Modified Subset Construction Algorithm for Finite Automata

Mirzakhmet Syzdykov

mspmail598@gmail.com

Satbayev University, Almaty, Kazakhstan

ABSTRACT

We propose the evolutionary algorithm for subset construction which superceeds previous known result due to Rabin and Scott.

ALGORITHM

We estimate the complexity of our algorithm as O(2^n / log(n)) and prove that it's most optimal rather than the algorithm proposed by Rabin and Scott which is O(2^n) in complexity and other known algorithms.

APPLICATION OF PQI-MODEL

In we have developed the overridden model for the modified subset construction which is relevant to the reduced cost of computation, thus, giving better results.

We have also developed the Java application package “Regex+” for the extended regular expressions.

The PQI-model in this package is successfully implemented via overridden PQI-operator and tagging rules giving the correct results for all the test cases provided within.

The implemented solution isn't, thus, recursive and combinatorially measured resulting to the class of effective algorithms where NP-completeness is avoided – this fact conventionally holds true for better evaluation, as we can represent the typical finite state machine as a neural network for the type of graph structures.

However, this graph structure is specific and, as described before, has the different and complex notation rather than typical finite state automatons – we will call these state of automatons as PQI, or PQI-automata along the provided and evaluated empirical results.

The proof was given also in prior works for the extended operators in regular expression and corresponding finite state automaton, as this proof is essential in giving the definition of PQI-operator and, similarly, PQI-model, which are different from the point of view of estimation and measurement and vice-versa of the practical experience.

In turn, the product construction machines, which where studied in modern works, give not quadratic, but exponential growth for the number of states in the resulting deterministic automaton – however, with our introduction and concept of PQI-operator we obtain results which are minimalistic which can be proven from the facts provided in the equlibria (1)–(14).

More facts about the evaluation of this empirical and proved model show our interest in developing even mobile-aware applications which can be obtained from author of this work by request.

For better discussion of the presented PQI-model we can state that P versus NP problem, which is still an open question, can be reduced to the empirical PQI-model and give the linear growth reduction of the exponentially growing complexity.

IN-DEPTH STUDY

In this section the graphical plot of PQI-operator for the variety of combinatorial functions which are not limited to factorial and power-set.

These graphical plots from the initial values show that, the PQI-operator still is less relevant to the combinatorial function derivatives – thus, to be more proper, it's non-convergent and is equally convergent along the size of input data when they are limited to infinity.

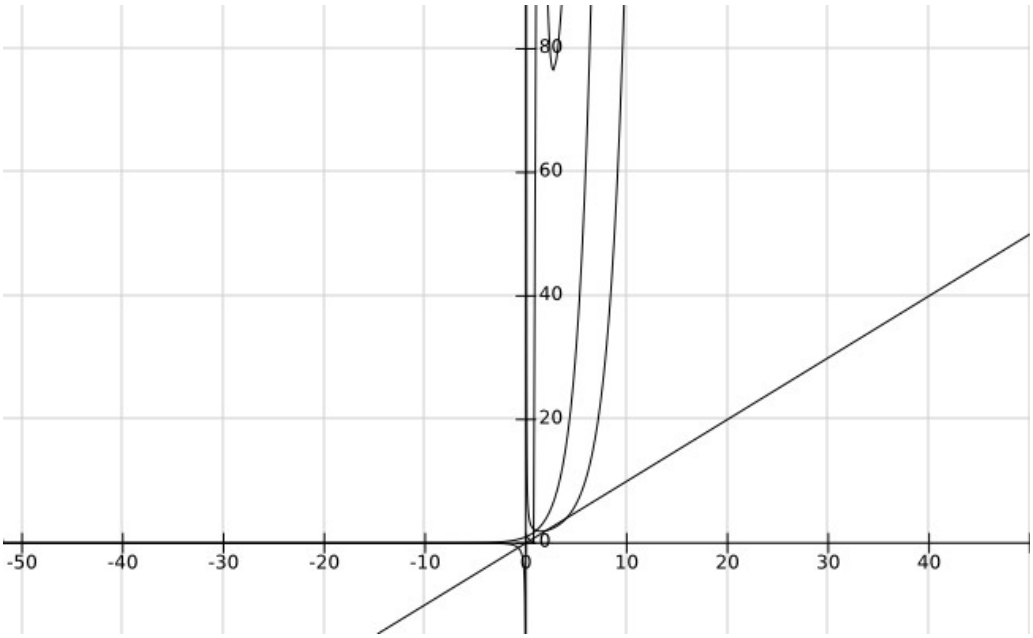

Figure 1 – Graphical plot of PQI-functions

From figure (1) it's seen that PQI-operator is expanding slower than exponential function and, thus, it's reducing to almost linear function O(n).

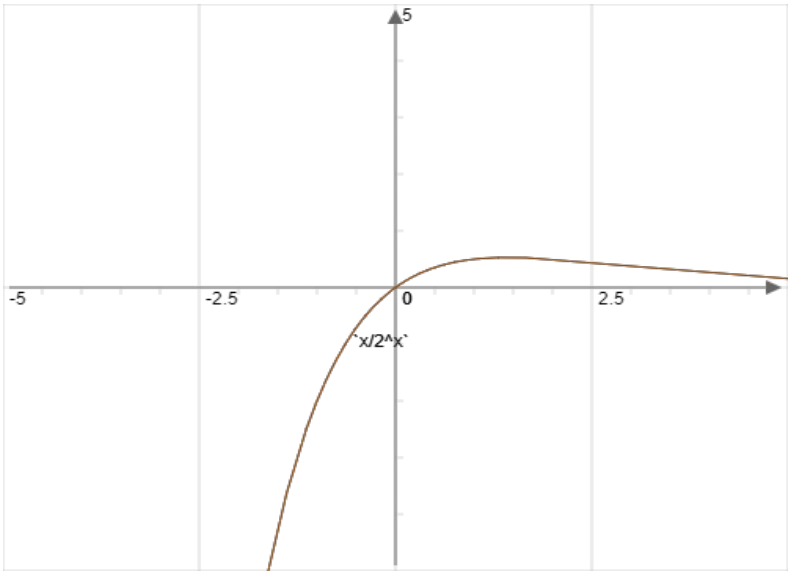

Figure 2 – Graphical plot of PQI-function

REFERENCES

Rabin M. O., Scott D. Finite automata and their decision problems //IBM journal of research and development. – 1959. – Т. 3. – №. 2. – С. 114-125.

Syzdykov M. et al. Membership Problem in Non-deterministic Finite Automata for Extended Regular Expressions in Linear Polynomial Time //ADVANCED TECHNOLOGIES AND COMPUTER SCIENCE. – 2021. – №. 4. – С. 14-17.

Syzdykov M. et al. Extended Regular Expressions in Finite Automata Revisited //ADVANCED TECHNOLOGIES AND COMPUTER SCIENCE. – 2022. – №. 1. – С. 4-7.

Berry G., Sethi R. From regular expressions to deterministic automata //Theoretical computer science. – 1986. – Т. 48. – С. 117-126.

Syzdykov M. Algorithm to Generate DFA for AND-operator in Regular Expression //International Journal of Computer Applications. – 2015. – Т. 124. – №. 8.

Thompson K. Programming techniques: Regular expression search algorithm //Communications of the ACM. – 1968. – Т. 11. – №. 6. – С. 419-422.