Stress-testing algorithms via Instance Space Analysis

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Abstract

Instance Space Analysis (ISA) is a recently developed methodology to support objective testing of algorithms. Rather than reporting algorithm performance on average across a chosen set of test problems, as is standard practice, ISA offers a more nuanced understanding via visualisation of the unique strengths and weaknesses of algorithms across different regions of the instance space that may otherwise be hidden on average. It also facilitates objective assessment of any bias in the chosen test instances, and provides guidance about the adequacy of benchmark test suites and the generation of more diverse and comprehensive test instances to span the instance space. This tutorial provides an overview of the ISA methodology, and the online software tools (seematilda.unimelb.edu.au) that are enabling its worldwide adoption in many disciplines. Several case studies from classical operations research problems will be presented to illustrate the methodology and tools, including timetabling, travelling salesman problem, 0-1 knapsack; and applications to machine learning will also be highlighted.