

Introducing Fault Tolerance to XCS

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ABSTRACT

In this paper, we introduce fault tolerance to XCS and propose a new XCS framework called *XCS with Fault Tolerance* (XCS/FT). As an important branch of learning classifier systems, XCS has been proven capable of evolving maximally accurate, maximally general problem solutions. However, in practice, it oftentimes generates a lot of rules, which lower the readability of the evolved classification model, and thus, people may not be able to get the desired knowledge or useful information out of the model. Inspired by the fault tolerance mechanism proposed in field of data mining, we devise a new XCS framework by integrating the concept and mechanism of fault tolerance into XCS in order to reduce the number of classification rules and therefore to improve the readability of the generated prediction model. A series of N -multiplexer experiments, including 6-bit, 11-bit, 20-bit, and 37-bit multiplexers, are conducted to examine whether XCS/FT can accomplish its goal of design. According to the experimental results, XCS/FT can offer the same level of prediction accuracy on the test problems as XCS can, while the prediction model evolved by XCS/FT consists of significantly fewer classification rules.

Categories and Subject Descriptors

I.2.6 [Artificial Intelligence]: Learning—*Concept learning, knowledge acquisition*; I.5.2 [Artificial Intelligence]: Design Methodology—*Classifier design and evaluation*

General Terms

Algorithms, Design, Performance

Keywords

XCS, XCS/FT, LCS, Fault tolerance, Data mining

1. XCS/FT

XCS [2] has become one of the representatives of LCS and is potentially applicable to data mining problems. Pei et al. [1] indicated that real-world data tend to be dirty and demonstrated that the *fault tolerance mechanism* was able to discover more general and more useful knowledge. In this study, inspired by fault tolerance, we develop a new framework of XCS, called *XCS with Fault Tolerance* (XCS/FT)

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GECCO'07, July 7–11, 2007, London, England, United Kingdom.
ACM 978-1-59593-697-4/07/0007.

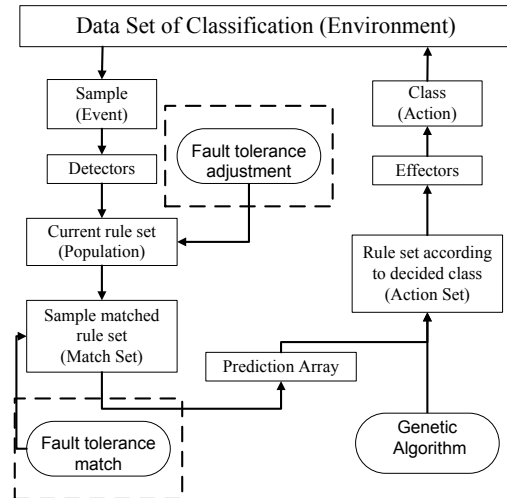


Figure 1: Framework of XCS/FT.

by introducing the concept of fault tolerance into XCS such that the readability of the evolved model can be improved and the useful knowledge of the given data can be extracted.

Figure 1 shows the overall framework of XCS/FT. The main modifications include the classifier definition, fault tolerance match, and fault tolerance adjustment. For more detailed descriptions, a complete paper is available at

<http://nclab.tw/TR/2007/NCL-TR-2007005.pdf>

Acknowledgments

The work was partially sponsored by the National Science Council of Taiwan under grants NSC-95-2221-E-009-092 and NSC-95-2627-B-009-001 as well as by the MOE ATU Program. The authors are grateful to the National Center for High-performance Computing for computer time and facilities.

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