Linguistic Description of Complex Phenomena with the rLDCP R Package

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Abstract

Monitoring and analysis of complex phenomena attract the attention of both academy and industry. Dealing with data produced by complex phenomena requires the use of advance computational intelligence techniques. Namely, linguistic description of complex phenomena constitutes a mature research line. It is supported by the Computational Theory of Perceptions grounded on the Fuzzy Sets Theory. Its aim is the development of computational systems with the ability to generate vague descriptions of the world in a similar way how humans do. This is a human-centric and multi-disciplinary research work. Moreover, its success is a matter of careful design; thus, developers play a key role. The rLDCP R package was designed to facilitate the development of new applications. This demo introduces the use of rLDCP, for both beginners and advance developers, in practical use cases.

1 Introduction

Trivino and Sugeno (2013) defined a framework for Linguistic Description of Complex Phenomena (LDCP). It is based on the Computational Theory of Perceptions (CTP) introduced by Zadeh (2001) as a new tool for paving the way from computing with numbers to computing with words (Zadeh, 1999). CTP is rooted in the computational intelligence technique best suited to deal with approximate reasoning and vague concepts, i.e., the Fuzzy Sets Theory (Zadeh, 1965; Trillas and Eciolaza, 2015).

LDCP has already been successfully applied in several multi-disciplinary projects. For example:
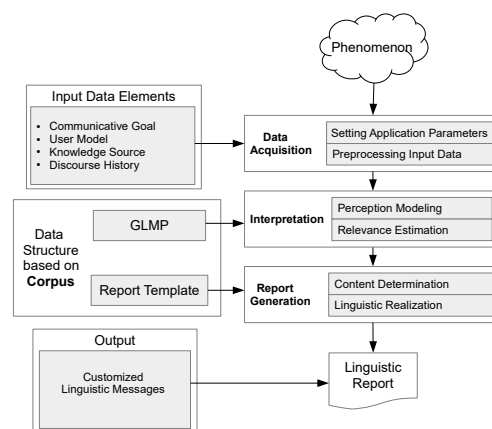

Figure 1: The LDCP Architecture for NLG/D2T.

describing big data (Conde-Clemente et al., 2017b); advising how to save energy at home (Conde-Clemente et al., 2016); describing physical activity (Sanchez-Valdes et al., 2016); describing drivers' behavior in driving simulations (Eciolaza et al., 2013); or describing double stars in astronomy (Arguelles and Trivino, 2013).

Figure 1 depicts the LDCP architecture for Natural Language Generation in Data-to-text applications (NLG/D2T). It is inspired on the well-known NLG pipeline proposed by Reiter and Dale (2000). The development of new applications with LDCP comprises the following steps:

- Careful analysis of the phenomenon under consideration, regarding: communicative goal, audience background, and the set of natural language expressions (corpus) most commonly used in the context of the application domain.

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- Design of a computational structure (the so-called Granular Linguistic Model of the Phenomenon, GLMP) which organizes all related perceptions in a similar way how humans usually organize their experience by means of natural language.

- Design of a Report Template easy to customize in accordance with the audience requirements.

- Implementation of a computational system able to collect and process raw data, interpret them according to the previously defined GLMP, and producing the Report with the most relevant information to convey to end-users.

Conde-Clemente et al. (2017a) have developed an R package called rLDCP[1] which constitutes a first implementation in R of the steps enumerated above. Thus, it facilitates the use of the LDCP architecture in new applications.

2 Structure of the Demo

This demo describes how to use rLDCP from scratch. Firstly, we explain how to download and install rLDCP. Secondly, we detail how to run step by step the toy example *ComfortableRoom* from the point of view of beginners and advance developers. The goal is describing the comfort in a room with respect to temperature and light intensity data values previously stored in a ".csv" file.

Then, we show how to use rLDCP for building a real application: The *inProfilePhoto* mobile app. We implement with rLDCP the application described in (Conde-Clemente et al., 2013) where an NLG system guided a person with visual disabilities to take his/her own profile photos.

Acknowledgments

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[1]rLDCP is an R package for text generation from data. It is freely available at [http://www.phedes.com/rLDCP]