Algorithmic Learning Theory

Language Identification in the Limit

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Structure

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Motivation

- **Study of child learning**

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- **Artificial Intelligence**

Idea

- **Learn rules from given information**

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  - **Examples**
  - **Oracle**
- Language is a set of strings

Language Learnability Model

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  1. **Definiton of learnability**
  2. **Method of information presentation**
  3. **Naming relation**

Learner

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- Information is a set of allowable training sequences $i_1, i_2, ..$
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- Objective: after some time all guesses are the same and correct

Results of Language Identification

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Remark

Super-finite class of languages contains all finite cardinality languages and at least one of infinite cardinality.

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1. Class of natural languages is smaller than expected
2. Child has an *informant*
3. Restriction on the class of texts

Identification situation

1. **Class Ω of objects**

Identification situation

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2. Method of information presentation

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- *Collapsing uncertainty condition* (*c.u.c*): **beginning of information sequence may lead to two objects, but will eliminate one option after finite time**
- *Ineffectively identifiable in the limit*: **suitable guessing function exists - does not have to be effective**

How it's done

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Remark

This is effective if there is an effective method for each finding the nth object and getting its name.

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Results via identification by enumeration

- Informant satisfies $c.u.c \Rightarrow$ any countable class of languages is ineffectively identifiable in the limit
- Recursive or primitive recursive texts are just as strong as informant
- Arbritrary text: class of languages of finite cardinality is ineffectively identifiable in the limit

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1. $r(G, \omega, \tilde{\imath}) \leq r(G', \omega, \tilde{\imath})$
2. $r(G, \omega_0, \tilde{\imath_0}) < r(G', \omega_0, \tilde{\imath}_0)$

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- Learner utilizes given information to guess a *name*
- In most cases the informant is a better choice than the text
- Ineffective identifiability in the limit has *better* results than identifiability in the limit
- Enumeration of the class of objects is *fast*