2017

A Lattice Theoretic Look: A Negated Approach to Adjectival (Intersective, Neutrosophic and Private) Phrases

Florentin Smarandache
University of New Mexico, smarand@unm.edu

Selcuk Topal

Selçuk Topal and Florentin Smarandache

Bitlis Eren University
Turkey

University of New Mexico
USA

A Lattice Theoretic Look: A Negated Approach to Adjectival (Intersective, Neutrosophic and Private) Phrases

Neutrosophic Set and Logic in Intelligent Systems

NSLIS 2017

Motivation

- Lattice theory, is a powerful tool of many areas such as linguistics, chemistry, physics, and information science.
- Especially, with a set theoretical view, lattice applications of mathematical models in linguistics are a common occurrence.
- The concept “Lattices of phrases” is one of the main work discipline in Linguistics which provides investigation of mathematical models of phrases.

Neutrosophy

- Introduced by Smarandache, mathematically, it presents a system which is an extension of fuzzy systems.

- Neutrosophy considers an entity, "*A*" in relation to its opposite, "*anti - A*" and that which is not *A*, "*non - A*", and that which is neither "*A*" nor "*anti - A*", denoted by "*neut - A*".

Phrases As Sets

Phrases such as “red cars” can be interpreted the intersection of the set of *red things* with the set of *cars* and get the set of “red cars”.

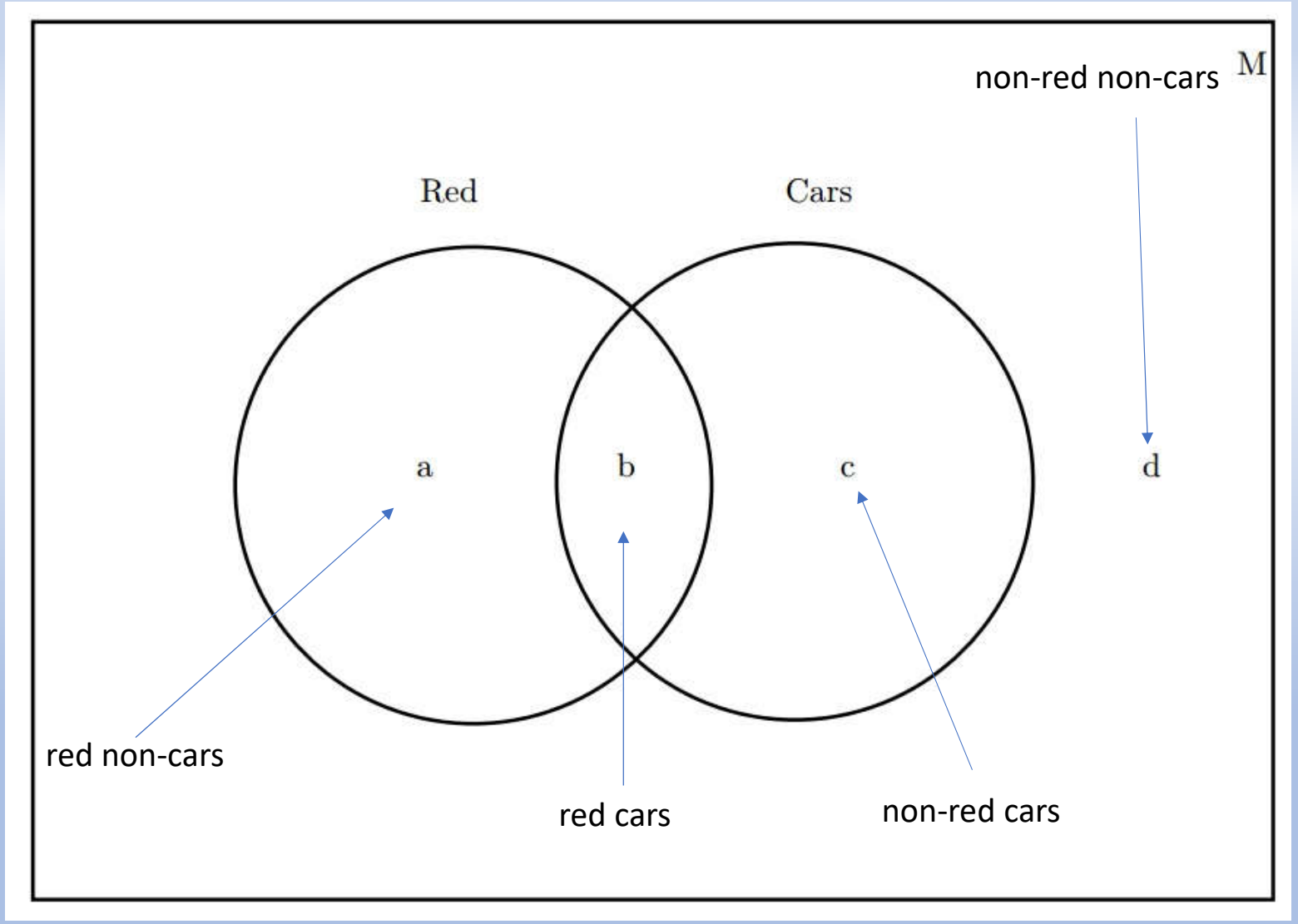
In the sense of model-theoretic semantics, the interpretation of a phrase such as *red cars* will be the intersection of the interpretation of *cars* with a set of *red individuals.*

Negating Intersective Adjectival Pharases

Here, we have four phrase forms:

red cars red non-cars non-red cars non-red non-cars

Figure 1


M
non-red non-cars
Red
Cars
a
b
c
d
red non-cars
red cars
non-red cars

Lattice Structure

- A lattice is an algebraic structure that consists of a partially ordered set in which every two elements have **a unique supremum** (a least upper bound or join) and **a unique infimum** (a greatest lower bound or meet)

- The most classical example is on sets by interpreting set intersection as meet and union as join. For any set *A*, the power set of *A* can be ordered via subset inclusion to obtain a lattice bounded by *A* and the empty set.

- We define a binary set operator $\cup^*$ for our languages as the follow: Let *S* be a set of sets and *A, B in S*.

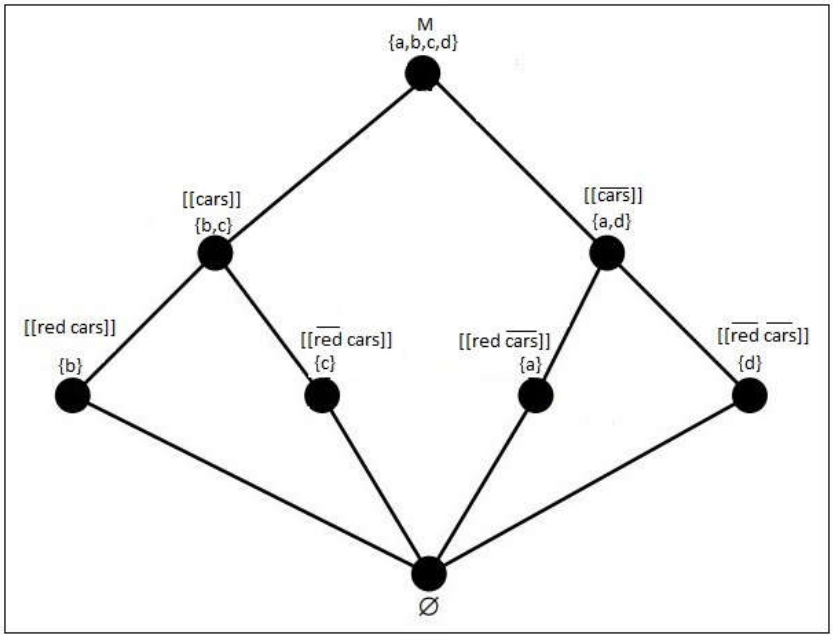
- *A* $\cup^*$ B = C if and only if *C* is the smallest set which includes both *A* and *B*, and also *C in S*.

- We define a partial order $\leq$ on sets as follows:

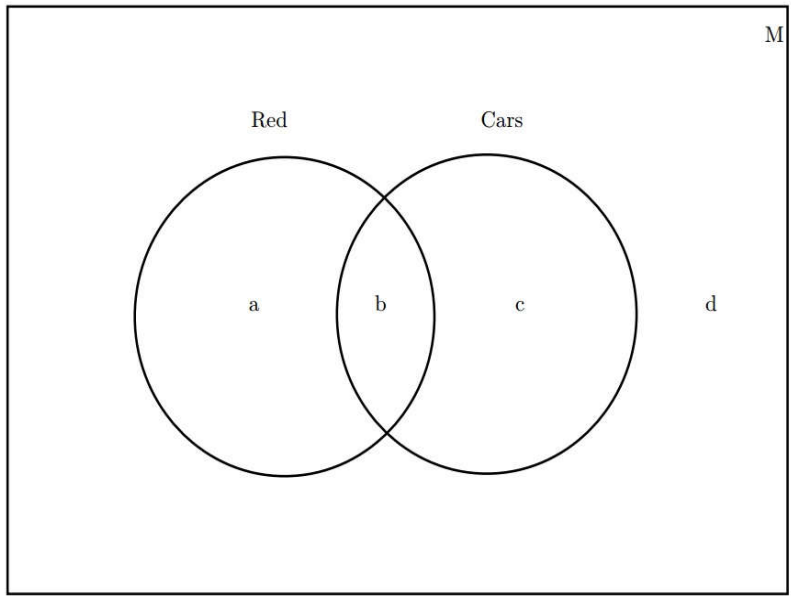
  - $A \leq B$ if and only if $B = A \cup^* B$

  - $A \leq B$ if and only if $A = A \cap B$

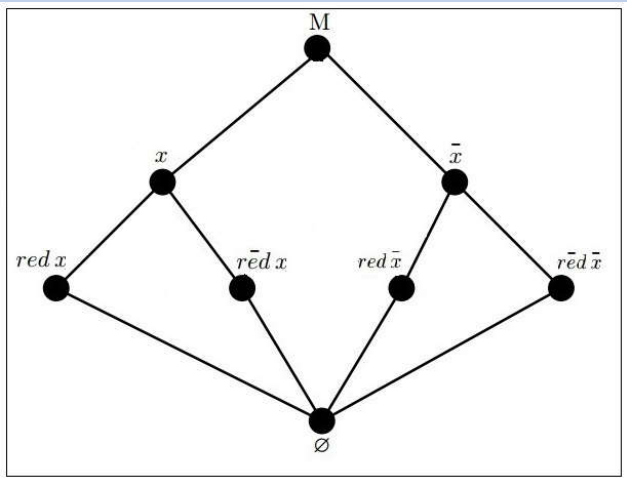
$\cap$ is the usual intersection



The interpretation of the set



The lattice form



The Extension of The Lattice By Neutrosophy

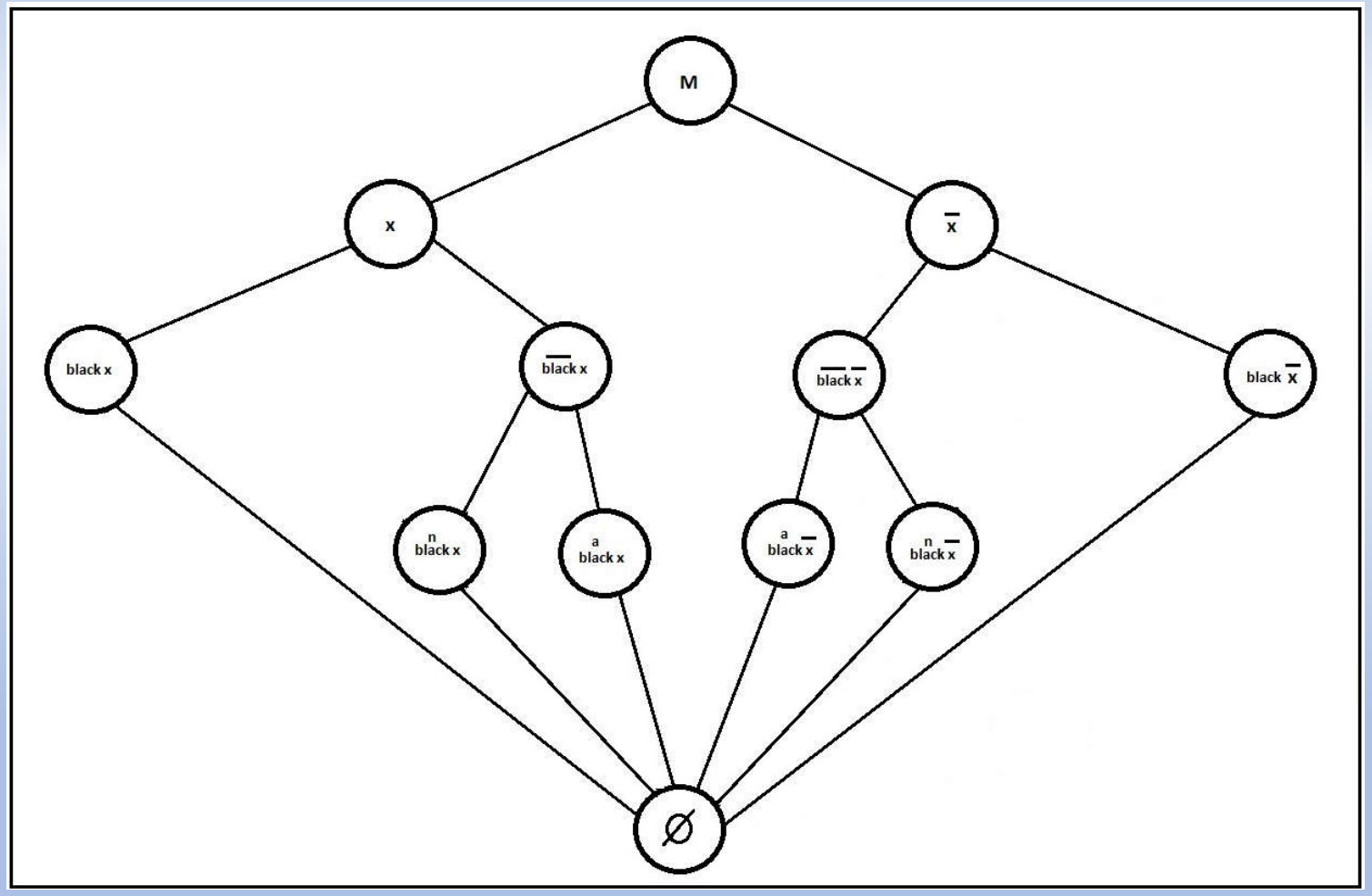
Here, we have four phrase forms:

black cars black non-cars non-black cars non-black non-cars

→ neut-black cars anti-black cars (white cars)

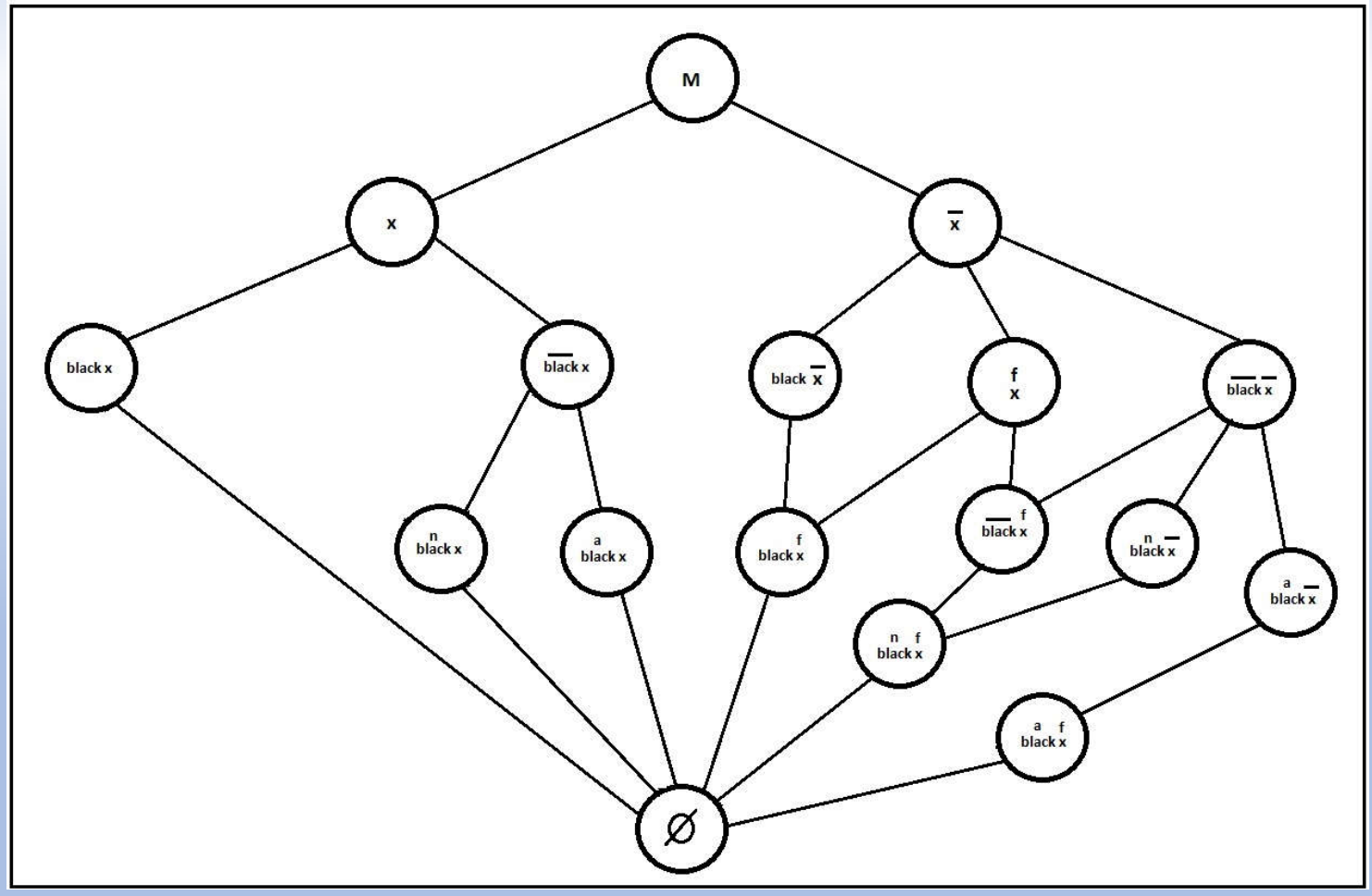
→ neut-black non-cars anti-black non-cars (white non-cars)

The Extended Lattice by Neutrosophy



* x for nouns (cars)

Adding ‘fake’ ,
fake x is a subset of non-x



Conclusion

- In this talk,
- we have proposed some new negated versions of set and model theoretical semantics of intersective adjectival phrases (plural).
- After we first have obtained a lattice structure *by negated phrases*, two lattices have been built from the proposed phrases by adding ‘neut’, ‘anti’ and ‘fake’ step by step.

Open Questions

- It might be interesting that lattices in this paper can be extended with incorporating coordinates such as *light red cars* and *dark red cars*.
- One might work on algebraic properties as filters and ideals of the lattices considering the languages.
- Some decidable logics might be investigated by extending syllogistic logics with the phrases.
- Another possible work in future, this idea can be extended to complex neutrosophic set, bipolar neutrosophic set, interval neutrosophic set.

Hopefully

linguists, computer scientists and logicians might be

interested in results in this paper and the results will help with other

results in several areas.

References(1)

- [1] L. S. Moss, *Natural logic and semantics*. In Logic, Language and Meaning (pp. 84-93), Springer Berlin Heidelberg, 2010
- [2] J. F. van Benthem, A brief history of natural logic, College Publications, 2008.
- [3] F. Smarandache, *A Unifying Field in Logics: Neutrosophic Logic. Neutrosophy, Neutrosophic Set, Neutrosophic Probability: Neutrsophic Logic. Neutrosophy, Neutrosophic Set, Neutrosophic Probability. Infinite Study*, 2005.
- [4] F. Smarandache, *Matter, antimatter, and unmatter*. CDS-CERN (pp. 173- 177). EXT-2005-142, 2004.
- [5] F. Smarandache, *Neutrosophic Actions, Prevalence Order, Refinement of Neutrosophic Entities, and Neutrosophic Literal Logical Operators*, A Publication of Society for Mathematics of Uncertainty, 11, Volum 10, pp. 102-107, 2015.
- [6] F. Smarandache, *Neutrosophy: Neutrosophic Probability, Set, and Logic: Analytic Synthesis & Synthetic Analysis*, 1998.
- [7] E. L. Keenan and L. M. Faltz, *Boolean semantics for natural language*, Vol. 23, Springer Science & Business Media, 2012.
- [8] Y. Winter and J. Zwarts, *On the event semantics of nominals and adjectives: The one argument hypothesis*, Proccedings fo Sinn and Bedeutung, 16, 2012.

References(2)

- [9] F. Roelofsen, *Algebraic foundations for the semantic treatment of inquisitive content*, Synthese, 190(1), 79-102, 2013.
- [10] L. Champollion, *Ten men and women got married today: Noun coordination and the intersective theory of conjunction*, Journal of Semantics, ffv008, 2015.
- [11] G. M. Hardegree, *Symbolic logic: A first course*, McGraw-Hill, 1994.
- [12] B. A. Davey and H. A. Priestley, *Introduction to lattices and order*, Cambridge University Press, 2002.
- [13] H. Uchida and N. L. Cassimatis, *Quantifiers as Terms and Lattice-Based Semantics*, 2014.
- [14] S. Chatzikyriakidis and Z. Luo, *Adjectives in a modern type-theoretical setting*, In Formal Grammar, Springer Berlin Heidelberg, 159-174, 2013.
- [15] B. Partee, *Compositionality and coercion in semantics: The dynamics of adjective meaning*, Cognitive foundations of interpretation, 145-161, 2007.

References(3)

- [16] P. C. Hoffher and O. Matushansky, *Adjectives: formal analyses in syntax and semantics*, Vol. 153, John Benjamins Publishing, 2010.

- [17] M. Ali, and F. Smarandache, *Complex Neutrosophic Set, Neural Computing and Applications*, Vol. 25, (2016),1-18. DOI: 10.1007/s00521-015-2154-y.
- [18] I. Deli, M. Ali, and F. Smarandache, Bipolar Neutrosophic Sets And Their Application Based On Multi-Criteria Decision Making Problems. (Proceeding of the 2015 International Conference on Advanced MechatronicSystems, Beijing, China, August 22-24, 2015. IEEE Xplore, DOI: 10.1109/ICAMechS.2015.7287068.
- [19] M. Ali, I. Deli, F. Smarandache, The Theory of Neutrosophic Cubic Sets and Their Applications in Pattern Recognition, Journal of Intelligent and Fuzzy Systems, vol. 30, no. 4, pp. 1957-1963, 2016, DOI:10.3233/IFS- 151906.
- [20] N. D. Thanh, M. Ali, L. H. Son, A Novel Clustering Algorithm on Neutrosophic Recommender System for Medical Diagnosis, Cognitive Computation. 2017, pp 1-19, 10.1007/s12559-017-9462-8

Thank you,

Any question?