MOVING TOWARD LESS UNCERTAINTY SEISMIC RISK PREDICTION USING GRANULAR COMPUTING ALGORITHM

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Iran is one of the seismically active areas of the world due to its position in the Alpine-Himalayan mountain system. So, strong earthquakes in this area have caused a high toll of casualties and extensive damage over the last centuries.

Pre-determining locations and intensity of seismic area of a city is considered as a complicated disaster management problem. As, this problem generally depends on various criteria, one of the most important challenges concerned is the existence of uncertainty regarding inconsistency in combining influencing criteria and extracting more consistent knowledge for next predictions. To overcome this problem, this paper proposes a new approach for seismic risk knowledge discovery based on granular computing theory. One of the significant properties of this method is induction of more compatible rules having zero inconsistency from existing databases. Furthermore, in this approach non redundant covering rules will be extracted for consistent classification where one object maybe classified with two or more non-redundant rules.

In this paper, the seismic risk of the area between 58˚ 24’ E, 60˚ 24’ E Longitude and 27˚ 45’ N, 29˚ 25’ N Latitude near Reygan (Kerman Province), South-East of Iran, where a devastating earthquake happened, is considered as the study area. The result of this paper exhibits why granular computing is proposed to decrease the uncertainty of knowledge extracted from input large dataset.

The basic ideas and principles of granular computing are not entirely new and have indeed been investigated in many disciplines of social and natural sciences. The study of granular computing aims at arriving at a new powerful philosophical view and a general problem-solving theory. They are referred to as structured thinking and problem-solving.

Two essential tasks in data mining are the representation of objects and the identification of forms and types of knowledge to be mined. Broadly, granular computing can be studied based on the notions of representation and process, which were also used by Marr in the study of vision (Marr, 1982). The representation concerns granules and their organizations in terms of levels, networks, and hierarchies. One focuses on common features and universally applicable principles for the understanding, description, organization, and formulation of various problems across many different disciplines. The process deals with (computational) methods that manipulate granules and granular structures. Many computational operations can be performed on granules such as reasoning, inferencing and learning. Elements in a granule are grouped together by indistinguishability, similarity, proximity or functionality. Algorithms for a granulation are a kind of semantic interpretation of why two objects are put into the same granule and how two objects are related with each other. Also, relationships between granules which can be interpreted as ordering, closeness, dependency or association between granules determine the linkage of the granules.

This paper exemplified data mining especially rule-based mining in two steps; the formation of concepts and the identification of relationship between concepts. Formal concept analysis may be considered as a concrete model of granular computing. It deals with the characterization of a concept by a unit of thoughts consists of the intension and the extension of the concept.

From the stand point of granular computing in this research, the concept of seismic risk assessment can be exemplified at two parts, extension, i.e., a set of objects as instances of pre-species category of seismic risk and intension which consists of all properties or attributes with more effective impacts in occurrence of earthquake, that are valid for all those areas where the concept applies. In this approach, each object is represented by the values of a set of attributes and the knowledge mined from a sample dataset is illustrated in the form of rules.

Table 1. Information table of the study area

Object	Seis_Rate	Fault	Fault_coin	More6.	Bet4_6.	Class
U1	Event existence	L>80	Nothing	Nothing	6 Event	A
U2	Low occurrence- fault	L<2	Nothing	Nothing	1 Event	C
U3	Non event with fault in surrounding	L<2	Nothing	Nothing	1 Event	C
U4	Low occurrence- fault	3(L>80)& 20<L<80	2 Existence	Event existence	Nothing	A
U5	Low occurrence- fault	3(L>80)& 10<L<20	2 Existence	2 Event	Nothing	A
U6	Event existence	2(L>80)	Nothing	Nothing	7 Event	B
U7	Low occurrence- fault	L>80	Nothing	Nothing	2 Event	B
U8	Non event with fault	20<L<80	Nothing	Nothing	Nothing	C
U9	Non event with fault	3(L>80)	Nothing	Nothing	Nothing	B
U10	Low occurrence- without fault	L<2	Nothing	Nothing	Nothing	D
U11	Low occurrence- fault	L>80	Nothing	Nothing	Nothing	B
U12	Low occurrence- without fault	L<2	Nothing	Nothing	1 Event	D
U13	Non event with fault in surrounding	4(L>80)	Existence	Nothing	Nothing	B
U14	Low occurrence- without fault	L<2	Nothing	Event existence	Nothing	B
U15	Low occurrence-fault	L<2	Nothing	Nothing	Nothing	B
U16	Event existence	L<2	Nothing	Nothing	Nothing	B
U17	Non event with fault in surrounding	L<2	Nothing	Nothing	Nothing	B
U18	Low occurrence- fault	L>80	Nothing	Nothing	Nothing	B

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