On Bridges in Transition Graphs for Finite Automata

Martin Tomko
xtomko02@stud.fit.vutbr.cz

Each finite automaton has a corresponding transition graph which can be examined using graph-theoretic approaches. One interesting graph-theoretic notion to consider is the concept of *bridges* – edges whose removal would split a continuous graph into two unconnected components. We can then divide the entire graph into bridgeless components connected by bridges, called *islands* (roughly corresponding to biconnected components of three or more vertices, except in edge cases).

In the first part of my presentation, I will introduce these concepts and show that we can add or merge islands arbitrarily by adding redundant states and transitions without changing the language accepted by the finite automaton, concluding that the class of languages accepted by n-bridge finite automata is equivalent to the class of regular languages. Furthermore, I will show that if we consider generalized finite automata, that is, automata which can read entire strings in a single transition, the class of languages still remains unchanged for any given n.

In the second part of my presentation, I will introduce the concept of *even computations* – computations of n-bridge finite automata, in which the same number of computation steps is performed in each island of the transition graph. Unlike with unrestricted computations, this leads to an infinite hierarchy of language classes corresponding to the language classes of n-parallel right-linear grammars for both ordinary and generalized finite automata.