Introduction

Roussanka Loukanova¹ · Michael Moortgat²

Published online: 1 June 2019
© Springer Nature B.V. 2019

This Special Issue of the Journal of Logic, Language and Information is a collection of articles based on presentations and discussions at the first edition of the workshop on Logic and Algorithms in Computational Linguistics 2017 (LACompLing2017), which took place at the Department of Mathematics, Stockholm University, August 16–19, 2017.

Computational linguistics studies natural language in its various manifestations from a computational point of view, both on the theoretical level and on the practical level. Theoretical work has been investigating and modeling grammar modules that deal with natural language form and meaning, and the relation between these two. Practical work has been on developing applications for language and speech technology.

Right from the start in the 1950ties, there have been strong links between computer science, logic, and many other areas of mathematics—one can think of Chomsky’s contributions to the theory of formal languages and automata, or Lambek’s logical modeling of natural language syntax.

LACompLing2017 brought together researchers from different communities to discuss the place of logic, mathematics, and computer science in present day computational linguistics. This special issue is a collection of articles that evolved from the workshop.

Construction-Based Compositional Grammar, by Lars Hellan The article is on a system for construction of grammar classifications by multiple layers of specification, in particular, grammatical functions, grammatically reflected actants, and lexical semantics, along with a compositional system of sign combination. The combinatorial medium is between a construction perspective and a valence perspective. The system uses a feature structure formalism, as in Head-Driven Phrase Structure Grammar

✉ Roussanka Loukanova
rloukanova@gmail.com
Michael Moortgat
M.J.Moortgat@uu.nl

¹ Stockholm University, Stockholm, Sweden

² Utrecht University, Utrecht, The Netherlands

(HPSG), by employing essential elements from Lexical Functional Grammar (LFG). It is based on large scale HPSG grammars. The essence is in compact construction specifications, according to valence frames, across languages. Grammatical functions are essential and they are presented by the system in a unified way.

Representing Types as Neural Events, by Robin Cooper Type Theory with Records (TTR) can be used to model types learned by agents in order to classify objects and events in the world, including speech events. In TTR, the types can be represented by patterns of neural activation in the brain. They represent a finite network of neurons. The paper discusses how to represent types in terms of neural events on a network. It presents a preliminary computational implementation that maps types to events on a network.

On Involutive Nonassociative Lambek Calculus, by Wojciech Buszkowski Involutive Nonassociative Lambek Calculus (InNL) is a version of Noncommutative Multiplicative Linear Logic (MLL) without admission of multiplicative constants. InNL adds two linear negations to Nonassociative Lambek Calculus (NL), resulting in a strongly conservative extension of NL. This article also adds unary modalities satisfying the residuation law and De Morgan laws to InNL, and studies the resulting logic InNLm. It investigates auxiliary systems InNLm(k) having the k-cyclic law for negation. The provability in InNLm is reduced to that in InNLm(k), which provides equivalence properties.

Parsing/Theorem-Proving for Logical Grammar CatLog3, by Glyn Morrill *CatLog3* is a Prolog parser/theorem-prover for a lexicalist, logical categorial grammar. *CatLog3* has a fixed, invariant logical calculus, which provides the syntax of a language. The system qualifies an expression over a given, lexical dictionary, as being grammatical if and only if a corresponding logical statement is a theorem in the calculus. The implementation is based on the principles of Andreoli's focusing and a generalisation of van Benthem's count-invariance. The article surveys these principles.

NL_λ as the logic of scope and movement, by Chris Barker The system NL_λ extends the classic Lambek Calculus (NL) by adding an inference rule "abstraction". This rule is like the linguistic rule of Quantifier Raising. It covers both semantic scope taking and syntactic displacement. The article argues that NL_λ is a legitimate substructural logic. NL_λ supports cut elimination, has an interpolation result, and is decidable. NL_λ is sound and complete with respect to the usual class of relational frames.

Inverse Linking, Possessive Weak Definites and Haddock Descriptions: A Unified Dependent Type Account, by Justyna Grudzińska and Marek Zawadowski The authors assume that the considered three kinds of interpretations, of certain expressions of natural language, share the same surface structure. The authors propose a compositional analysis of the shared structure, by using particular dependent types. The claim is that the analysis provides an answer to the question of why inversely linked and weak definite readings are blocked by certain prepositions, while Haddock-type readings are not.

Variable Handling and Compositionality: Comparing DRT and DTS, by Yukiko Yana, Koji Mineshima, and Daisuke Bekki The article gives a comparison between two of

the existing frameworks for discourse semantics, namely Discourse Representation Theory (DRT) and Dependent Type Semantics (DTS). The authors argue that DRT and DTS differ with respect to their operations on variables, specifically on how substitution and other operations on variables are defined in DRT and DTS, respectively.

Natural Language Semantics and Computability, by Richard Moot and Christian Retoré The article provides an overview of computability of the logical models and algorithms currently used for natural language semantics, within the class of type-logical grammars. The authors take a definition of semantics of natural language, with respect to a given grammar, as a function that maps any grammatical sentence to a non-empty set of logical formulas, with each formula corresponding to one of its readings. They state that, by refraining from computations of the interpretations in the possible world models, the semantic representations of a given statement expressed by a grammatical sentence, including lexical meaning for it, can be computed.

Combining Machine Learning and Semantic Features in the Classification of Corporate Disclosures, by Stefan Evert et al. The article investigates an approach of improving statistical text classification, by combining machine learners with an ontology-based categorisation of topics in a specific domain. The approach is based on a combination of natural language parsing with a formal ontology considered as a semantic domain. The study is in the specific domain of disclosures by public companies that affect stock price. The ontology classifies disclosures concerning particular topics from a prescribed list. The analysis identifies some of these topics with reasonable accuracy. The article demonstrates that machine learners improve when combined with ontology.

A Type-Driven Vector Semantics for Ellipsis with Anaphora using Lambek Calculus with Limited Contraction, by Gijs Wijnholds and Mehrnoosh Sadrzadeh The paper provides a vector space semantics for verb phrase ellipsis with anaphora using type-driven compositional distributional semantics based on Jäger's extended Lambek calculus with limited contraction. Interpretation is mediated via vector interpretable lambda terms associated with syntactic derivations. Sentence meaning is seen as a program that allows for non-linear copying of word meanings. The theoretical model is complemented by experimental evaluation.

Boon or Burden? The Role of Compositional Meaning in Figurative Language Processing and Acquisition, by Mila Vulchanova et al. The article investigates current theories of figurative language, by focusing on the roles of literal and compositional meaning. The hypothesis is that, depending on multiple factors, compositional meaning may either facilitate or impede intended figurative meaning. The hypothesis has support from a case study of processing and acquisition of figurative expressions, which compares highly verbal individuals with autism spectrum disorder (ASD) with neuro-typical individuals. The conclusion is that specific importance is given to the expression's decomposability and to the strength of semantic relations between the compositional and figurative meanings.

Publisher's Note Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.