

Knowledge Recognition Algorithm enables P = NP

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Summary

This paper introduces a knowledge recognition algorithm (KRA) that is both a Turing machine algorithm and an Oracle Turing machine algorithm. By definition KRA is a non-deterministic language recognition algorithm. Simultaneously it can be implemented as a deterministic Turing machine algorithm. KRA applies mirrored perceptual-conceptual languages to learn member-class relations between the two languages iteratively and retrieve information through deductive and reductive recognition from one language to another. The novelty of KRA is that the conventional concept of relation $R \subseteq \{\Sigma^* \times \Sigma^*\}$ is adjusted to $R \subseteq \{\Sigma_p^* = \Sigma_c^* \cup \Sigma_{|p|}^* \in \Sigma_{|c|}^*\}$. The computation therefore becomes efficient bidirectional string mapping.

Key words: “innate” logic, membership-class relation, sensation, induction, deduction, reduction.

1. Descriptions of Knowledge Recognition Algorithm

Knowledge recognition (also called relation recognition) algorithm (KRA), was originally designed to simulate the mirrored language structure of the human brain by Han (Han08). The human brain contains a mirrored perceptual-conceptual language structure for storing member-class relations between the two languages as knowledge. That is, KRA has two levels of languages, which permit the perceptual language L_p as the members of the conceptual language L_c , and conceptual language as the class of the perceptual. Based on this continuous iterative structure, four “innate” logic functions exist, defined by four axioms:

Sensation: Innate mapping function of *one-to-one correspondence* $L_p \ni p = c \in L_c$ exists between the perceptual language L_p and conceptual language L_c . The existence of sensation also can be presented equivalently as the “diagonal” set $\{(p,c) | p = c\}$ (see Fig1).

Induction: *Learning* function of *member-class relation* $L_p \ni |p| \in |c| \in L_c$ exists between the perceptual language L_p and conceptual language L_c , where $|p|$ and $|c|$ denote the length level of p and c , respectively. The existence of induction also can be presented equivalently as the “membership” set $\{(p,c) | |p| \in |c|\}$.

Deduction: *Class recognition* function exists for recognizing relations from the perceptual language L_p to conceptual language L_c , defined as follows: Suppose that L_k is a language of knowledge over Σ_k , $k = p, c$, Then $L_p \geq L_c$ iff $p = c$ and $|p| \in |c|$ such that $p \in \Sigma_p^* \rightarrow c \in \Sigma_c^*$, for all $p \in \Sigma_p^*$ and $c \in \Sigma_c^*$.

Reduction: *Membership recognition* function exists for recognizing relations from the conceptual language L_c to perceptual language L_p , defined as follows: Suppose that L_k is a

language of knowledge over Σ_k , $k = p, c$, Then $L_p \leq L_c$ iff $p = c$ and $|p| \in |c|$ such that $p \in \Sigma_p^*$ $\leftarrow c \in \Sigma_c^*$, for all $p \in \Sigma_p^*$ and $c \in \Sigma_c^*$. This function is equivalent to the notion of reducibility. It is an inverse function of deduction.

Formally KRA is a *string mapping* language L_k over Σ_k , $k = p, c$. Let Σ_p and Σ_c be two identical sets over a binary alphabet, and let Σ_p^* and Σ_c^* be two sets of finite identical strings over Σ_p and Σ_c . Then the *language* L_p over Σ_p is a subset of Σ_p^* , and the *language* L_c over Σ_c is a subset of Σ_c^* . Thus L_p and L_c are identical languages, denoted by $L_p \ni p = c \in L_c$. There exists a binary relation $R \subseteq \Sigma_p^* \times \Sigma_c^*$ for some finite alphabets Σ_p and Σ_c . We associate with each such relation R a language L_R over $\Sigma_p^* \cup \Sigma_c^* \cup \{\#\}$ defined by

$$L_R = \{p \# c \mid R(p, c)\}$$

where the symbol $\#$ is not in Σ_p and Σ_c .

There exists a *subset one-to-one correspondence* $R_1^* = \{\Sigma_p^* = \Sigma_c^*\}$ in $R \subseteq \Sigma_p^* \times \Sigma_c^*$.

There also exists a *subset member-class relation* $R_2^* = \{\Sigma_{|1|}^* \in \Sigma_{|2|}^* \in \Sigma_{|3|}^* \dots \in \Sigma_{|n-1|}^* \in \Sigma_{|n|}^*\} = \{\Sigma_{|p|}^* \in \Sigma_{|c|}^*\}$ in $R \subseteq \Sigma_p^* \times \Sigma_c^*$, where $|1|, |2|, |3| \dots |n-1|, |n|$ denote the length of the binary strings in the continued iterative perceptual-conceptual relations.

Then relation L_R is the union of $\Sigma_p^* = \Sigma_c^*$ and $\{\Sigma_{|p|}^* \in \Sigma_{|c|}^*\}$ iteratively, defined by

$$L_R = \{p \# c \mid \Sigma_p^* = \Sigma_c^* \cup \Sigma_{|p|}^* \in \Sigma_{|c|}^*\}$$

The notion *string mapping* is to map member-class relations, where *deduction* is the mapping from perceptual to conceptual language denoted by $L_p \geq L_c$, and *reduction* is the mapping from conceptual to perceptual language denoted by $L_p \leq L_c$.

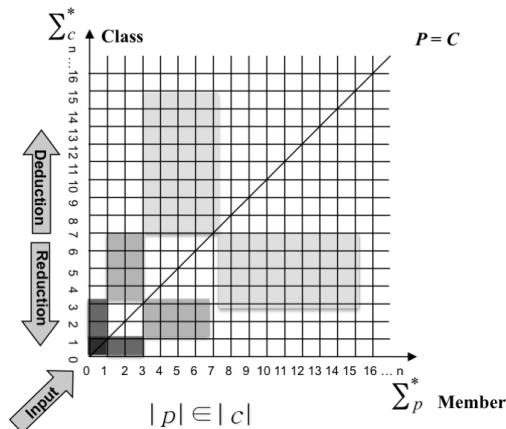


Fig1. Iterations of member-class relations between perceptual and conceptual language

2. KRA enables P = NP

We denote by $t_M(w)$ the number of steps in the computation of M on input w . We denote by $T_M(n)$ the *worst case run time* of M ; that is,

$$T_M(n) = \max \{t_M(w) \mid w \in \Sigma_{|w|}^* \in \Sigma_{|2|}^* \in \Sigma_{|3|}^* \dots \in \Sigma_{|n-1|}^* \in \Sigma_{|n|}^*\}$$

It is easy to see that KRA can answer membership and class relation questions of the form $L_p \ni p \in |c| \in L_c$ correctly in polynomial time.

Theorem 1. L_k is both a P and an NP language ($P = L_k = NP$) iff L_k is over Σ_k , $k = p, c$, where $L_p \ni p = c \in L_c$, and $L_p \ni p \in |c| \in L_c$, for all $p \in \Sigma_p^*$ and $c \in \Sigma_c^*$.

Proof. L_k is an NP language by definition where there is a countable domain D set, a finite alphabet Δ such that $\Delta^* \cap \{\text{ACCEPT}, \text{REJECT}\} = \emptyset$, an encoding function $E: D \rightarrow \Delta^*$, a transition relation $\tau: \Delta^* \times (\Delta^* \cup \{\text{ACCEPT}, \text{REJECT}\})$, such that $p \in L_p \Leftrightarrow f(p) \in L_c$, for all $p \in \Sigma_p^*$.

L_k is a P language by definition where there is a countable domain set D, a countable range R = D, a finite alphabet Δ such that $\Delta^* \wedge R = \emptyset$, an encoding function $E: D \rightarrow \Delta^*$, a transition function $\tau: \Delta^* \rightarrow \Delta^* \cup R$, such that $r(p, c) \Leftrightarrow p \in L_k$, for all $p, c \in \Sigma_k^*$. Thus $P = L_k = NP$.

$P = L_k = NP$ means that the deterministic algorithm can take efficiency advantage of relation mapping where relations are learned into and retrieved from a polynomial space in polynomial time through relation recognition. The conventional concept of relation $R \subseteq \{\Sigma^* \times \Sigma^*\}$ is adjusted to $R \subseteq \{\Sigma_p^* = \Sigma_c^* \cup \Sigma_{|p|}^* \in \Sigma_{|c|}^*\}$. The computation becomes a pure string mapping such that, for every $y_0 \in \Delta^*$, the set $\{<y_0, y> \mid y_0, y \in \tau\}$ has fewer than k_A elements, where k_A is a constant. The computation of A on input $x \in D$ is a sequence y_1, y_2, \dots which ends with y_K , such that $y_1 = E(x)$, $<y_i, y_{i+1}> \in \tau$ for all i , and $y_K \in \{\text{ACCEPT}, \text{REJECT}\}$. [Coo00, Kar72]

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Reference

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