Approximation Cumputing in Formal Languages

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Approximate computing is a new design paradigm which enables highly efficient hardware or software implementations by exploiting the inherent resilience of applications to inexactness in their computations. Approximate computing can be used in applications such as image processing, classifiers or text search. The main goal of this work is to join approximation computing with formal languages.

In theoretical informatics, we can construct a computational machine $M(\bar{L})$ in such a way that the accepted language $\bar{L}$ is not equal to the required language L, $\bar{L} \neq L$. Additionally, $\bar{L}$ and L have at least one common string, $\bar{L} \cap L \neq \emptyset$. We observe the error language E between $\bar{L}$ and L by using operation exclusive disjunction, $E = \bar{L} \oplus L$. Thus we can say that language $\bar{L}$ is an approximation of language L. Furthermore, the constructed machine $M(\bar{L})$ can have less states or transitions or even it can have less computational power than a machine that accepts the required language L.

In the past, cover automata were presented in [1]. A cover automaton for a finite language L is a finite automaton that accepts all strings in L and possibly other strings that are longer than any string in L. In other words, a cover automaton is an cyclic automaton and a counter (the maximal length of words) replacing an acyclic automaton (since L is final, a DFA for L is acyclic) in order to reduce the number of states.

Cover automata accept only languages that are finite. In this work, I would like to present cover automata for infinite languages. Moreover, we will observe the error language, the required computational power of automata, the number of states and the number of transitions.

References

1. Campeanu, C., Santean, N., Yu, S.: Minimal cover-automata for finite languages. In Champarnaud, J.M., Maurel, D., Ziadi, D., eds.: Third International Workshop on Implementing Automata, WIA'98, Springer Verlag (September 1998) 43–56