

Ambiguous Antecedents Resolution in Summarization of Vietnamese Sentences Formed by Identical Relationship with Copula “LÀ”

Trung Tran^(✉) and Dang Tuan Nguyen

Faculty of Computer Science, University of Information Technology,
Vietnam National University - Ho Chi Minh City, Ho Chi Minh City, Vietnam
ttrung@nlke-group.net, dangnt@uit.edu.vn

Abstract. We deal with two main issues in this article for the contexts of Vietnamese paragraphs composing two simple sentences having the main feature: the first sentence has two identical objects connected by copula “là”; the second sentence has one anaphoric pronoun indicating human. As the special context, between two identical objects at the first sentence there is only one is actually referred to by the pronoun at the second sentence. At the first issue, we express the mechanism for determining exact antecedents of anaphoric human pronouns and building the meaning representation structure for each sentential pair. We continue to present techniques for analyzing this structure for the issue which is to determine main contents and relationships. Then, we propose the method to generate a new complete Vietnamese sentence having the content which summarizes the meaning of the original pair of sentences.

Keywords: Anaphoric pronoun · Referent resolution · Meaning representation · Meaning summarization · Sentence generation

1 Introduction

In our new approach for summarizing the meaning of pairs of simple Vietnamese sentences, an important step is to resolve the ambiguous problem in determining antecedents of anaphoric pronouns. Firstly, we proposed in [13] a new approach which is the combination of ideas and techniques belonging to two research fields are Natural Language Generation (cf. [3]) and Text Summarization (cf. [1, 2, 5–7]). At the first phase, we proposed the solution to understand the meaning of the input pair with two processes: resolve anaphoric pronouns and build a meaning representation structure for the paragraph. Next, we proposed the solution for generating the new meaning-summarizing Vietnamese sentence with three processes: determine and model relationship factors from the above structure; generate the syntactic structure; combine the lexical set to complete the new sentence. However, in [13] we only applied the new approach in the contexts of four pair types having the general characteristic: the first sentence has one transitive verb relating to two objects which are not identical; the second sentence has one pronoun indicating human, standing with demonstrative

adjective [“ta” / “ây” / “này”] and relating to the object at the first sentence taking the object role of the transitive verb. We only presented in [13] steps for implementing processes at the second phase, and we applied techniques in [12] to implement processes at the first phase.

Expanding the research, in [14] we considered the others contexts of four types in which there is the appearance of pronoun “nó” at the second sentence. This is a special pronoun in Vietnamese, can indicate human, animated or non-animated object depending on the actual context and content of the paragraph. Therefore, an important issue is to resolve the ambiguous problem in determining the object at the first sentence which is referred to by pronoun “nó”. We applied techniques in [12] and proposed some improvements in describing lexical structure to determine the exact referent and build the meaning representation structure. Next, we analyze this structure, identify relationships. Finally we proposed the algorithm for generating the syntactic structure and combined with the built lexical set to complete the new sentence.

Based on the new approach, the considered contexts here are pairs of simple Vietnamese sentences having characteristic: the first sentence has two identical objects are connected by copula “là” (is) and has the structure as in Table 1; the second sentence has one pronoun indicating human and has the structure as in Table 2. With these types, although two objects at the first sentence are identical but there is only one object is mentioned and referred to by the pronoun at the second sentence. To handle this problem, we propose some improvements in comparison with [12]:

- Propose the new strategy to find the antecedent at the first sentence.
- Add appropriate information in technique of describing the lexical characteristics.
- Adjust the technique that implements the referent finding algorithm.

At the next phase, we analyze the meaning representation structure to determine: the main content of the paragraph; relationships between found object with the next verb or adjective. Then, we propose new general algorithm for generating the syntactic structure of the new sentence and combine with the lexical set to complete.

Table 1. The structure of the first sentence

Type	Characteristic
1	<ul style="list-style-type: none"> • The object which is represented by a proper noun stands at the subject position of verb “là”. Example 1: “ <i>Nhân là người thanh niên.</i> ” (English: “ <i>Nhân is a young man.</i> ”)
2	<ul style="list-style-type: none"> • The object which is represented by a proper noun stands at the object position of verb “là”. Example 2: “ <i>Người đàn ông là Nghĩa.</i> ” (English: “ <i>The guy is Nghĩa.</i> ”)
3	<ul style="list-style-type: none"> • Two objects are represented by two proper nouns. Example 3: “ <i>Lẽ là ông Trí.</i> ” (English: “ <i>Lẽ is Mr Trí.</i> ”)
4	<ul style="list-style-type: none"> • Two objects are represented by two common nouns. Example 4: “ <i>Người đàn ông là giám đốc.</i> ” (English: “ <i>The guy is the chairman.</i> ”)

Table 2. The structure of the second sentence

Type	Characteristic
1	<ul style="list-style-type: none"> The pronoun stands at the subject role of verb “là”. Example 5: “ <i>Anh là bác sĩ.</i> ” (English: “ <i>He is a doctor.</i> ”)
2	<ul style="list-style-type: none"> The pronoun stands at the object role of verb “là”. Example 6: “ <i>Bác sĩ là anh.</i> ” (English: “ <i>The doctor is him.</i> ”)
3	<ul style="list-style-type: none"> The pronoun stands at the subject role of adjective. Example 7: “ <i>Anh đẹp trai.</i> ” (English: “ <i>He is handsome.</i> ”)
4	<ul style="list-style-type: none"> The pronoun stands at the subject role of intransitive verb. Example 8: “ <i>Anh mỉm cười.</i> ” (English: “ <i>He smiles.</i> ”)
5	<ul style="list-style-type: none"> The pronoun stands at the subject role of transitive verb. Example 9: “ <i>Anh giúp Nghĩa.</i> ” (English: “ <i>He helps Nghĩa.</i> ”)
6	<ul style="list-style-type: none"> The pronoun stands at the object role of transitive verb. Example 10: “ <i>Tín nói chuyện với anh.</i> ” (English: “ <i>Tín talks to him.</i> ”)

2 Determine the Referent of Anaphoric Human Pronoun

In this section, we present some improvements from the method in [12] to determine the exact antecedent and build the appropriate meaning representation structure.

Based on framework Graph Unification Logic Programming (GULP) [8], our method of resolving anaphoric pronouns and building the meaning representation structure in [12] included steps: (i) analyzed the paragraph into two separated sentences and described position information; (ii) analyzed the syntactic structure of each sentence and described the appropriate characteristic information; (iii) described the characteristic of each lexicon; (iv) in turn built each component of the meaning representation structure; (v) determine the referent for each pronoun. These steps were implemented based on information transferring mechanism in the syntactic tree of theory Unification-Based Grammar [8]. In our approach, we apply Discourse Representation Theory (DRT [4, 9–11]) in which the semantic of a paragraph is represented by a structure called Discourse Representation Structure (DRS) which is a tuple of two ordered lists: (i) the first contains unique indexes indicating each object in the paragraph and denoted as U; (ii) the second contains predicates (in the sense of theory DRT) represent conditions which objects have to satisfy and denoted as Con.

With considered paragraphs in this study, we propose the new referent finding strategy. The main idea is based on the experiences in actual contexts: a main object will normally be referred to first or described by a proper noun. The general strategy:

- If the first sentence has proper noun:
 - If the first sentence has one proper noun: The referent is the object which is described by this proper noun.
 - If the first sentence has two proper nouns: The referent is either the first or the second object. We choose the object standing at the object role of copula “là”.

- If the first sentence does not have proper noun: The referent is the object which is described by the noun standing at the subject role of copula “là”.

To realize this strategy, firstly we identify the information for finding the referent: position of the object in the paragraph (at the first or second sentence); sub-class of category (proper or common noun); role of verb or adjective (subject or object role). Then, we implement improvements from techniques in [12] as follows:

- Describe additional feature `flag_role` describing the role of the object in relationship with copula “là” in analyzing structure of the sentence which has the structure in Table 1. This feature takes value `[subject]` for the object taking the subject role, `[object]` for the object taking the object role (Fig. 1).

```
s(S,H1,H3) --> {
  S = syn~flag_position~FP,
  NP1 = syn~flag_position~FP,      NP2 = syn~flag_position~FP,
  NP1 = syn~flag_role~[subject],  NP2 = syn~flag_role~[object],
  S = sem~A,
  NP1 = sem~A,                      NP2 = sem~B,
  NP1 = sem~scope~B,
  NP1 = syn~flag_index~I1,          NP2 = syn~flag_index~I2,
  NP2 = sem~scope~ (in~ [drs(U,Con)|Super] ..
                    out~ [drs(U,[(I1=I2)|Con])|Super])
}, np(NP1,H1,H2), [là], np(NP2,H2,H3).
```

Fig. 1. Analyze the structure of the sentence in Table 1 (based on framework GULP [8])

- Describe additional feature `flag_proper` and predicate `f_proper` in describing lexical characteristics. This feature and predicate take value `[proper]` if the lexicon is proper noun, `[common]` if the lexicon is common noun. Predicate `f_proper` is added to the DRS structure and helps for determining the referent in the technique that resolves the anaphoric pronoun (Fig. 2).

When meet a pronoun at the second sentence, we in turn resolve according to two algorithms: the first algorithm finds the proper noun (Fig. 3), the second algorithm finds the noun standing at the subject role of copula “là” (Fig. 4).

Algorithm 1: Find the proper noun.

```
Consider DRS at the time considering the current anaphoric pronoun;
While index I is in list U
  While predicate associated with I is in list Con
    If (position(I) takes value [first]) && (species(I) takes value
[human]) && (f_proper(I) takes value [proper]) Then
      Index of Referent = I;
    End If
  End While
End While
```

```
n(N) --> [nhân], {
  append([position(I,FP),role(I,FR), species(I,FS),f_proper(I,FPR),
    named(I,[nhân],noun,proper)], Con,NewCon),
  unique_integer(I), FS = [human], FPR = [proper],
  N = syn~(flag_index~I .. flag_position~FP ..
    flag_role~FR .. flag_species~FS ..
    flag_proper~FPR) ..
  sem~(in~ DRSList .. out~ NewDRSList),
  add_to_topmost_drs(I,[position(I,FP),role(I,FR),species(I,FS),
  f_proper(I,FPR),
  named(I,[nhân],noun,proper)], DRSList,NewDRSList) }.
```

Fig. 2. Describe the characteristics of proper noun “Nhân” (based on framework GULP [8])

```
np(NP,H,H) --> ([anh]), {
  NP=sem~in~DrsList,
  member(drs(U,Con),DrsList),member(Index,U),
  member(position(Index2,[first]),Con),
  member(species(Index2,[human]),Con),
  member(f_proper(Index2,[proper]),Con),
  Index == Index2,
  NP=syn~flag_index~Index,
  NP=sem~scope~in~DrsList, NP=sem~scope~out~DrsOut,
  NP=sem~out~DrsOut }.
```

Fig. 3. Implement Algorithm 1 (based on framework GULP [8])

Algorithm 2: Find the noun standing at the subject role of copula “là”.

```
Consider DRS at the time considering the current anaphoric pronoun;
While index I is in list U
  While predicate associated with I is in list Con
    If (position(I) takes value [first]) && (species(I) takes value
[human]) && (role(I) takes value [subject]) Then
      Index of Referent = I;
    End If
  End While
End While
```

The final result of this first phase is a DRS structure representing the meaning of the paragraph. As an example, the DRS structure of the pair of Vietnamese sentences “*Tin là nhà thơ. Anh nhạy cảm.*” (English: “*Tin is a poet. He is sensitive.*”) (Fig. 5):

3 Generate the New Vietnamese Sentence

The main content of this section is to present determining main contents and relationships in the paragraph through analyzing the DRS structure. Thence, we propose the algorithm for generating the syntactic structure and complete the new sentence.

```

np(NP,H,H) --> ([anh]),{
  NP=sem~in~DrsList,
  member(drs(U,Con),DrsList),member(Index,U),
  member(position(Index2,[first]),Con),
    member(species(Index2,[human]),Con),
    member(role(Index2,[subject]),Con),
    Index == Index2,
  NP=syn~flag_index~Index,
  NP=sem~scope~in~DrsList, NP=sem~scope~out~DrsOut,
  NP=sem~out~DrsOut }.

```

Fig. 4. Implement Algorithm 2 (based on framework GULP [8])

3.1 Determine Main Contents and Relationships

At the first analyzing step, we determine that contents of the paragraph is described by main predicates in list Con of the DRS. These are predicates describing semantic of noun, verb, adjective and in turn indicate object, action or property. With the considered sentential pairs, the content indicating two identical objects is described by a special predicate form which we call identical predicate. This predicate form has structure “I1 = I2” in which I1 is unique index indicating the first object and I2 is unique index indicating the second object. Consider the DRS in Fig. 5, we build three ordered lists containing indexes and predicates which describe main contents:

```

[1,2]
named(1,[tín],noun,proper)
f_proper(1,[proper])
species(1,[human])
role(1,[subject])
position(1,[first])
nhà_thơ(2,[nhà,thơ],noun,common)
f_proper(2,[common])
species(2,[human])
role(2,[object])
position(2,[first])
1=2
nhảy_câm(1,[nhảy,câm],adjective)

```

Fig. 5. The DRS structure of paragraph “*Tín là nhà thơ. Anh nhảy câm.*”

- mapIndexObjects: contain indexes indicating each object in the paragraph: 1 – indicates object “Tín”; 2 – indicates object “nhà thơ”.
- mapPredicateObjects: contain predicates describing semantic of nouns:
 - named(1,[tín],noun,proper) – describe the semantic of proper noun “Tín”.
 - nhà_thơ(2,[nhà,thơ],noun,common) – describe the semantic of common noun “nhà thơ”.
- mapPredicateBehaviors: contain predicates describing semantic of verb, adjective and identical predicates:
 - 1 = 2 – describes object “Tín” is identical with object “nhà thơ”.

- `nhay_cảm(1, [nhay, cảm], adjective, property)` - describe the semantic of adjective “nhay cảm”.

We determine relationships when analyzing predicates in `mapPredicateBehaviors`. These predicates contain the information about indexes associating to objects which have the relationship with each other and with action or property. Generally, we model in Table 3 predicates describing semantic of verb, adjective or identical.

3.2 Generate the New Meaning-Summarizing Vietnamese Sentence

Based on predicate structures in Table 3, we determine considered pairs of sentences are represented by pairs of predicates in which the first predicate has the structure form 4 and the second predicate has the structure 1, 2, 3, 4. We propose the algorithm for generating the syntactic structure of the new sentence: in turn adds predicates describing semantic of lexicons into appropriate positions in the syntactic structure.

Algorithm 3: Generate the syntactic structure of the new Vietnamese sentence.

```

(i) Step 1: Consider index I1 or I2 appearing in both predicate.
    If is I1 Then
        Add predicate object associated with I1;           Add "là" (is);
        Add predicate object associated with I2;
    Else If is I2 Then
        Add predicate object associated with I2;           Add "là";
        Add predicate object associated with I1;
    End If
    Add "và" (and);
(ii) Step 2: Consider second predicate.
    If is predicate of intransitive or adjective Then
        If I1 taking subject role Then
            Add predicate object associated with I1; Add second predicate;
        Else If I2 taking subject role Then
            Add predicate object associated with I1; Add second predicate;
        Else If is predicate of transitive Then
            If I1 or I2 taking subject role Then
                Add second predicate; Add predicate object associated with I3;
            Else If I1 or I2 taking object role Then
                Add "được" (is - passive voice);   Add second predicate;
                Add "bởi" (by);           Add predicate object associated with I3;
            End If
        Else If is identical predicate Then
            Add "là" (is);   Add predicate object associated with I3;
        End If
    
```

Table 3. Modeled structure of semantic predicates of verb, adjective, identical

Form	Structure
1	<ul style="list-style-type: none"> • <code>p_transitive(I1, I2, content, verb, transitive)</code> ➔ Relationships: I1 is the subject of transitive verb <code>p_transitive</code>; I2 is the object of transitive verb <code>p_transitive</code>.
2	<ul style="list-style-type: none"> • <code>p_intransitive(I, content, verb, intransitive)</code> ➔ Relationships: I is the subject of intransitive verb <code>p_intransitive</code>.
3	<ul style="list-style-type: none"> • <code>p_adjective(I, content, adjective)</code> ➔ Relationships: I is the subject of adjective <code>p_adjective</code>.
4	<ul style="list-style-type: none"> • <code>I1 = I2</code> ➔ Relationships: I1 and I2 are identical.

In Table 4, we synthesize pairs of predicates and general syntactic structures of new Vietnamese sentences when applying Algorithm 3. We use the notation [I] to indicate the semantic predicate of the object associating to index I.

Applying the algorithm in [14] about replacing each component in the syntactic structure by the appropriate Vietnamese lexicon, we complete the new meaning-summarizing Vietnamese sentence. Ad an example, consider the paragraph having the DRS structure in Fig. 5, determined main predicates in Sect. 3.1, the syntactic structure and new complete Vietnamese sentence:

- The syntactic structure: `named(1, [tín], noun, proper) + “là” + nhà_thơ(2, [nhà, thơ], noun, common) + “và” + nhạy_cảm(1, [nhạy, cảm], adjective, property)`
- The complete Vietnamese sentence: “*Tín là nhà thơ và nhạy cảm*” (English: “*Tín is a poet and is sensitive.*”)

4 Experiment and Discussions

For testing, we collected 120 paragraphs in which the first sentence has the structure as in Table 1 and the second sentence has the structure as in Table 2. The experiment is performed through two phases: the first phase is to test determining the antecedent of the anaphoric pronoun and build the semantic representation structure; the second phase is to test generating the new meaning-summarizing Vietnamese sentence.

At the first experiment phase, the system determines antecedents for anaphoric pronouns and builds DRS structures for all 120 paragraphs. Analyzing the results, due to there is no impact of external factors of time or space, so the pronoun resolution for these paragraphs is suitable for proposed strategies in Sect. 2. There is a problem here with some pairs of sentences in which the first sentence does not have proper noun, and the proposed strategy in Sect. 2 is finding the object which is described by the noun standing at the subject role of copula “là” and is commonly accepted in reality. However, if the sentence structure is more complex and there are addition factors then the result may be not correct.

Table 4. Pairs of Predicates and Syntactic Structures of the New Sentences

Type	Pair of predicates
1	→ Structure form of each predicate: $I1 = I2; p_transitive(I1, I3)$ → Syntactic structure of the new Vietnamese sentence: $[I1] + "l\grave{a}" + [I2] + "v\grave{a}" + p_transitive(I1, I3) + [I3]$
2	→ Structure form of each predicate: $I1 = I2; p_transitive(I3, I1)$ → Syntactic structure of the new Vietnamese sentence: $[I1] + "l\grave{a}" + [I2] + "v\grave{a}" + "đ\grave{u}c" + p_transitive(I1, I3) + "b\grave{o}i" + [I3]$
3	→ Structure form of each predicate: $I1 = I2; p_transitive(I2, I3)$ → Syntactic structure of the new Vietnamese sentence: $[I2] + "l\grave{a}" + [I1] + "v\grave{a}" + p_transitive(I2, I3) + [I3]$
4	→ Structure form of each predicate: $I1 = I2; p_transitive(I3, I2)$ → Syntactic structure of the new Vietnamese sentence: $[I2] + "l\grave{a}" + [I1] + "v\grave{a}" + "đ\grave{u}c" + p_transitive(I3, I2) + "b\grave{o}i" + [I3]$
5	→ Structure form of each predicate: $I1 = I2; p_intransitive(I1)$ → Syntactic structure of the new Vietnamese sentence: $[I1] + "l\grave{a}" + [I2] + "v\grave{a}" + p_intransitive(I1)$
6	→ Structure form of each predicate: $I1 = I2; p_intransitive(I2)$ → Syntactic structure of the new Vietnamese sentence: $[I2] + "l\grave{a}" + [I1] + "v\grave{a}" + p_intransitive(I2)$
7	→ Structure form of each predicate: $I1 = I2; p_adjective(I1)$ → Syntactic structure of the new Vietnamese sentence: $[I1] + "l\grave{a}" + [I2] + "v\grave{a}" + p_adjective(I1)$
8	→ Structure form of each predicate: $I1 = I2; p_adjective(I2)$ → Syntactic structure of the new Vietnamese sentence: $[I2] + "l\grave{a}" + [I1] + "v\grave{a}" + p_adjective(I2)$
9	→ Structure form of each predicate: $I1 = I2; I1 = I3$ → Syntactic structure of the new Vietnamese sentence: $[I1] + "l\grave{a}" + [I2] + "v\grave{a}" + "l\grave{a}" + [I3]$
10	→ Structure form of each predicate: $I1 = I2; I2 = I3$ → Syntactic structure of the new Vietnamese sentence: $[I2] + "l\grave{a}" + [I1] + "v\grave{a}" + "l\grave{a}" + [I3]$

At the second experiment phase, the system generates 120 new Vietnamese sentences for 120 DRS structures. Analyzing the results, these new Vietnamese sentences satisfy two main requirements: having the grammatically correct structure in Vietnamese; and having the content that summarizes the meaning of the original paragraph. However, we point out that there are two issues here:

- Following the new approach, the new Vietnamese sentence is generated based on the DRS structure which is built from the source pair of Vietnamese sentences. This leads to if the anaphoric pronoun resolution is not totally correct and thus the DRS

structure does not exactly represent the meaning of the paragraph, then the new Vietnamese sentence does not have accurate content.

- With Algorithm 3 generating the syntactic structure, there are some generated Vietnamese sentences are not totally natural, in the sense of commonly using, in the common Vietnamese communication.

Moreover, we see that can continue to extend the research to apply for paragraphs having more complex structure or composing more than two sentences.

5 Conclusion

We presented in this paper some changes and improvements in comparison with [12] to resolve some ambiguity in determining antecedents for anaphoric human pronouns in paragraphs composing two Vietnamese sentences which have the structure presented in section Introduction. We also presented steps in the phase that generates the new meaning-summarizing Vietnamese sentences with modeling the structure of pairs of predicates corresponding to each sentential pair and the general syntactic structure of each form of new Vietnamese sentence.

The experiment shows that with presented techniques based on the new approach, the generated Vietnamese sentences satisfied the given requirements. We also pointed out some limitations. These limitations will be objectives in our next researches.

References

1. Das, D., Martins, A.F.T.: A survey on automatic text summarization. Language Technologies Institute, Carnegie Mellon University (2007)
2. Lloret, E.: Text summarization: an overview, paper supported by the Spanish Government under the project TEXT-MESS (TIN2006-15265-C06-01) (2008)
3. Reiter, E., Dale, R.: Building Natural Language Generation System. Cambridge University Press, Cambridge (1997)
4. Kamp, H.: A theory of truth and semantic representation. In: Groenendijk, J., Janssen, T.M. V., Stokhof, M. (eds.) *Formal Methods in the Study of Language, Part 1*, pp. 277–322. Mathematical Centre Tracts, Amsterdam (1981)
5. Mani, I., Maybury, M.T.: *Advances in Automatic Text Summarization*. MIT Press, Cambridge (1999)
6. Jezek, K., Steinberger, J.: Automatic text summarization. In: Snasel, V. (ed.): *Znalosti 2008, FIIT STU Bratislava, Ustav Informatiky a softveroveho inzinierstva*, pp. 1–12 (2008). ISBN 978-80-227-2827-0
7. Jones, K.S.: *Automatic summarising: a review and discussion of the state of the art*, Technical Report 679, Computer Laboratory, University of Cambridge (2007)
8. Covington, M.A.: *GULP 4: An Extension of Prolog for Unification Based Grammar*. Research Report number: AI-1994-06. USA: Artificial Intelligence Center, The University of Georgia (2007)

9. Covington, M.A., Schmitz, N.: An Implementation of Discourse Representation Theory. ACMC Research Report number: 01-0023. Advanced Computational Methods Center, The University of Georgia (1989)
10. Covington, M.A., Nute, D., Schmitz, N., Goodman, D.: From English to Prolog via Discourse Representation Theory. ACMC Research Report number: 01-0024. Advanced Computational Methods Center, University of Georgia (1988)
11. Blackburn, P., Bos, J.: Representation and Inference for Natural Language. Working with Discourse Representation Structures, vol. II. Department of Computational Linguistics, University of Saarland, Germany (1999)
12. Tran, T., Nguyen, D.T.: A solution for resolving inter-sentential anaphoric pronouns for vietnamese paragraphs composing two single sentences. In: Proceedings of the 5th International Conference of Soft Computing and Pattern Recognition (SoCPaR 2013), Hanoi, Vietnam, pp. 172–177 (2013)
13. Tran, T., Nguyen, D.T.: Merging two vietnamese sentences related by inter-sentential anaphoric pronouns for summarizing. In: Proceedings of The 1st NAFOSTED Conference on Information and Computer Science, Hanoi, Vietnam, pp. 371–381 (2014)
14. Tran, T., Nguyen, D.T.: Semantic predicative analysis for resolving some cases of ambiguous referents of pronoun “Nó” in summarizing meaning of two vietnamese sentences. In: Proceedings of UKSim-AMSS 17th International Conference on Computer Modelling and Simulation (UKSim2015), Cambridge, UK, pp. 340–345 (2015)