On Equivalence of Tractable and Non-polynomial Classes of Complexity

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ABSTRACT

In this preamble we give the full diversification towards our methods applied to the universality of non-deterministic finite automatons with respect to the question of equivalence of complexity classes like tractable, or polynomial, and non-tractable, or non-polynomial – the study goes deep into what wasn't reconsidered before according to the pattern matching within extended operators like intersection, subtraction and complement: the latter gives the full power of our automaton construction and method of validation which, in turn, leads to the "Time hierarchy theorem" collapse.

Keywords: P versus NP, EXPTIME, P, NP, equivalence, proof.

INTRODUCTION

The long-standing question and theorem is due to Stephen Cook [1], which states if the solution for non-polynomial problem can be verified and solved in both polynomial times, the past research also showed that P-class problem cannot be within the exponential one simultaneously, EXPTIME [2] – we will show that this is a common assumption without the existence of the correctable methodology [3] for extended regular expression matching with subtraction which requires determinization in exponential time $O(2^n)$, where n is the length of the automaton or corresponding regular expression.
The remained question was the rigor proof of the correctness of our solution towards language or automaton complementation: $(\sim L(r) \mid A)$, as we have used the tagging approach or even event-driven simulation [4], we have also broadened the question towards the existence of the linear solution in subset construction within the example of 'state explosion' [5].

STATEMENT & PROOF

The statement of the problem is whether there exist polynomial solution to the problem of constructing the valid non-deterministic automaton (NFA) for the complement of the language $L(r)$ or any other automaton A – as we know this problem is in EXPTIME, however, we have already presented a rigor proof based upon the event-driven model and tagging conditions [3, 4], thus allowing this method to be linear.

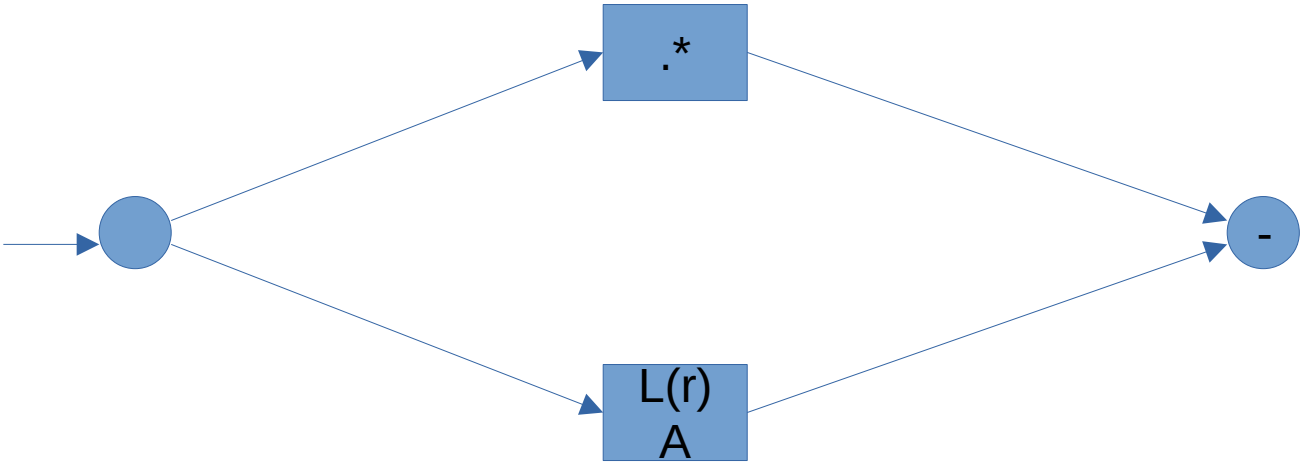

Figure 1. The construction of minus event-driven model for complement of language $L(r)$

On the figure above we see the valid construction for the ‘minus-operator’ [3] and its correctness according to event driven model of reaching the star language “.*” and not-reaching the language defined by *L(r)* or any other automaton defined by *A*. As we can see it’s linear in size and operation *O(n = |L(r)| = A)*, while the traditional construction is exponentially explosive and leads to the determinization with worst complexity $O(2^n)$.
We also make a remark that our event-driven construction is correct for any other arbitrary automaton, not only that which lay within P-domain of regular languages.

DISCUSSIONS

We have shown in short our approach of defining the complementary language or automaton, while preserving the linear, or polynomial, balance between the functionality and definition – all these leads us to the strong understanding of non-polynomial complexity as ‘what can be simulated with modified model’.
To go beyond the presented complement operation, we know that both subtraction and intersection of non-deterministic finite automatons (NFA) require also exponential and factorial number of steps which lays in classes of complexity EXPTIME and NP as well, while our constructions produce linear results with magnitude *O(1)*, these constructions are better illustrated in [6].
Subtraction and complement of arbitrary automatons is in P and NP, additionally to our prior arguments towards our proof, we are to complete the final note to be more rigor: yes, indeed, P = NP as any arbitrary automaton which can be isomorphic to graph structures or to be of any topological order can be constructed and simulated using our methodology, which is worth to study in our first works.
Our method is linear in size of automatons and relates to such operations like subtraction and complement based upon the event-driven model.

CONCLUSION

We have demonstrated the underlying power and existence of the non-deterministic finite automatons for recognizing complementation of the given language or for constructing complement or subtraction for given automatons, which was exponential before, and this is a total contrary towards hierarchy theorem and many other misbeliefs like the intractability of the problem.

Thus, we have: *P = NP*, and our outlet goes as **“the problem can be verified and solved in polynomial time by using extensible approach”**.

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