

Linguistic Models: from Data to Granular Architectures.

A Study in Granular Computing

Witold Pedrycz

Department of Electrical & Computer Engineering
University of Alberta, Edmonton AB T6R 2G7 Canada
and

System Research Institute, Polish Academy of Sciences
Warsaw, Poland

[e-mail: pedrycz@ee.ualberta.ca]

Abstract

Linguistic (granular) models have emerged as a broad category of constructs whose parameters are inherently granular and thus represented in terms of fuzzy sets or rough sets. In panoply of existing models, linguistic models play an important role by striking a sound compromise between model accuracy and transparency while taking into account the quality of data along with their granularity.

The underlying design methodology of linguistic models is aimed at addressing an active and dominant role of the user (designer) in a way that available experimental evidence is looked upon and incorporated into the model from the perspective established by the designer. Such a perspective is reflective of his needs and specific goals of modeling and the required specificity of modeling itself. In a nutshell, the developer of the model can take full advantage of data by casting its processing in the context predetermined by his requirements and the ultimate way in which the model is going to be applied in a given real-world framework.

We elaborate on detailed design algorithms that are used when building linguistic models by guiding the audience through consecutive development steps, offering a thorough analysis and bringing some motivating features as well as pointing at possible alternatives. The granulation of information becomes a crucial design facet of linguistic models. We discuss various methods of fuzzy clustering which are reflective of the modeling perspective (context) assumed by the user. In particular, this concerns a suite of so-called context-based fuzzy clustering techniques.

We also show that some generic versions of linguistic models support a principle of rapid prototyping in which the model is constructed with a minimal learning effort and, if acceptable from the user's perspective, it could be further refined and augmented. Interestingly, the issue of rapid prototyping has not been raised and discussed in depth when building constructs of Computational Intelligence. As a matter of fact, quite commonly we are engaged in a fairly laborious and computationally demanding design pursuits not being fully confident as to the quality of the model constructed in this way. Given this, in the lecture we discuss essential pros and cons of rapid prototyping in system modeling.