Informatik-Kolloquium

Fachgruppe Informatik

Lehrstuhl Informatik 2

RHEINISCH-WESTFÄLISCHE TECHNISCHE HOCHSCHULE AACHEN

EINLADUNG

Zeit: Montag, 20.06.2011, 14.30 Uhr

Ort: AH 2, Ahornstr. 55

Referentin: Frau Prof. Dr. Nicole Schweikardt,
Goethe-Universität Frankfurt am Main

Titel: On the expressive power of invariant logics

Abstract:

Many natural problems in computer science concern structures like graphs or databases where elements of the structure are not inherently ordered, and thus expose certain symmetries under which problems or queries of interest are invariant. For example, when restricting attention to graphs, properties of interest (such as connectivity, existence of a perfect matching, existence of a Hamiltonian cycle, etc.) are closed under isomorphism; i.e., if a graph G has a particular property, then all isomorphic copies of G have this property.

When considering logical definability of properties or queries, closure under isomorphisms usually comes for free. Thus, graph properties can be specified in a straightforward way by formulas of a given logic (such as, e.g., first-order logic FO or least fixed-point logic LFP) over the signature of graphs. But plain FO and LFP are well-known to be too weak for expressing computationally simple properties like, e.g., properties dealing with the size of a graph (i.e., its number of nodes or edges).

One way of enhancing the expressive power of a logic is to add predicates for linear order and arithmetic, and to allow formulas to use these predicates. To achieve closure under isomorphisms, however, one wants the formulas to be invariant under the particular interpretation of these predicates. For example, order-invariant formulas are formulas for which the following is true: If a structure satisfies the formula with one particular linear order, then it satisfies the formula with any linear order. From the Immerman-Vardi Theorem it follows that the polynomial time computable graph properties are precisely captured by order-invariant LFP. Similarly, arithmetic-invariant LFP and arithmetic-invariant FO precisely capture the graph properties that belong to the complexity classes P/poly and AC0, respectively.

However, Trakhtenbrot's Theorem implies that it is impossible to automatically check if a given formula is order- or arithmetic invariant. Thus, invariant logics are not "logics" in the strict formal sense, as they do not have a decidable syntax.

In this talk I want to give an overview of the state-of-the-art concerning invariant logics, including results on their expressive power and on decidable characterisations on restricted classes of structures.

Es laden ein: Die Dozenten der Informatik