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Tim Kovacs

# Strength or Accuracy: Credit Assignment in Learning Classifier Systems



Springer

# Strength Or Accuracy Credit Abignment In Learning Clabifier Systems

**Timothy Michael Douglas Kovacs**



## **Strength Or Accuracy Credit Abignment In Learning Clabifier Systems:**

*Strength or Accuracy: Credit Assignment in Learning Classifier Systems* Tim Kovacs, 2012-12-06 Classifier systems are an intriguing approach to a broad range of machine learning problems based on automated generation and evaluation of condition action rules. In reinforcement learning tasks they simultaneously address the two major problems of learning a policy and generalising over it and related objects such as value functions. Despite over 20 years of research however classifier systems have met with mixed success for reasons which were often unclear. Finally in 1995 Stewart Wilson claimed a long awaited breakthrough with his XCS system which differs from earlier classifier systems in a number of respects the most significant of which is the way in which it calculates the value of rules for use by the rule generation system. Specifically XCS like most classifier systems employs a genetic algorithm for rule generation and the way in which it calculates rule fitness differs from earlier systems. Wilson described XCS as an accuracy based classifier system and earlier systems as strength based. The two differ in that in strength based systems the fitness of a rule is proportional to the return reward payoff it receives whereas in XCS it is a function of the accuracy with which return is predicted. The difference is thus one of credit assignment that is of how a rule's contribution to the system's performance is estimated. XCS is a Q learning system in fact it is a proper generalisation of tabular Q learning in which rules aggregate states and actions. In XCS as in other Q learners Q values are used to weight action selection.

**Learning Classifier Systems** Pier Luca Lanzi, Wolfgang Stolzmann, Stewart W. Wilson, 2003-11-24 The 5th International Workshop on Learning Classifier Systems IWLCS2002 was held September 7-8 2002 in Granada Spain during the 7th International Conference on Parallel Problem Solving from Nature PPSN VII. We have included in this volume revised and extended versions of the papers presented at the workshop. In the first paper Browne introduces a new model of learning classifier system iLCS and tests it on the Wisconsin Breast Cancer classification problem. Dixon et al present an algorithm for reducing the solutions evolved by the classifier system XCS so as to produce a small set of readily understandable rules. Ene and Barbaroux take a close look at Pittsburgh style classifier systems focusing on the multi agent problem known as El farol. Holmes and Bilker investigate the effect that various types of missing data have on the classification performance of learning classifier systems. The two papers by Kovacs deal with an important theoretical issue in learning classifier systems the use of accuracy based fitness as opposed to the more traditional strength based fitness. In the first paper Kovacs introduces a strength based version of XCS called SB XCS. The original XCS and the new SB XCS are compared in the second paper where Kovacs discusses the different classes of solutions that XCS and SB XCS tend to evolve.

**Learning Classifier Systems** Pier L. Lanzi, Wolfgang Stolzmann, Stewart W. Wilson, 2003-06-26 Learning Classifier Systems LCS are a machine learning paradigm introduced by John Holland in 1976. They are rule based systems in which learning is viewed as a process of ongoing adaptation to a partially unknown environment through genetic algorithms and temporal difference learning. This book provides a unique survey of the current state of the art of LCS and highlights some of the most promising

research directions The first part presents various views of leading people on what learning classifier systems are The second part is devoted to advanced topics of current interest including alternative representations methods for evaluating rule utility and extensions to existing classifier system models The final part is dedicated to promising applications in areas like data mining medical data analysis economic trading agents aircraft maneuvering and autonomous robotics An appendix comprising 467 entries provides a comprehensive LCS bibliography Mathematical Reviews, 2005 **Advances in Evolutionary Computing** Ashish Ghosh, Shigeyoshi Tsutsui, 2012-12-06 The term evolutionary computing refers to the study of the foundations and applications of certain heuristic techniques based on the principles of natural evolution thus the aim of designing evolutionary algorithms EAs is to mimic some of the processes taking place in natural evolution These algorithms are classified into three main categories depending more on historical development than on major functional techniques In fact their biological basis is essentially the same Hence EC GA uGP uES uEP EC Evolutionary Computing GA Genetic Algorithms GP Genetic Programming ES Evolution Strategies EP Evolutionary Programming Although the details of biological evolution are not completely understood even nowadays there is some strong experimental evidence to support the following points Evolution is a process operating on chromosomes rather than on organisms Natural selection is the mechanism that selects organisms which are well adapted to the environment to reproduce more often than those which are not The evolutionary process takes place during the reproduction stage that includes mutation which causes the chromosomes of offspring to be different from those of the parents and recombination which combines the chromosomes of the parents to produce the offspring Based upon these features the previously mentioned three models of evolutionary computing were independently and almost simultaneously developed An evolutionary algorithm EA is an iterative and stochastic process that operates on a set of individuals called a population *Proceedings of the Genetic and Evolutionary Computation Conference*, 2000 GECCO-2000 L. Darrell Whitley, 2000 Proceedings of the ... International Joint Conference on Artificial Intelligence, 1989 IJCAI-89 International Joint Conferences on Artificial Intelligence, 1989 GECCO-99 Wolfgang Banzhaf, 1999 *The British National Bibliography* Arthur James Wells, 2005 **Genetic Programming** John R. Koza, 1998 *Proceedings of the Annual Conferences on Genetic Programming* These proceedings present the most recent research in the field of genetic programming as well as recent research results in the fields of genetic algorithms artificial life and evolution strategies DNA computing evolvable hardware and genetic learning classifier systems **American Book Publishing Record**, 2004 **Learning Classifier Systems** Pier L. Lanzi, 2000-06-21 Learning Classifier Systems LCS are a machine learning paradigm introduced by John Holland in 1976 They are rule based systems in which learning is viewed as a process of ongoing adaptation to a partially unknown environment through genetic algorithms and temporal difference learning This book provides a unique survey of the current state of the art of LCS and highlights some of the most promising research directions The first part presents various views of leading people on what

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**AI, Simulation and Planning in High Autonomy Systems** Bernard P. Zeigler, Jerzy Rozenblit, 1990 **Information Wissenschaft & Praxis**, 2006 **Proceedings**, 1990 **Artificial Intelligence and Simulation** Willard Holmes, 1985

**A Comparison of Strength and Accuracy-based Fitness in Learning and Classifier Systems** Timothy Michael Douglas Kovacs, 2002 *Introduction to Learning Classifier Systems* Ryan J. Urbanowicz, Will N. Browne, 2017-08-17 This accessible introduction shows the reader how to understand implement adapt and apply Learning Classifier Systems LCSs to interesting and difficult problems The text builds an understanding from basic ideas and concepts The authors first explore learning through environment interaction and then walk through the components of LCS that form this rule based evolutionary algorithm The applicability and adaptability of these methods is highlighted by providing descriptions of common methodological alternatives for different components that are suited to different types of problems from data mining to autonomous robotics The authors have also paired exercises and a simple educational LCS eLCS algorithm implemented in Python with this book It is suitable for courses or self study by advanced undergraduate and postgraduate students in subjects such as Computer Science Engineering Bioinformatics and Cybernetics and by researchers data analysts and machine learning practitioners

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