ANTI-CONTEXT-FREE LANGUAGES

Carles Cardó

*Departament de Ciències Bàsiques, Universitat Internacional de Catalunya
c/ Josep Trueta s/n, Sant Cugat del Vallès, 08195, Catalunya, Spain*
`ccardo@uic.es`

ABSTRACT

Context-free languages can be characterized in several ways. This article studies projective linearisations of languages of simple dependency trees, i. e., dependency trees in which a node can govern at most one node with a given syntactic function. We prove that the projective linearisations of local languages of simple dependency trees coincide with the context-free languages.

Simple dependency trees suggest alternative dual notions of locality and projectivity, which permits defining a dual language for each context-free language. We call this new class of languages anti-context-free. These languages are related to some linguistic constructions exhibiting the so-called cross-serial dependencies that were historically important for the development of computational linguistics. We propose that this duality could be a relevant linguistic phenomenon.

Keywords: anti-context-free languages, context-free languages, local tree languages, projectivity, dependency grammar

1. Introduction

1.1. Historical and Linguistic Motivation

From the beginning of the history of computational linguistics, there was a suspicion that, although context-free grammars could describe a large part of natural languages, they were insufficient [10]. After some discussions over the next decades (see [32] for state of the art at that time), it was confirmed that some natural languages present non-context-free constructions [35]. In this respect, let us consider a pair of formal languages for a fixed alphabet Σ:

$$L_{\text{squa}} = \{a_1^2 \cdots a_n^2 \,|\, a_1, \ldots, a_n \in \Sigma, n \geq 0\}, \tag{1}$$

$$L_{\text{copy}} = \{xx \,|\, x \in \Sigma^*\}, \tag{2}$$