Probabilistic automata and stochastic languages

Lecturer: Florent Garnier

Spring 2009

Abstract

This lecture comes is the sequel to Radu Iosif's course about language theory. Some hindsight in the field of regular and ω-regular languages will be needed to fruitfully benefit the listener.

Probabilistic models of automata, and their languages.

In this part, we study probabilistic extension of both deterministic and non-deterministic automata.

- Rabin's model of Probabilistic Finite Automata (PFA).
- Probabilistic Deterministic Finite Automata (PDFA).
- η-Stochastic languages of a PFAs and a PDFAs.
- Comparing PDFAs's and PFAs' expressiveness power.
- Operations on PFAs.
- Relations between PFAs: Equivalence, Isomorphism, Simulation and Bisimulations.
- Decision problem, solved and open ones.
- General class of models of PFAs and PDFAs:
  - Reactive models.
  - Generative models.
  - Stratified models.

A Probabilistic model of ω-automaton

In this part, we prospect recent works dealing with a probabilistic extention of the classical Büchi automaton.

- Baier and Größer's model of Probabilistic Büchi automaton (PBA).
- Why PBA are strictly more expressive than Non deterministic Büchi Automata (NBA).
- PBA's from a language theory point of view: Deciding Emptiness, computing the intersection of two PBA language, computing the complementary language of PBA.
- Uniform Probabilistic Automata, a model that is just as expressive as NBA.
- Decision problems on UPBA.
- Comparing the complexity –in space and time– of operations on PBA, UPBA, NBA.