Scattered Context Grammars

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2006

Scattered Context Grammar (**SCG**)

Scattered context grammar $G = (V, T, P, S)$

V is a finite alphabet

T is a set of terminals, $T \subset V$

S is a starting symbol, $S \in (V - T)$

P is a finite set of productions of the form $(A_1, \ldots, A_n) \rightarrow (x_1, \ldots, x_n)$; $A_1, \ldots, A_n \in (V - T)$; $x_1, \ldots, x_n \in V^*$

Propagating scattered context grammar (**PSCG**)

- special case of **SCG**
- every $(A_1, \ldots, A_n) \rightarrow (x_1, \ldots, x_n)$ satisfies $x_1, \ldots, x_n \in V^+$

SCG – Generated Language

Derivation step

If

- $(A_1, \ldots, A_n) \rightarrow (x_1, \ldots, x_n) \in P$
- $u = u_1 A_1 \ldots u_n A_n u_{n+1}$
- $v = u_1 x_1 \ldots u_n x_n u_{n+1}$

then $u \Rightarrow v\ [(A_1, \ldots, A_n) \rightarrow (x_1, \ldots, x_n)]$

Generated language

$L(G) = \{x \mid x \in T^*, S \Rightarrow {}^*x\}$

Generative power

- $\mathcal{L}_{SCG} = \mathcal{L}_{RE}$
- $\mathcal{L}_{CF} \subset \mathcal{L}_{PSCG} \subseteq \mathcal{L}_{CS}$

SCG – Example

Example

$G_1 = (V_1, T_1, P_1, S)$, where
$V_1 = \{a, b, c, A, B, C, S\}$
$T_1 = \{a, b, c\}$
$P_1 = \{(S) \rightarrow (ABC),$
$(A, B, C) \rightarrow (aA, bB, cC),$
$(A, B, C) \rightarrow (\varepsilon, \varepsilon, \varepsilon)\}$

$S \Rightarrow ABC \Rightarrow aAbBcC \Rightarrow aaAbbBccC \Rightarrow aaaAbbbBcccC \Rightarrow aaabbbccc$
$L(G_1) = \{a^n b^n c^n \mid n \geq 0\}$

G_1 is a **SCG**
G_1 is not a **PSCG**

Bibliography I


J. Gonczarowski and M. K. Warmuth.
Scattered versus context-sensitive rewriting.
Acta Informatica, 27:81–95, 1989.


S. Greibach and J. E. Hopcroft.
Scattered context grammars.
Journal of Computer and System Sciences, 3:233–247, 1969.


A. Meduna.
A trivial method of characterizing the family of recursively enumerable languages by scattered context grammars.
EATCS Bulletin, 56:104–106, 1995.


A. Meduna.
Automata and Languages: Theory and Applications.
Springer-Verlag, London, 2000.

Bibliography II


V. Virkkunen.
On scattered context grammars.
Acta Universitatis Ouluensis, Series A, Mathematica 6:75–82, 1973.