I)** like personal pronouns in a better way.

5.3 YES-NO QUESTIONS IN FRAME STRUCTURE

‘Polar questions’ and ‘general questions’ are selected for yes-no questions in linguistics. Each one receives one word answer (either affirmative or negative). See Table 3.

Table 3. Yes-no Questions in Frames.

| Slot | Value | Type |
|------|-------|------|
|------|-------|------|

| ਹਾਂ/Yes | | |
|---------|--------------|----------------------|
| Sex | Male/Female | Human |
| Age | 24 yrs | Biological |
| Query | Satisfaction | Acceptable/Rejection |

Table 3 demonstrates that ਹਾਂ/Yes as affirmative answer comes under slot which is filled up by sex, age and query like variables. Value and type is another sort of information source for yes-no questions. Value which means that a person may belong to male category or not and it may be 24 yrs old. Under query, it is shown that satisfaction is kept against the slot and it falls down either accepted or rejected.

5.4 DELETION IN FRAME STRUCTURE

Deletion means to see omit items in spoken and written dialogues. For instance, ਉੜਦੇ ਮੋਰ/Flying Peacocks is deleted in the phrase ‘ਉੜਦੇ ਮੋਰ’ ਨੂੰ ਦੇਖੋ.... ਹੌਲੀ-ਹੌਲੀ ਦੇਖੋ but remember that this ____ empty space is filled up with ‘ਉੜਦੇ ਮੋਰ’ only. See Table 4.

Table 4. Deletion in Frames.

| Slot | Value | Type |
|----------------------------------|-------------|------------|
| ਉੜਦੇ ਮੋਰ (Flying Peacock) | | |
| Sex | Male | Non- Human |
| Age | 20 yrs | Biological |
| Home | Rain forest | Stay |

Table 4 indicates that ‘ਉੜਦੇ ਮੋਰ’/Flying Peacock is not appeared in the second line because it is in omitted mode.

5.5 PLANNING FOR AN ALGORITHM

It is pointed out that frames can generalize dialogue structures in a better way. Slot, value and type do simplification for mentioned each dialogue structure and they provide a complete package of information. In this regard, following algorithm is proposed for DS₁, DS₂, and DS₃.

Step 1

Check nouns in dialogues (1, 2 and 3)

Collect all possible nouns

Select each one for frames

Step 2

Check pronouns in dialogues (1, 2 and 3)

Collect all possible pronouns

Select each one for frames

Step 3

Check yes-no questions in dialogues (1, 2 and 3)

Collect all possible polar questions

Select each one for frames

Step 4

Check deletion in dialogues (1, 2 and 3)

Collect all possible deletion/omitted cases

Select each one for frames

It is represented in **Fig. 3**.

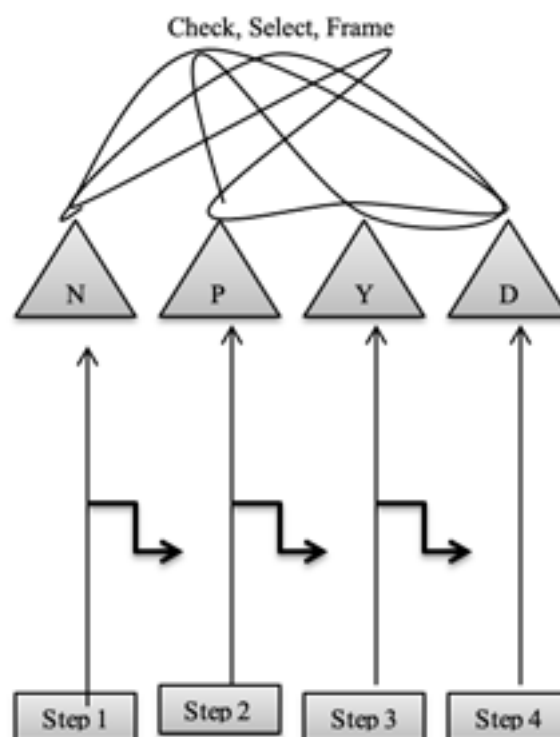


Fig 3. Steps of an Algorithm.

As per given an algorithm, it is suggested that there are total four steps where there is generally three conditions are applied. In step 1, capital N denotes nouns, capital P denotes pronoun in step 2. Similarly, it is seen that Y indicates (yes-no questions) and last D denotes deletion case in step 3 and 4 respectively. All four steps with corresponding N, P, Y, and D must follow the sequence of (check>select>frame) at the execution time.

In other words, it is simply mentioned that noun, pronoun, yes-no question and deletion kind of cases are seen in dialogue 1,2,3. All they pass through check, select and giving frame slot three criteria. It is pointed out that total number (as already given in fig 2) is successfully identified.

6. CONCLUSION AND FUTURE WORKS

Dialogues usually contain nouns, pronouns, anaphors and zero forms. Frames are used to explain them in the work of ਜੜਾਂ/Roots. The highest number of nouns is 45 that find in DS1 whereas a single deletion case is found in DS3. It is noticed that above mentioned algorithm fairly defines each DS and in future, it could be modified to incorporate other dialogues like ‘ਚਿੱਟੇ ਹਾਸੀਏ ਵਾਲੀ ਤਸਵੀਰ’, ਕਾਗਜ਼, ਲਾਲ ਝੰਡਾ, ਕੇਵਲ ਕੌਰਦੀ ਯਾਦ ਵਿਚ, ਚਿਤਰਕਾਲ ਸੰਪਯਾ, ਹਣ-ਖਿਣ, ਟੇਜ਼ ਕੰਢੇ, ਕੋਵਟ ਗਾਰਡਨ ਲੰਡਨ, ਭੋਗਾਵਸਥਾ, ਸਟੋਕਹੋਮ ਤੋਂ ਖਿਕਚਰ ਕਾਰਡ, ਸਾਂਭ ਕੇ ਰਖੀ ਚੀਜ਼ etc.

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