

Preface

This book is based on the material presented at the Twelfth Workshop on Genetic Programming Theory and Practice by the Center for the Study of Complex System at the University of Michigan in Ann Arbor on May 8th–10th, 2014. The purpose of this workshop is to promote the exchange of ideas between theorists working on genetic programming and people applying genetic programming to real-world problems. It is designed to encourage speculative presentations with a lot of time for discussion between presentations and focuses on the underlying principles of Genetic Programming (GP) and methods of application used to get the best results. Each chapter of this book was sent to two other participants *before* the workshop who responded with comments and suggestions, thus allowing the authors to revise and expand the work presented at the workshop. After the workshop, the authors revised the work based on comments and discussions from the participants. In many cases the involvement of reviewers, and the general discussions during workshop is considered the most important aspect of the the workshop.

In addition to the GP researchers and practitioners, there were three keynote speakers who presented on a related area of study at the start each day. Traditionally, these have involved a biological component as GP is inspired by the mechanisms of natural selection, a presentation on a related field of computer science, often related to machine learning, and a presentation by someone from industry describing the use of a cutting edge technology in a practical application. This year, on the first day, Dr. Chao Cheng of Dartmouth University presented *Application of Machine-Learning Methods to Transcriptional Regulation by Histone Modifications and Transcription Factors* where he discussed his group's use of machine learning and genetic programming in the analysis of molecular biology, and in particular, the mechanisms of genetics. On the second day, Paco Nathan presented *Nine Decades of Machine Learning: GP in the context of Big Data and contemporary open source* which described the history of machine learning, its growing importance in the analysis of 'Big Data' and the potential for GP in this space. Finally, Theresa Kotanchek presented *Materials Innovation and the Next Manufacturing Renaissance*, a description of her tenure as the VP of Sustainable Technology at Dow Chemical Company, the difficulties and successes of applying machine learning and GP to the development of

more energy efficient manufacturing processes, and the future use of GP in designing new materials.

In addition to the presentations and keynote speakers, we expanded the format of the workshop this year to include “whiteboard sessions”—discussions led by a participant of the workshop on a topic of ongoing research. The goal of these sessions was to expand the speculative nature of the workshop so that people could present and discuss topics on which their thinking was not yet complete in order to solicit new ideas and suggestions on these topics. Though the results of these sessions do not appear in this book, they provided another avenue of discussion for ideas that were not quite ready for general release. The hope is that these sessions will take advantage of the collected experience and knowledge of the participants and will lead to future papers and presentations at GP Theory and Practice.

Here is a list of the whiteboard sessions and the people who led the discussions:

- *Evolving Arbitrary Software*—Led by Lee Spector
- *Mobile Computing and Evolutionary Computing*—Led by Moshe Sipper
- *Application Spaces and Opportunities*—Led by William P. Worzel

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