MULTIDISCIPLINARY DESIGN OPTIMIZATION

UNSW Canberra

Never Stand Still

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Transferring learning of knowledge and functionality from simple problems to larger scale and related problems

Abstract: Transfer learning is an increasingly important concept as the scalability of existing artificial intelligence methodologies is stagnating due to the complexity of modern problems. Individual problems can be solved, but an alternative to many individual computers working in ensembles is required for convenience, cost and elegance. Sub-symbolic approaches can now share models of learned patterns, but not functionality. Symbolic approaches can learn building blocks of knowledge as well as select and construct problem features, but are often restarted for each new problem. The symbolic evolutionary computation technique of Learning Classifier Systems (LCSs) was conceived 40 years ago as a cognitive system, although it is since been developed into a powerful and flexible classification approach. The work presented shows how LCSs can utilise code fragments (building blocks of knowledge) in 'if-then' rules to transfer learnt knowledge from small to large scale problems in the same domain. Furthermore, the use of these rules enables functionality learned in sub-problems to be transferred to related problems. Provided the human experimenter can set a rough curricula for learning threshold concepts, the underlying patterns/models in a problem domain can be learnt in an interpretable manner. Solutions to previously intractable problems and general solutions to domains, such as even/odd parity, carry and multiplexer problems, are presented for the first time.

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Blue skies research includes analogues of emotions, abstraction, memories, Small-Worlds phenomenon, dissonance and machine consciousness. He is an Associate Editor for Neural Computing sand Applications, and Applied Soft Computing. He has published over 100 academic papers, including two best paper awards in Genetic and Evolutionary Computation Conference and in IEEE Transactions on Evolutionary Computation on scalable learning.