The intuitionistic fuzzy set approach in the psychological research

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ABSTRACT: The applicability of the Intuitionistic Fuzzy Sets approach to psychological research on the basis of two empirical studies in the cognitive and personality psychology is illustrated.

Intuitionistic fuzzy sets have been advanced as a mathematical formalism for vagueness (Atanassov,1986). Vagueness exists in the natural languages due to the lack of clear boundaries of the natural categories (Rosh, 1975). Therefore fuzzy sets are consistent with human cognitive processes of concept forming and categorization. Theoretical and empirical research show that the set models of categorization and concept formation correlate with fuzzy sets (P. Dunn, 1994). Basing on the well studied in the cognitive psychology typicality effects Dunn (1994) examined the applicability of response time registration to the verification of fuzzy membership functions. Empirical evidence shows that more *typical* category items are learned more quickly than less typical instances. They take less time to be verified as category members ; are named more frequently and are rated as being more typical. Dunn's results show as expected that peaks in the set theoretic response time typicality effect occurred in the vague regions in the empirically derived fuzzy sets. Therefore fuzzy sets can be seen as valuable tool for identifying central and peripheral category members. Although membership function generation techniques need further verification this study is an interesting and stimulating example of the fuzzy sets relations to the cognitive psychology.

Following an approach of Asparuchov and Atanassov (1993) we would like to describe further another possible application of intuitionistic fuzzy interpretations for decision making in an empirical psychological study.

In the frame of long-term research program on delinquency, we conducted, psychological instruments aimed at assessing children's predisposition towards antisocial behavior were developed and evaluated. 32 secondary teachers described their students (N=612) trough: 1) 6-grade scale consisting of 30 personality characteristics presumed to be related to antisocial behavior in children; 2) 6-grade scale consisting of 11 antisocial behavior indicators.

In order to study the Antisocial indices' validity we examined whether they could distinguish between delinquent and non delinquent children. To obtain delinquent and non delinquent groups the median of an aggregated antisocial index score was calculated. Subjects who were above the median were defined as delinquent, whereas those who were below the median were defined as non delinquent. In order to differ the two groups and to yield a new antisocial index, discriminant analysis with *The Bulgarian adaptation of the Jesness Inventory* for juvenile delinquency assessment was accomplished. This is a multidimensional instrument consisting of 122 items. They constitute 7 cluster scales, which allow the estimation of following personality dimensions: Autism, Alienation, Manifested Aggression, Withdrawal Depression, Social Anxiety, Repression and Denial as well as the assessment of three criterion derived indices: Social Maladjustment, Immaturity and Asocial Index. A subset of the total item pool was selected which discriminates most highly between the groups. This subset is constructed after the criterion of the item importance for the discrimination. 36 of the items from the Jesness Inventory revealed as indispensable. They formed a new sub scale for antisocial orientation in children.

According to the fuzzy sets approach the judgmental data set we obtained could be interpreted as a set consisting of clear members and non members as well as of poor members and non members. The poor members and non members should be translated into numbers of a membership vague region. Using the way for aggregation of confidential intervals of criteria for decision making as described in Asparoukhov and Atanassov (1993) we could obtain more exactly criterion for classification of delinquent and non delinquent school boys and girls. This is a valuable possibility with respect to the fact that the median value used by us does not represent a very precise statistical measure. Our data didn't permit the application of other measures because of the positive skewed distribution we obtained (the majority of the scores in the distribution were low).

This fuzzy set approach offers also the possibility to validate the used in the discriminant analysis intervals for the criterion variable.

Although the described approach needs verification it seems to be well suited for solving of decision making problems in the empirical psychological research.

References:

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