Automatic generation of natural language comments of scalar fields

Vilém Novák

Czechoslovak Academy of Sciences, Mining Institute,
Hladnovská 7, 710 00 Ostrava 2, Czechoslovakia

1. INTRODUCTION

The results of mathematical models of practical problems of mining geomechanics are various scalar fields being derived from a tension tensor which is computed using the finite element method. Such fields represent the reality either in the plane or in the space. The user thus obtains a big amount of numbers (scalar characteristics, e.g. tensile stress, shearing stress etc) describing the tension situation in the given (mining) area. If the number of variants is small and we work with mathematical model in the plane then the user can take advantage of graphical presentation. If the model is more extensive then the interpretation of results is very laborous and there is a danger of missing some important information. Quite natural means for more exhaustive description of results could be the natural language. This paper very briefly presents a system for generation of natural language comments of scalar fields which could serve the user to facilitate his work. The system is based on the fuzzy set theory.

2. BRIEF DESCRIPTION OF THE SYSTEM

The system generates comments to the plane scalar fields. They can be imagined as a simple rectangular net

	u_{ij}	

where u_{ij} is a given scalar characteristics.

The comments employ the so called <u>evaluation terms</u>, i.e. natural language expressions such as "very small", "roughly equal" etc. The meaning of atomic terms "small, average, big" is modelled by means of S and Π fuzzy sets. Their membership functions are determined by setting six parameters. The evaluation terms consist of a linguistic modifier m (highly, very, rather, more of less, roughly) and of an atomic term $\mathcal{A}$. We work with the following ordering of terms

$$\text{highly } \mathcal{A} \prec \text{ very } \mathcal{A} \prec \text{ rather } \mathcal{A} \prec \mathcal{A} \prec \text{ more or less } \mathcal{A} \prec$$
$$\prec \text{ roughly } \mathcal{A}$$

where "$\prec$" is an ordering of "being more exact".

These eveluation terms are derived from the values u_{ij} of the scalar field. The comments have the following structures (m denotes the linguistic modifier including the empty one):

1. $m\mathcal{A}$ ⟨scalar characteristics⟩ is prevailing in the given area [however, there also appears $m'\mathcal{A}'$ ⟨scalar characteristics⟩]
2. The ⟨scalar characteristics⟩ is m uniformly spread out in the given area
3. There appear ⟨number⟩ $m_1\mathcal{A}_1$ $\left\{\begin{matrix}\text{focuses}\\ \text{areas}\end{matrix}\right\}$ of $m_2\mathcal{A}_2$ ⟨scalar characteristics⟩ in the given area
4. The ⟨scalar characteristics⟩ in the ⟨state 1⟩ is

m equal as in the ⟨state 2⟩

{m higher / m smaller} than in the ⟨state 2⟩, ⟨indefinite number⟩ -times in average

where ⟨indefinite number⟩ denotes the numbers such as "about n, approximately n, almost n" etc.

One can see that such somments may make the user possible to focus his attention only to interesting places which can be thus analyzed in much more details and we need not be afraid of missing something important. More details will be presented in another paper.