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**Riccardo Poli, William B. Langdon, Nicholas F. McPhee:
A Field Guide to Genetic Programming**

Lulu.com, 2008, 250 pp, ISBN 978-1-4092-0073-4

Michael O'Neill

The latest book on Genetic Programming, Poli, Langdon and McPhee's (with contributions from John R. Koza) *A Field Guide to Genetic Programming* represents an exciting landmark with the authors choosing to make their work freely available by publishing using a form of the Creative Commons License[1]. In so doing they have created a must-read resource which is, to use their words, '*aimed at both newcomers and old-timers*'. The book is freely available from the authors companion website [2] and Lulu.com [3] in both pdf and html form. For those who desire the more traditional page turning exercise, inexpensive printed copies can be ordered from Lulu.com. The *Field Guides* companion website also provides a link to the TinyGP code printed over eight pages of Appendix B, and a Discussion Group centered around the book.

The book is divided into four parts with fourteen chapters and two appendices. Part I introduces the basics of Genetic Programming, Part II overviews more advanced topics, Part III highlights some of the real world applications and discusses issues facing the GP researcher or practitioner, while Part IV contains two appendices, the first introducing some key resources and the second appendix describes the TinyGP code. The pdf and html forms of the book have an especially useful feature, providing links to the articles available on-line at the time of publication, and to bibtex entries of the GP Bibliography.

Following an overview of the book in chapter 1, chapter 2 introduces the basic concepts of GP focusing on the tree representation, initialisation, selection, and the search operators. Chapter 3 is centered around the preparatory steps in applying GP to a problem, which is followed by an outline of a sample run of GP on a simple instance of symbolic regression in Chapter 4. Overall these chapters provide a compact and useful introduction to GP.

The first of the Advanced GP chapters in Part II looks at alternative strategies for initialisation and the search operators for tree-based GP. An overview of Modular, Grammatical and Developmental GP is provided in Chapter 6. While the chapter title

suggests the focus is on tree-based GP, some linear GP approaches, such as Grammatical Evolution, are also discussed here. The theme of alternative representations is continued then in Chapter 7 with an introduction to graph and linear approaches. The use of alternative search engines such as Estimation of Distribution Algorithms are covered in Probabilistic GP (Chapter 8). Practical issues such as handling multi-objective problems are discussed in Chapter 9, with Fast and Distributed approaches in Chapter 10. The final chapter in Part II provides a crash course summary on the development of a Theory of GP and its applications. Part II of the *Field Guide* is commendable for its breadth of coverage, and consequently can't be expected to cover this vast literature in more detail.

Part III begins with an overview of the applications of GP, and in particular provides a useful discussion on what types of problem GP is suited to. Chapter 13, entitled *Troubleshooting GP* is a useful discussion on a diverse set of issues that can face researchers and practitioners of GP alike, covering areas such as buggy code, analysing run behaviour, checkpointing and how to approach reporting experimental results. Some brief conclusions are drawn in Chapter 14.

The *Field Guide to Genetic Programming* is an invaluable starting point for the new GP researcher or practitioner, assisting them with an initial perspective on the field with most significant research areas mentioned. By the very nature of the field guides sample of a snapshot in time it is not a complete review of GP, which would cite all papers on each topic. The authors themselves note '*In 1996 it was possible to list almost all the studies and applications of GP [4], but today the range is far too great*'. The responsibility rests with the reader to dive more deeply into the literature on each area of interest, and the *Field Guide* provides an excellent launch pad.

Acknowledgements

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