Translation State Systems with a Limited Distribution

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Abstract

Translation grammars and transducers represent an importatnt part in the field of formal language theory with a wide scale of applications. In general, its purpose is to translate a string in the input language (based on the input alphabet) to a string in the output language (based on the output alphabet). The process can be either deterministic or nondeterministic and also the number of possible outputs may vary based on the type and attributes of the concept used.

Although having matching power, translation systems are often easier to put in practice than standard models (automatons, turing machines and gramatics). The reason is that they much better reflect the demands we put on an algorithm or program – to provide an output based on the input, rather than just giving a simple answer yes/no.

In this presentation, we will focus on models working with \$-strings with limited distribution. Such string can be defined as $w \in (\Sigma \cup \{\$\})^*, \$ \notin \Sigma$, where for every substring y of w satisfying $y \in \{\$\}\Sigma^*\{\$\}$ exists some number k such that $|y| \leq k$.

Basically, we are going define a translationg system which, based on a set of specific rules, rewrites the input \$-string to an output \$-string. We call this system limited iff every string derived from the input has a limited distribution and every occurance of \$ is rewritten no more than j-times for some number j.

We expect this model to find applications particularly in biology and genetics, where finite sequences of aminoacids are created, clustered and otherwise processed. Another use for this model is suggested in the field of formal language theory itself, where hierarchy and paralelism represent the modern trend.

Based on an exact and formal definition of the model, we will also prove that these systems are equal in power with finite state machines and that both these models are mutually convertible. We believe that the algorithm converting translation state system with a limited distribution to a finite state machine will yet improve the overall applicability of these systems as finite state machines constitute a fundamental model with lots of existent tools and implementations.