Patter Theory Ideas

On reachability of generators

Overview

Chen et al. (CVPR 06) modeled cloth parts using a Spatial And-Or graph, as shown in Figure 1.

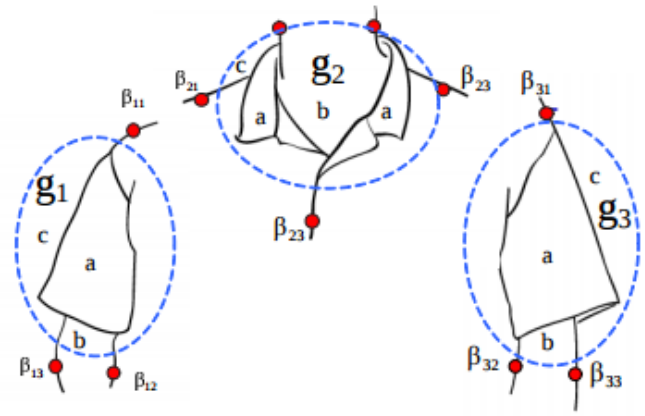

Figure 1: Cloth parts are compositional.

The terminal nodes of the AOG are subtemplates, which are essentially *generators* from the language of Pattern Theory. So first, below are a couple definitions.

Pattern Theory

These definitions are taken from Grenander.

Definition 1 (Generator space)**.** A set of all generators, partitioned into disjoint subsets.

$$G = \cup_\alpha G^\alpha \tag{1}$$

Definition 2 (Similarity group)**.** A group with elements $s \in S$ mapping G onto G.

$$s : G \to G \tag{2}$$

Definition 3 (Similar)**.** Two generators in the same equivalence class induced by a partition G/S.

Definition 4 (Bonds)**.** Each generator g has $\omega(g)$ number of bonds, described by structure $B_s(g)$ and values $B_v(g)$.

$$B(g) = \big(B_s(g), B_v(g)\big) \tag{3}$$

Definition 5 (Congruence)**.**

$$g_1 \cong g_2 \quad \Leftrightarrow \quad B(g_1) = B(g_2) \tag{4}$$

Observations

An intuitive question to ask is "How expressive is a small set of generators?"

Figure 2 shows two examples of constructing new configurations out of basic ones. Notice how the grammars do not exponentially explode into hundrends of possibilities. Any other configuration not shown in this figure would be congruent to a configuration already shown.

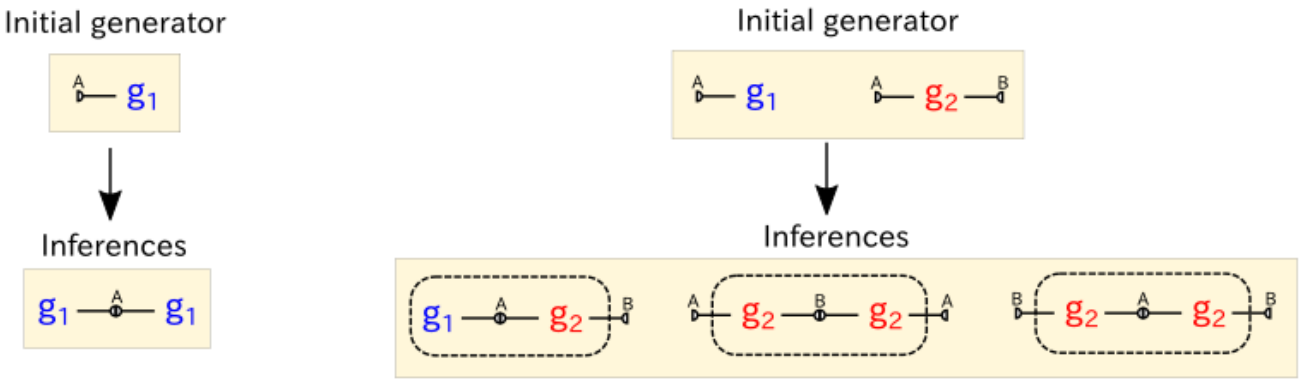

Figure 2: These two grammars are bounded. No further external bond interfaces are possible.

In Figure 3 on the next page, we see a very interesting starting set of generators. The number of possible entailed configurations is unbounded! But a good question to ask now is "what configurations are reachable?"

For example, given a starting set of initial generators as shown in the figure, is a generator with only one external bond of value "B" possible?

Is there a fundamental limit to answering this reachability question, like the Halting problem?

Knowing the structure of the possible set of configurations entailed from a starting set of generators is important because they form the nodes of our AOG.

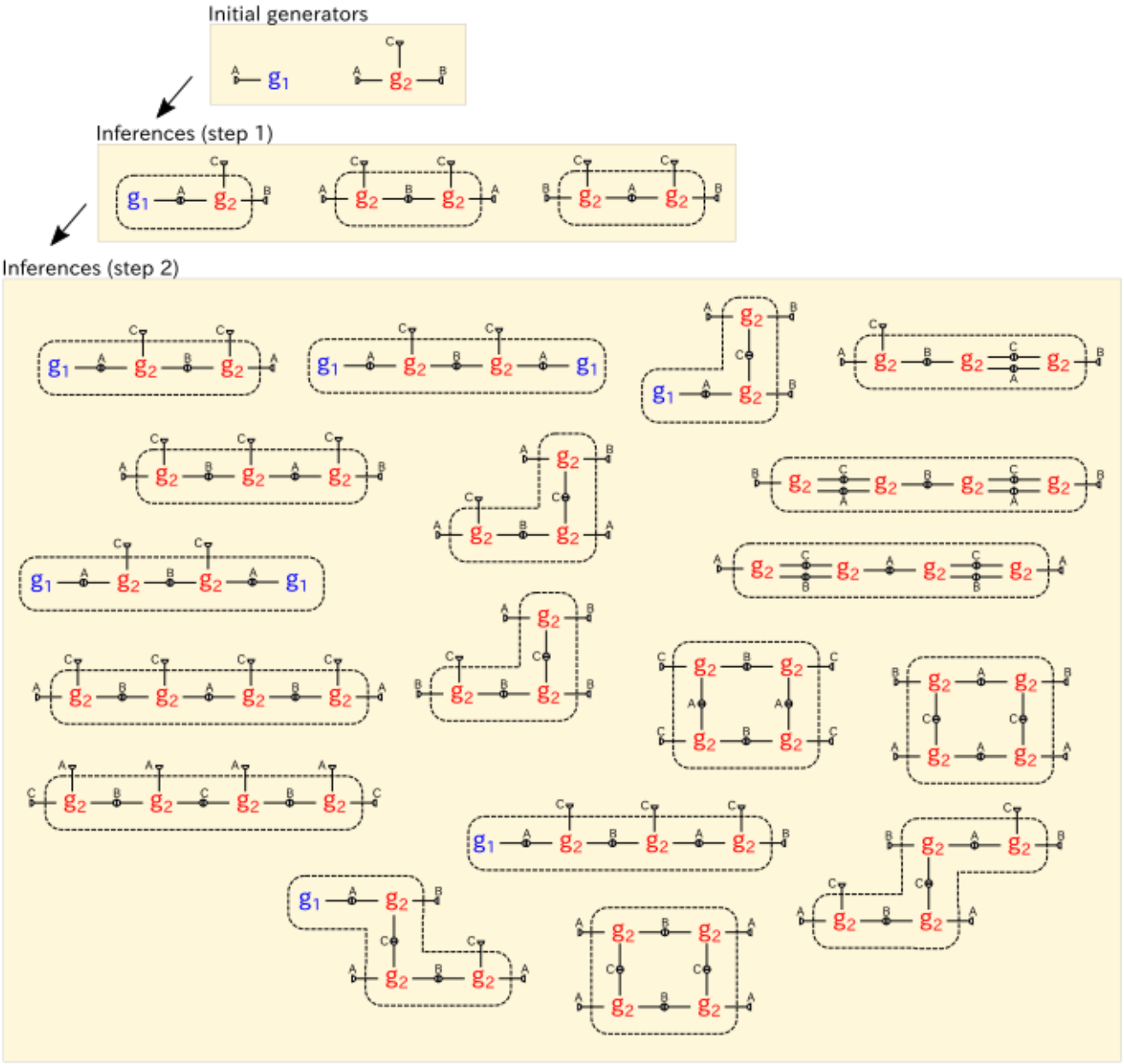

Figure 3: This grammar is unbounded. The generators produce infinite possible external bond interfaces.