which is predicted whenever its confidence is bigger than 1/3. Consequently, the class *CAS*5 appears for the first time in the simulation results of this classifier, as shown in Fig. 6. Note also the improved smooth behavior of the classifier, producing a soft transition between classes. In fact, a straight line could be drawn in the input space passing through all the classes in order. More importantly, this classifier enable to distinguish a clear trend in the consequences, in such a way that worst consequences are associated with lower HDI values (and thus with a greater vulnerability) and greater intensities of earthquakes. This trend is logically expected, but notice that no one of the previous classifiers could express it so clearly. The performance measures of this classifier, shown in Table 6, presents a further reduction of the average cost (AVCOST=0.968) and thus of the underestimation risk, that could be even more important since the rate of correct classification (%CC=50.52) is lower than before (with the subsequent increment of non-zero costs).

%CC	AVCOST
50.52	0.968

Table 6: Performance measures for the worst case scenario analysis ($\Delta \equiv \Delta_2$).

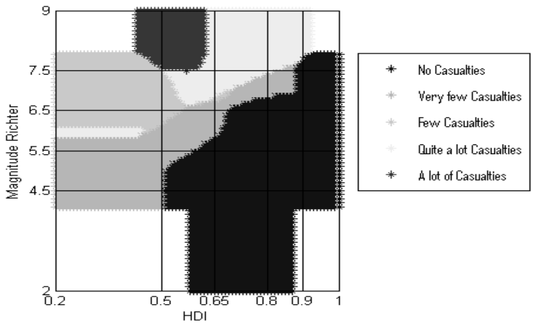

Figure 6. Simulation result of the classifier with $\Delta \equiv \Delta_2$.

4. Conclusions

When considering the production of an initial assessment of disaster consequences as a structured classification problem, the structure of the set of classes gets closely related with the semantic features and decision requirements of the disaster management context. For this reason, an adequate characterization of this structure is an important step towards the adaptation of a classifier to those features and requirements. In this paper, we have shown that the introduction of a dissimilarity operator over the set of classes enables the consideration of several structures and their introduction in the classifier's learning and reasoning procedures. As a consequence, a significant improvement in the accuracy and adaptation of the classifiers to the decision requirements of the disaster management context is achieved.

References

[1] Aleskerov, F., Iseri Say, A., Toker, A., Akin, H. L., Altay, G. (2005) A cluster-based decision support system for estimating earthquake damage and casualties, Disasters, 29 (3) 255-276

[2] Casillas J, Cordón O, Herrera F (2002) COR: A Methodology to Improve Ad Hoc Data-Driven Linguistic Rule Learning Methods by Inducing Cooperation Among Rules. IEEE Trans. on Systems, Man and Cybernetics-Part B: Cybernetics 32 (4): 526- 537

[3] Cordón, O., del Jesús, M. J., Herrera, F. (1999) A proposal on reasoning methods in fuzzy rule-based classification systems, International Journal of Approximate Reasoning, 20 (1) 21-45

[4] Drabek, T. E., Hoetmer, G. J. (1991) Emergency management: principles and practice for local government, International City Management Association, Washington DC

[5] Hüllermeier, E. (2005) Fuzzy methods in machine learning and data mining: Status and prospects, Fuzzy Sets and Systems, 156 (3) 387-406

[6] Mendonça, D., Beroggi, E. G., Wallace, W. A. (2001) Decision support for improvisation during emergency response operations, International Journal of Emergency Management, 1 30-38

[7] Montero, J., Gomez, D., Bustince, H. (2007) On the relevance of some families of fuzzy Sets, Fuzzy Sets and Systems, 158 (22) 2429-2442

[8] Morrow, B. H. (1999) Identifying and mapping community vulnerability, Disasters, 23 (1) 1-18

[9] Olsen, G. R., Carstensen, N., Hoyen, K. (2003) Humanitarian crises: What determines the level of emergency assistance? Media coverage, donor interests and the aid business, Disasters, 27 (2) 109-126

[10] Rodriguez J. T., Franco C.A., Vitoriano B., Montero J. (2011) An axiomatic approach to the notion of semantic antagonism, Procs IFSA-AFSS'11 FT104-1/6

[11] Rodríguez, J. T., Vitoriano, B., Montero, J. (2011) Rule-based classification by means of bipolar criteria. 2011 IEEE Symposium on Multicriteria Decision Making (SSCI-MCDM) 197-204

[12] Rodríguez, J. T., Vitoriano, B., Montero, J. (2012) A general methodology for data-based rule building and its application to natural disaster management, Computers & Operations Research, 39 (4) 863-873

[13] Rodríguez, J. T., Vitoriano, B., Montero, J., Omaña, A. (2008) A decision support tool for humanitarian operations in natural disaster relief, Computational Intelligence in Decision and Control, 1 805-810

[14] Rodríguez, J. T., Vitoriano, B., Montero, J., Kecman V. (2011) A disaster-severity assessment DSS comparative analysis. OR Spectrum 33(3) 451-479

[15] Schweizer B., Sklar A. (1983) Probabilistic Metric Spaces. North–Holland/Elsevier, New York

[16] Vitoriano, B., Ortuño, M. T., Tirado, G., Montero, J. (2010) A multi-criteria optimization model for humanitarian aid distribution, Journal of Global Optimization (JOGO), 51 189-208

[17] Wallace, W. A., De Balogh, F. (1985) Decision Support Systems for Disaster Management, Public Administration Review, 45 134-146