Adaptive Automata and Grammars

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Topics

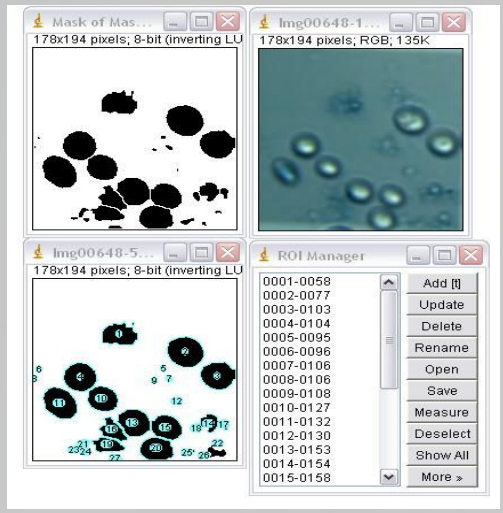
- INOVISAO Projects
- Adaptive Devices – A Brief History
- Adaptive Automata
- Adaptive Grammars
- Final Remarks

Where we are

Blue Lake Cave - Bonito

Pantanal – Largest Wetland in World

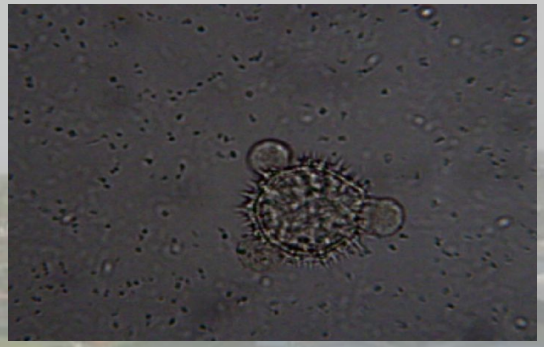
INOVISAO Projects in a Glance



Yeast viability calculation for fermentation process control

Larvae mortality rate calculation for testing new insecticides

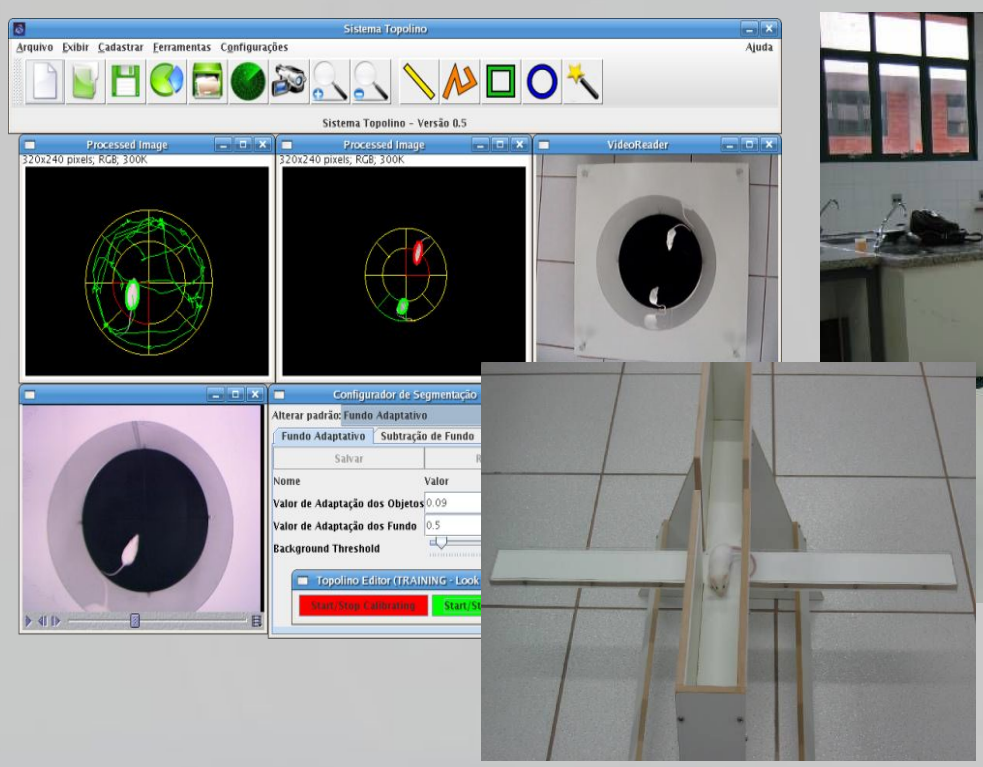
Bovine leather classification



Identification of Honey Origin from images of pollens

Measuring eating habits of the weevil for bamboo species selection

INOVISAO Projects in a Glance

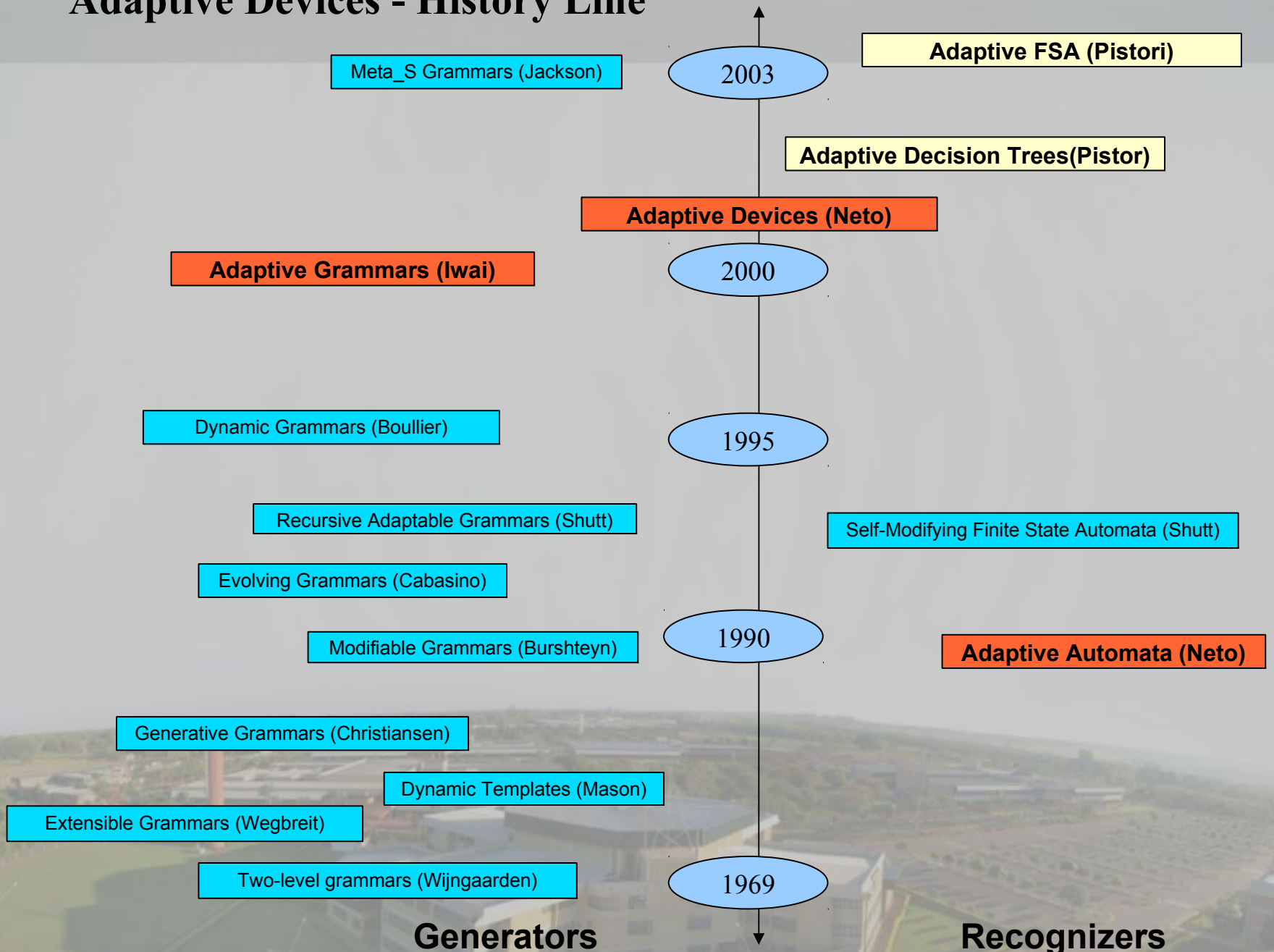


Mice behaviour analysis in lab. experiments

INOVISAO – Some Contributions

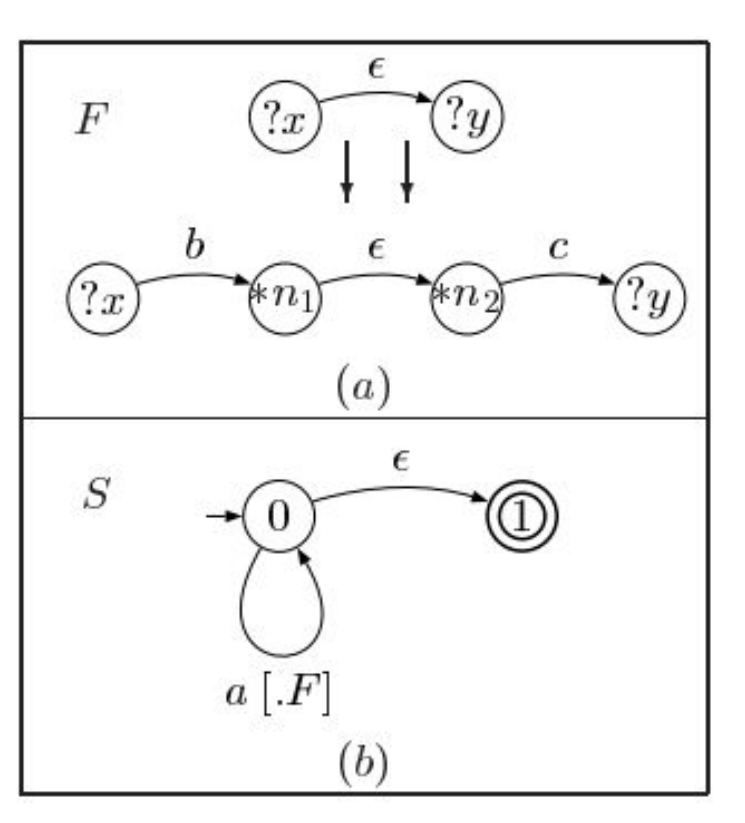
- Simulated Annealing + SVM (Paper)
- Particle Filters with Self-Adjustable Observation Models (Paper)
- Leather Classification System (Patent)
- Mice Behaviour Analysis System (Patent Pend.)
- Lots of combinations and experimental parameter tuning of existing techniques (pre-processing, segmentation, feature extraction, feature selection, tracking, supervised learning) to solve real life problems

Adaptive Devices - History Line



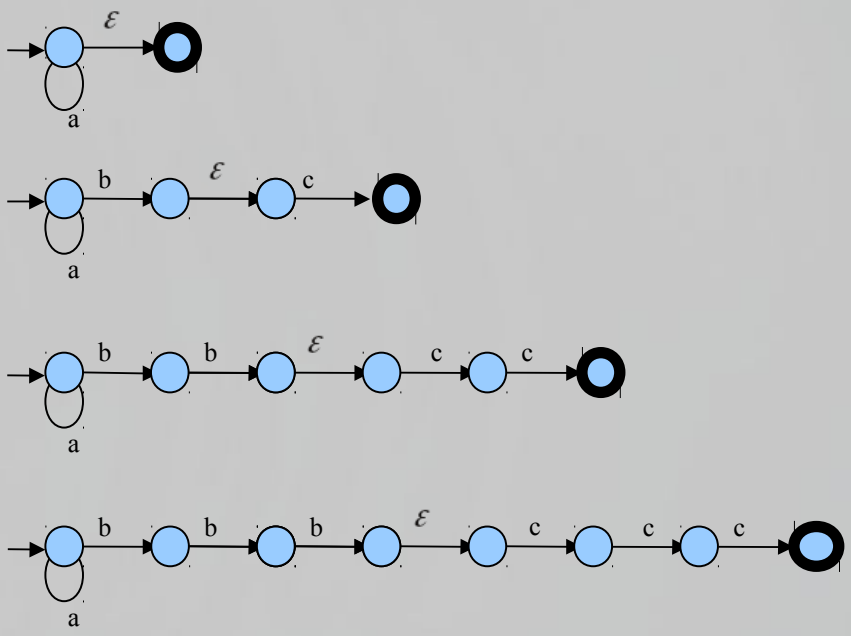
Adaptive Automata for $a^n b^n c^n$ (non CF lang.)

Adaptive Layer

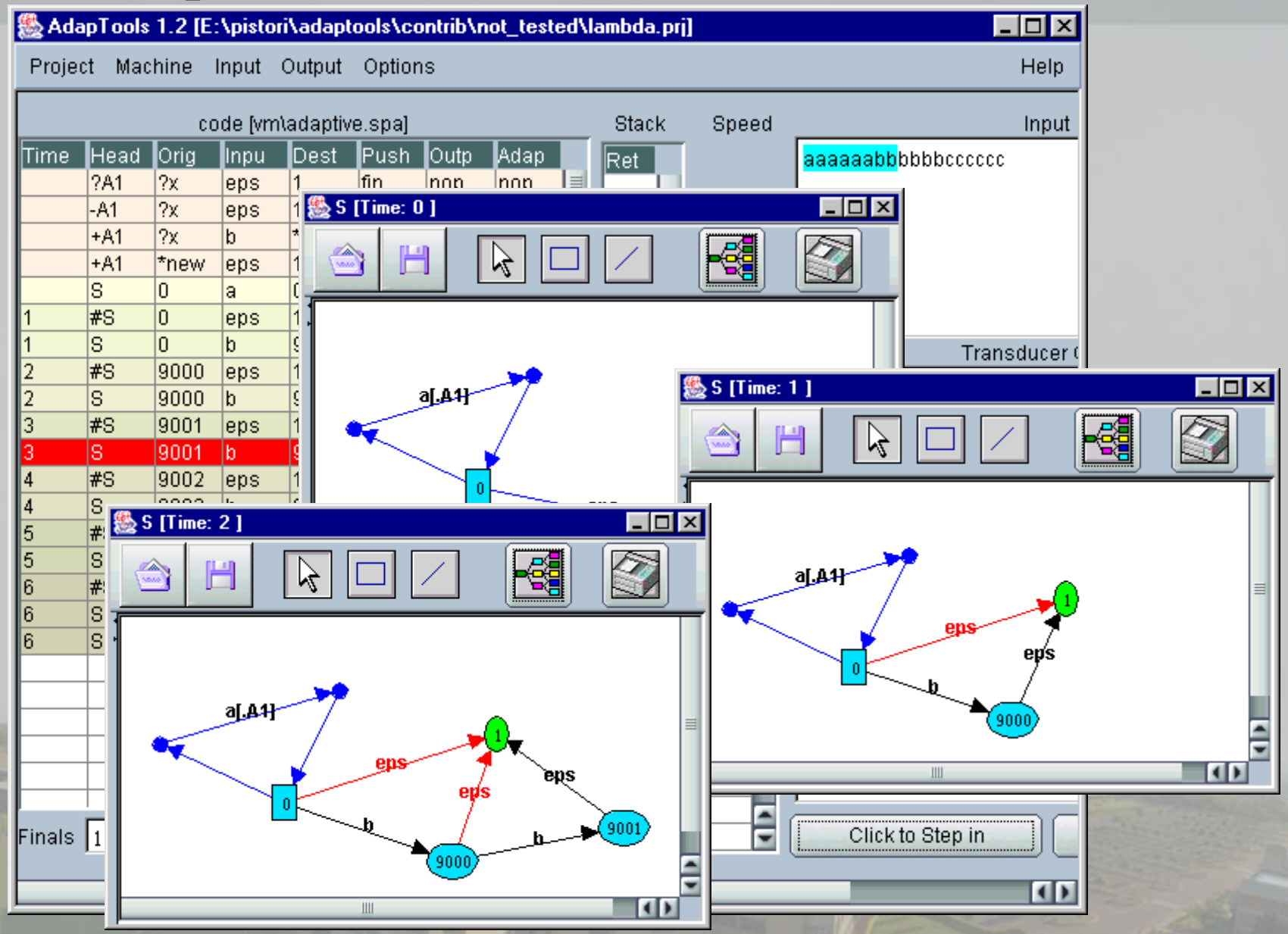


Subjacent Device

Example - Input String: aaabbbccc



Adaptools


AdapTools 1.2 [E:\pistori\adaptools\contrib\not_tested\lambda.prj]
Project Machine Input Output Options Help
code [vm\adaptive.spa]
Stack
Speed
Input
aaaaaabbbbbbcccccc
Time Head Orig Inpu Dest Push Outp Adap
?A1 ?x eps
-A1 ?x eps
+A1 ?x b
+A1 *new eps
S 0 a
1 #S 0 eps
1 S 0 b
2 #S 9000 eps
2 S 9000 b
3 #S 9001 eps
3 S 9001 b
4 #S 9002 eps
Ret
Transducer
Finals
Click to Step in
S [Time: 0]
a[.A1]
0
S [Time: 1]
a[.A1]
eps
eps
b
0
1
9000
S [Time: 2]
a[.A1]
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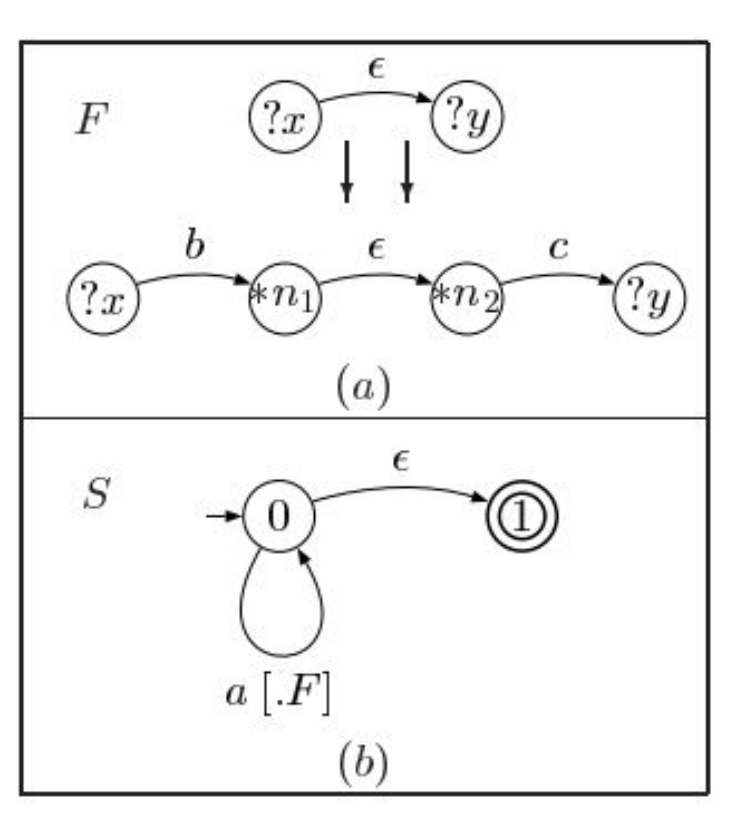
eps
eps
b
b
0
1
9000
9001

Adaptive Grammars



Adaptive Level:
Search and replace production rules patterns as symbols are generated

Subjacent Device:
Production rules in place of Transitions and States

$$P = \{ S \xrightarrow{F} aSb, S \rightarrow \varepsilon \}$$

Final Remarks

- Few works applying Grammar Learning Techniques to Computer Vision problems
- Adaptive Automata and Grammars are virtually unknown outside the Automata and Formal Language community
- Inducing a formal representation (like a grammar or an automaton) of a language from a set of exemplar strings is machine learning (AFL community is constantly developing new ML algorithms)
- Visual information may be prone to standard and non-standard grammatical representations (E.g: Sign Language Grammars)

- Main broad goal during my Sabbatical Leave: investigate new interfaces between computer vision, formal language, machine learning and adaptive devices.

For more information

- www . gpec. ucdb. br / pistori
- pistori @ ucdb . br

Thanks !