Software Engineering: An Ideal Set of Challenges for Evolutionary Computation

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ABSTRACT
Software is an engineering material to be optimised. Until comparatively recently many computer scientists doubted this; why would one want to optimise something that could be made perfect by pure logical reasoning? However, the wider community has come to realise that, while very small programs may be perfect in isolation, larger software systems may never be (because the world in which they operate is not perfect). Once we accept this, we soon arrive at evolutionary computation as a means of optimising software. However, software is not merely some other engineering material to be optimised. Software is virtual and inherently adaptive, making it better suited to evolutionary computation than any other engineering material. This is leading to breakthroughs at the interface of software engineering and evolutionary computation, though there are still many exciting open problems for evolutionary computation researchers to get their teeth into. This talk will cover some of these recent developments in Search Based Software Engineering (SBSE) and Dynamic Adaptive SBSE.

Categories and Subject Descriptors
D.2 [Software Engineering]

General Terms
Software Engineering, Evolutionary Computation, Automatic Programming

Keywords
SBSE, Self-Adaptive Systems, Software Engineering

1. BACKGROUND
Search Based Software Engineering (SBSE) is the name given to a field of research and practice in which computational search and optimisation techniques are used to address problems in Software Engineering [15]. This keynote is primarily concerned with Dynamic Adaptive Search Based Software Engineering. Following the tradition for GECCO keynote abstracts, this abstract contains pointers to the literature that will be covered in the talk, together with biographic information about the speaker.

An overview of the area of Dynamic Adaptive SBSE is described in the ESEM 2012 keynote paper [14], while readers interested in the use of genetic programming to construct pareto program surfaces can find a more detailed treatment in the ASE 2012 keynote paper [17].

The talk will also cover some of the landmarks in the development of SBSE. Readers interested in reading more about this background can find surveys of SBSE for requirements [27], predictive modelling [1], the cloud [16], machine learning and AI [13], design [26] and testing [2, 3, 22]. There are also comprehensive surveys of the whole field of SBSE [18] and trend analyses [5, 7].

There are also a number of tools for SBSE applications including tools for testing [4, 6, 19, 20] modularisation [24], and bug fixing [21]. Readers interested to find sets of open problems in SBSE can find these in papers on SBSE for program comprehension [9], software maintenance [25], predictive modelling [11], testing [23], bug fixing [8] and testability transformation [10].

Finally, for readers specifically interested in applications of Evolutionary Computation in Software Engineering, there is a recent IEEE Computer article [12].

The DAASE Project: Readers might also be interested in the DAASE (Dynamic Adaptive Automated Software Engineering) project. DAASE is a major research initiative running until May 2018, funded by the Engineering and Physical Sciences Research Council (EPSRC). DAASE has a programme for short and longer term visiting scholars (at all levels from PhD student to full professor) and arrangements for staff exchanges and internships with other organisations. For more information, contact Lena Hierl, the DAASE Administrative Manager (email: crest-admin@ucl.ac.uk) or Mark Harman, the DAASE project director.

2. SHORT BIOGRAPHY
Mark Harman is professor of Software Engineering in the Department of Computer Science at University College London where he directs the CREST centre. He is widely known for work on source code analysis and testing and was instrumental in the founding of the field of Search Based Software Engineering (SBSE), the topic of this keynote. Since its inception in 2001, SBSE has rapidly grown to include over 800 authors, from 270 institutions spread over 40 countries. Harman’s SBSE work has been used by many organisations including Daimler, Ericsson, Google, IBM, Microsoft and Motorola. A curated and searchable repository of all papers by all authors on SBSE can be found on the web at URL: crestweb.cs.ucl.ac.uk/resources/sbse_repository/.

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ACM 978-1-4503-1964-5/13/07.
3. REFERENCES


