Computational Hermeneutics: Using Automated Reasoning for the Logical Analysis of Natural-Language Arguments

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While there have been major advances in automated deduction during the last years, its main field of application has mostly remained bound to mathematics and hardware/software verification. We argue that its application in philosophy can also be very fruitful, not only because of the obvious quantitative advantages of automated reasoning (e.g. reducing by several orders of magnitude the time needed to test some argument's validity), but also because it enables a novel approach to the logical analysis of arguments, which we call *computational hermeneutics* [3]. In this project, we want to explore the computer-supported application of formal logic (using automated theorem provers and model finders) to issues in philosophy concerned with: (i) the methodical evaluation (logic as *ars iudicandi*) and interpretation (logic as *ars explanandi*) of arguments and, building upon this, we want to tackle (ii) the problem of formalization: how to search *methodically* for the most appropriate logical form(s) of a given natural-language argument, by casting its individual statements into expressions of some sufficiently expressive logic (classical or non-classical).

The proposed approach draws its inspiration from work in the philosophy of language such as Donald Davidson's theory of *radical interpretation* [2] and contemporary so-called *inferentialist* theories of meaning [1], which do justice to the inherent circularity of linguistic understanding: the whole is understood (compositionally) on the basis of its parts, while each part is understood only in the (inferential) context of the whole. *Computational hermeneutics* is thus a holistic, iterative, trial-and-error enterprise, where we evaluate the adequacy of some candidate formalization of a sentence by computing the logical validity of the whole argument [4]. We start with formalizations of some simple statements (taking them as tentative) and use them as stepping stones on the way to the formalization of other argument's sentences, repeating the procedure until arriving at a state of *reflective equilibrium*: A state where our beliefs have the highest degree of coherence and acceptability.

The main touchstone for the validity of the gained insights will be the implementation of a software system, whose main functionality will be automated logical analysis: accepting an argument in natural-language as input and generating as output its most appropriate formalization (under consideration of different logics in view of some well-defined criteria). This software will interface and cooperate with other existing systems and technologies such as software for linguistic analysis and text mining/analytics, automated theorem provers (e.g. Leo-III, Satallax, Vampire) and interactive proof assistants (e.g. Isabelle, Coq). Further applications in areas like knowledge/ontology extraction, semantic web and legal informatics are currently being contemplated.

References

1. R. B. Brandom. *Making It Explicit: Reasoning, Representing, and Discursive Commitment.* Harvard University Press, 1994.
2. D. Davidson. *Inquiries into Truth and Interpretation: Philosophical Essays*, volume 2. Oxford University Press, 2001.
3. D. Fuenmayor and C. Benzmüller. A case study on computational hermeneutics: E. J. Lowe's modal ontological argument. *Journal of Applied Logic (special issue on Formal Approaches to the Ontological Argument)*, 2018. To appear.
4. J. Peregrin and V. Svoboda. *Reflective Equilibrium and the Principles of Logical Analysis: Understanding the Laws of Logic.* Routledge Studies in Contemporary Philosophy. Taylor and Francis, 2017.