XCS for Adaptive User-Interfaces

Anil Shankar
Department of Computer Science and Engineering
University of Nevada, Reno
anilk@cse.unr.edu

Sushil J. Louis
Department of Computer Science and Engineering
University of Nevada, Reno
sushil@cse.unr.edu

Sergiu Dascalu
Department of Computer Science and Engineering
University of Nevada, Reno
dascalus@cse.unr.edu

Ramona Houmanfar
Department of Psychology
University of Nevada, Reno
ramonah@unr.nevada.edu

Linda J. Hayes
Department of Psychology
University of Nevada, Reno
lhayes@unr.nevada.edu

ABSTRACT

We outline our context learning framework that harnesses information from a user's environment to learn user preferences for application actions. Within this framework, we employ XCS in a real world application for personalizing user-interface actions to individual users. Sycophant, our context aware calendaring application and research test-bed, uses XCS to adaptively generate user-preferred alarms for ten users in our study. Our results show that XCS' alarm prediction performance equals or surpasses the performance of One-R and a decision tree algorithm for all the users. XCS' average performance is close to 90 percent on the alarm prediction task for all ten users. These encouraging results further highlight the feasibility of using XCS for predictive data mining tasks and the promise of a classifier systems based approach to personalize user interfaces.

Categories and Subject Descriptors

H.5.2 [**User Interfaces**]: [User-Centered Design], I.2.1Artificial Intelligence[Applications and Expert Systems]

General Terms

Design, Algorithms, Experimentation

Keywords

Genetic Algorithms, Learning Classifier Systems, XCS, Data Mining

1. INTRODUCTION

Current computer applications are partially aware of a user and her environment. Activity of an internal clock, keyboard and mouse provide input or context to these applications for interacting with a user. Such applications rely on meager contextual information to make weak attempts in adapting their behavior to individual user needs. A user's environment is a rich source for simple contextual information like the existence of motion or speech - in addition to the activity of an internal clock, keyboard and mouse. We gather such contextual information using simple sensors like a web-camera to detect motion and a microphone to detect the presence or absence of speech. Next, we mine this data using machine learning techniques to build a user model. Within our context learning framework, we then make this user model available through an API to enable Sycophant to personalize its alarm-generation behavior to ten users in our study.

GECCO 2007, July 7-11, London, England, United Kingdom
ACM 978-159593-697-4/07/0007

2. RESULTS AND CONCLUSIONS

In our user-interface personalization experiment, we evaluate the performance of Zero-R, One-R and J48 and XCS on the individual context data sets collected from the ten users in our study [3, 2, 1]. On the *4Class Alarm Problem* of learning to discriminate between four alarm types, the average performance of other machine learning schemes was close to 64 percent while XCS' average performance was close to 92 percent. XCS significantly outperformed other learning algorithms for 90 percent of the users. XCS' performance was similar on the *2Class Alarm Problem* of deciding whether or not to interrupt a user; XCS outperformed other learning methods for 80 percent of the users. We attribute XCS' superior performance over the other machine learning schemes to the increased number of rules that covered different alarm types for different users. For the next phase of our research we aim to collect long term data from different users and evaluate the generalizability of our approach to additional applications. Our results clearly show that XCS is a viable approach for predictive data mining tasks and highlight the potential of a classifier systems based approach to user interface personalization.

3. REFERENCES

[1] A. Shankar, S. J. Louis, S. Dascalu, R. Houmanfar, and L. J. Hayes. User-context for adapative user interfaces. In *2007 Intelligent User Interfaces, January 27-31, Honolulu, USA.*

[2] S. W. Wilson. Classifier fitness based on accuracy. *Evolutionary Computation*, 3(2):149–175, 1995.

[3] I. H. Witten and E. Frank. *Data Mining: Practical machine learning tools with Java implementations.* Morgan Kaufmann, San Francisco, USA, 2000.