Karlsruher Institut für Technologie

Institut für Theoretische Informatik (ITI)
Anwendungsorientierte Formale Verifikation
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Masterarbeit – Praxis der Forschung

A Component-Based Approach to the Property-Oriented Design of Voting Rules

Background. Voting rules are algorithms to aggregate multiple individual decisions (e.g., for electing a parliament) into one election outcome. They aim to establish trust in an election process by balancing a variety of desiderata such as, e.g., proportionality and majority representation. Most voting rules are designed to satisfy many of them, but experiences show that errors are easy to make, see e.g., the changed German federal elections 2013 to comply with the German constitution. Social choice theory defined many such requirements in “axiomatic properties“.

Goal. The goal of this work is to identify and analyse voting rules for core components, e.g., some elimination mechanism in a round-based voting rule, or some mechanism to resolve ties between candidates, etc, which enable a property-oriented construction of voting rules. The resulting component library should enable the user to construct her own voting rule, knowing that already some specified properties are guaranteed by the underlying components. The vision of this library is to support the development of voting rules which guarantee a high level of trust by construction without the need to re-check the whole voting rule.

Profile. (1) Interest and solid knowledge in formal languages and formal methods. **(2)** Good abstraction capability and ability to work systematically. **(3)** Motivation to work in a theoretical field of current research.

References. (1) Y. Chevaleyre, U. Endriss, J. Lang, and N. Maudet. A Short Introduction to Computational Social Choice. SOFSEM 2007. (`http://www.cril.univ-artois.fr/~konieczny/IAF07/slides_synthese/sofsem07.pdf`)
(2) B. Beckert, T. Bormer, M. Kirsten, T. Neuber, and M. Ulbrich. Automated Verification for Functional and Relational Properties of Voting Rules. COMSOC 2016.
(`https://www.irit.fr/COMSOC-2016/proceedings/BeckertEtAlCOMSOC2016.pdf`) **(3)** L. Xia, J. Lang, and M. Ying. Strongly Decomposable Voting Rules on Multiattribute Domains. AAAI 2007. (`http://www.aaai.org/Papers/AAAI/2007/AAAI07-123.pdf`)

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