

Joshua Knowles



## Overview

Joshua Knowles is a research scientist at Schlumberger Cambridge Research Ltd, in Cambridgeshire, UK.

## Current Employment

### Principal Scientist

Schlumberger Cambridge Research  
Cambridge, United Kingdom  
11 Apr 2022 → present

### Honorary Fellow

University of Birmingham  
Birmingham, United Kingdom  
2 Apr 2019 → present

## Previous Employment

### Senior Researcher

Invenia Labs  
Cambridge, United Kingdom  
30 Jun 2020 → 15 Mar 2022

## Research outputs (50 most recent)

### On Benchmarking Interactive Evolutionary Multi-Objective Algorithms

Shavarani, S. M., López-Ibáñez, M. & Knowles, J., 23 Jun 2023, (Accepted/In press) In: IEEE Transactions on Evolutionary Computation.

### An Interactive Decision Tree-Based Evolutionary Multi-Objective Algorithm

Shavarani, S. M., López-Ibáñez, M., Allmendinger, R. & Knowles, J., 1 Feb 2023, (Accepted/In press) *EMO 2023*.

### Cooperative Multi-Agent Search on Endogenously-Changing Fitness Landscapes

Lim, C. W., Allmendinger, R., Knowles, J., Alhosani, A. & Bleda, M., 28 Jun 2022.

### Deep Optimisation: Transitioning the Scale of Evolutionary Search by Inducing and Searching in Deep Representations

Caldwell, J., Knowles, J., Thies, C., Kubacki, F. & Watson, R., 15 May 2022, In: SN Computer Science. 3, 3, 253.

### Expensive Optimization with Production-Graph Resource Constraints: A First Look at a New Problem Class

Pricopie, S., Allmendinger, R., López-Ibáñez, M., Fare, C., Benatan, M. & Knowles, J., 25 Mar 2022, (Accepted/In press) *GECCO '21: Proceedings of the Genetic and Evolutionary Computation Conference*.

### Realistic Utility Functions Prove Difficult for State-of-the-Art Interactive Multiobjective Optimization Algorithms

Shavarani, S. M., López-Ibáñez, M. & Knowles, J., 26 Jun 2021, *GECCO '21: Genetic and Evolutionary Computation Conference Proceedings*. Association for Computing Machinery, p. 457-465 9 p. (GECCO 2021 - Proceedings of the 2021 Genetic and Evolutionary Computation Conference).

**Deep Optimisation: Multi-scale Evolution by Inducing and Searching in Deep Representations**

Caldwell, J., Knowles, J., Thies, C. & Kubacki, F., 2021, *Applications of Evolutionary Computation - 24th International Conference, EvoApplications 2021, Held as Part of EvoStar 2021, Proceedings*. Castillo, P. A. & Jiménez Laredo, J. L. (eds.). Springer Nature, p. 506-521 16 p. (Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics); vol. 12694 LNCS).

**Deep Optimisation: Solving Combinatorial Optimisation Problems using Deep Neural Networks**

Caldwell, J. R., Watson, R. A., Thies, C. & Knowles, J. D., 2 Nov 2018, 9 p.

**An Improved and More Scalable Evolutionary Approach to Multiobjective Clustering**

Garza-Fabre, M., Handl, J. & Knowles, J., 2018, In: *IEEE Transactions on Evolutionary Computation*. 22, 4, p. 515 - 535

**Sequential experimentation by evolutionary algorithms**

Shir, O. M., Bäck, T., Knowles, J. & Allmendinger, R., 15 Jul 2017, *GECCO 2017 - Proceedings of the Genetic and Evolutionary Computation Conference Companion*. Association for Computing Machinery, p. 828-851 24 p. (GECCO 2017 - Proceedings of the Genetic and Evolutionary Computation Conference Companion).

**Initialization of Bayesian Optimization Viewed as Part of a Larger Algorithm Portfolio**

Morar, M. T., Knowles, J. & Sampaio, S., 1 May 2017, (Accepted/In press) *Data Science meets Optimization Workshop: CEC2017 & CPAIOR 2017: DSO 2017*. 6 p.

**Editorial**

Brockhoff, D., Knowles, J., Naujoks, B. & Sindhya, K., 1 Mar 2017, In: *Computers and Operations Research*. 79, p. 264-265 2 p.

**Editorial: Special issue on understanding complexity in multiobjective optimization**

Greco, S., Klamroth, K., Knowles, J. & Rudolph, G., 1 Jan 2017, In: *Journal of Multi-Criteria Decision Analysis*. 24, 1-2, p. 3-4 2 p.

**A new reduced-length genetic representation for evolutionary multiobjective clustering**

Garza-Fabre, M., Handl, J. & Knowles, J., 2017, p. 236-251. 17 p.

**On using decision maker preferences with ParEGO**

Hakanen, J. & Knowles, J. D., 2017, *Evolutionary Multi-Criterion Optimization*. p. 282-297 16 p.

**Simheuristics for the multiobjective nondeterministic firefighter problem in a time-constrained setting**

Michalak, K. & Knowles, J. D., 2 Apr 2016, *Applications of Evolutionary Computation*.

**Generating, Maintaining and Exploiting Diversity in a Memetic Algorithm for Protein Structure Prediction**

Garza-Fabre, M., Kandathil, S. M., Handl, J., Knowles, J. & Lovell, S. C., 2016, In: *Evolutionary Computation*.

**Global network cooperation catalysed by a small prosocial migrant clique**

Miller, S. & Knowles, J., 2016, *Unconventional Computation and Natural Computation*. p. 62-74 13 p.

**The emergence of cooperation in public goods games on randomly growing dynamic networks**

Miller, S. & Knowles, J., 2016

**Using machine learning to explore the relevance of local and global features during conformational search in Rosetta**

Garza-Fabre, M., Kandathil, S. M., Handl, J., Knowles, J. & Lovell, S. C., 11 Jul 2015, *GECCO 2015 - Companion Publication of the 2015 Genetic and Evolutionary Computation Conference*. Silva, S. (ed.). Association for Computing Machinery, p. 935-938 4 p. (GECCO 2015 - Companion Publication of the 2015 Genetic and Evolutionary Computation Conference).

### **Population Fluctuation Promotes Cooperation in Networks**

Miller, S. & Knowles, J., 10 Jun 2015, In: *Scientific Reports*. 5, 11054.

### **Multiobjective Optimization: When Objectives Exhibit Non-Uniform Latencies**

Allmendinger, R., Handl, J. & Knowles, J., 1 Jun 2015, In: *European Journal of Operational Research*. 243, 2, p. 497-513 16 p.

### **Machine Decision Makers as a Laboratory for Interactive EMO**

Lopez-Ibanez, M. & Knowles, J., 18 Mar 2015, *Proceedings of the 2015 International Conference on Evolutionary Multi-Criterion Optimization (EMO'15)*. Berlin: Springer Nature, Vol. 9019. p. 295-309 14 p. (Lecture Notes in Computer Science (LNCS); vol. 9019).

### **Molecular phenotyping of a UK population: defining the human serum metabolome**

Dunn, W., Lin, W., Broadhurst, D., Begley, P., Brown, M., Zelena, E., Vaughan, A., Halsall, A., Harding, N., Knowles, J., Francis-McIntyre, S., Tseng, A., Ellis, D., O'Hagan, S., Aarons, G., Benjamin, B., Chew-Graham, S., Moseley, C., Potter, P., Winder, C., & 16 others Potts, C., Thornton, P., McWhirter, C., Zubair, M., Pan, M., Burns, A., Cruickshank, K., Jayson, G., Purandare, N., Wu, FC., Finn, J., Haselden, JN., Nicholls, AW., Wilson, ID., Goodacre, R. & Kell, D., Feb 2015, In: *Metabolomics*. 11, 1, p. 9-26 18 p.

### **Nature-inspired clustering**

Handl, J. & Knowles, J., 1 Jan 2015, *Handbook of Cluster Analysis*. Hennig, C., Meila, M., Murtagh, F. & Rocci, R. (eds.). CRC Press and Balkema, p. 419-440 22 p.

### **A Minimal Model for the Emergence of Cooperation in Networks**

Knowles, J., 2015, *European Conference on Artificial Life*.

### **Evolutionary Clustering**

Handl, J., Corne, D. & Knowles, J., 2015, *Encyclopedia of Machine Learning (2nd edition)*.

### **MUSCLE: Automated Multi-objective Evolutionary Optimisation of Targeted LC-MS/MS Analysis**

Bradbury, J., Genta-Jouve, G., Allwood, J. W., Dunn, W. B., Goodacre, R., Knowles, J. D., He, S. & Viant, M. R., 11 Nov 2014, In: *Bioinformatics*.

### **Ephemeral Resource Constraints in Optimization**

Knowles, J., Allmendinger, R., Datta, R. (ed.) & Deb, K. (ed.), 2014, *Evolutionary Constrained Optimization*. Springer Nature

### **Hellinger Distance Trees for Imbalanced Streams**

Lyon, R., Brooke, J., Knowles, J. & Stappers, B., 2014, *22nd International Conference on Pattern Recognition (ICPR 2014)*.

### **Meta-Decoders: Self-Reproducing Genotype-Phenotype Maps**

Webb, A. & Knowles, J., 2014, *ALIFE 14: The Fourteenth International Conference on the Synthesis and Simulation of Living Systems*.

### **Studying the evolvability of self-encoding genotype-phenotype maps**

Webb, A. M. & Knowles, J., 2014, *Artificial Life 14 - Proceedings of the 14th International Conference on the Synthesis and Simulation of Living Systems, ALIFE 2014*. Sayama, H., Rieffel, J., Risi, S., Doursat, R. & Lipson, H. (eds.). MIT Press Journals, p. 79-86 8 p. (Artificial Life 14 - Proceedings of the 14th International Conference on the Synthesis and Simulation of Living Systems, ALIFE 2014).

### **Accuracy and tractability of a kriging model of intramolecular polarisable multipolar electrostatics and its application to histidine**

Kandathil, S. M., Fletcher, T. L., Yuan, Y., Knowles, J. & Popelier, P. L. A., 2013, In: *Journal of Computational Chemistry*. p. 1-29

**Comparing multi-objective and threshold-moving ROC curve generation for a prototype-based classifier**

Aler, R., Handl, J. & Knowles, J. D., 2013, *GECCO 2013 - Proceedings of the 2013 Genetic and Evolutionary Computation Conference/GECCO - Proc. Genet. Evol. Comput. Conf.*. Association for Computing Machinery, p. 1029-1036 7 p.

**Evidence accumulation in multiobjective data clustering**

Handl, J. & Knowles, J., 2013, *host publication*. Springer Nature, Vol. 7811. p. 543-557 15 p.

**'Hang on a minute': Investigations on the effects of delayed objective functions in multiobjective optimization**

Allmendinger, R. & Knowles, J., 2013, *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)/Lect. Notes Comput. Sci.*. Springer Nature, Vol. 7811. p. 6-20 14 p. (Lecture Notes in Computer Science, Volume 7811).

**On handling ephemeral resource constraints in evolutionary search**

Allmendinger, R. & Knowles, J., 2013, In: *Evolutionary Computation*. 21, 3, p. 497-531 34 p.

**Predicting skill from gameplay input to a first-person shooter**

Buckley, D., Chen, K. & Knowles, J., 2013, *IEEE Conference on Computational Intelligence and Games, CIG/IEEE Conf. Comput. Intell. Games, CIG*. U.S.A.: IEEE

**Systematic construction of algorithm portfolios for a maintenance scheduling problem**

Almakhlafi, A. & Knowles, J., 2013, *2013 IEEE Congress on Evolutionary Computation, CEC 2013/IEEE Congr. Evol. Comput., CEC*. IEEE, p. 245-252 7 p.

**Exploiting Genomic Knowledge in Optimising Molecular Breeding Programmes: Algorithms from Evolutionary Computing**

O'Hagan, S., Knowles, J. & Kell, D. B., 21 Nov 2012, In: *PLoS ONE*. 7, 11, e48862.

**The dual role of fragments in fragment-assembly methods for de novo protein structure prediction**

Handl, J., Knowles, J., Vernon, R., Baker, D. & Lovell, S. C., Feb 2012, In: *Proteins: Structure, Function and Bioinformatics*. 80, 2, p. 490-504 14 p.

**Selected aspects of natural computing**

Corne, D. W., Deb, K., Knowles, J. & Yao, X., 1 Jan 2012, *Handbook of Natural Computing*. Springer Nature, Vol. 4-4. p. 1737-1801 65 p.

**Benchmarks for maintenance scheduling problems in power generation**

Almakhlafi, A. & Knowles, J., 2012, *2012 IEEE Congress on Evolutionary Computation, CEC 2012/IEEE Congr. Evol. Comput., CEC*. IEEE

**Clustering criteria for use in multiobjective clustering**

Handl, J. & Knowles, J., 2012, *Parallel Problem Solving from Nature - PPSN XII*. Springer Nature, p. 32-41 10 p.

**Clustering criteria in multiobjective data clustering**

Handl, J. & Knowles, J., 2012, *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)/Lect. Notes Comput. Sci.*. Berlin/Heidelberg: Springer Nature, Vol. 7492. p. 32-41 9 p.

**Learning in Multiobjective Optimization (Dagstuhl Seminar 12041)**

Knowles, J. D., Greco, S. (ed.), Miettinen, K. (ed.) & Zitzler, E. (ed.), 2012, *Leibniz-Zentrum für Informatik*. 50 p. (Dagstuhl Reports)

**Efficient discovery of anti-inflammatory small-molecule combinations using evolutionary computing**

Small, B. G., McColl, B. W., Allmendinger, R., Pahle, J., Lopez-Casteon, G., Rothwell, N. J., Knowles, J., Mendes, P., Brough, D. & Kell, D. B., Dec 2011, In: *Nature chemical biology*. 7, 12, p. 902-908 6 p.

### **Procedures for large-scale metabolic profiling of serum and plasma using gas chromatography and liquid chromatography coupled to mass spectrometry**

Dunn, W. B., Broadhurst, D., Begley, P., Zelena, E., Francis-Mcintyre, S., Anderson, N., Brown, M., Knowles, J. D., Halsall, A., Haselden, J. N., Nicholls, A. W., Wilson, I. D., Kell, D. B. & Goodacre, R., Jun 2011, In: Nature protocols. 6, 7, p. 1060-1083 23 p.

### **Evolutionary search in lethal environments**

Allmendinger, R. & Knowles, J., 2011, *ECTA 2011 FCTA 2011 - Proceedings of the International Conference on Evolutionary Computation Theory and Applications and International Conference on Fuzzy Computation Theory and Applications*|*ECTA FCTA - Proc. Int. Conf. Evol. Comput. Theory Appl. Int. Conf. Fuzzy Comput. Theory Appl.* p. 63-72 9 p.

### **On sequential online archiving of objective vectors**

López-Ibáñez, M., Knowles, J. & Laumanns, M., 2011, *Lecture Notes in Computer Science (including subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*|*Lect. Notes Comput. Sci.* Berlin-Heidelberg: Springer Nature, Vol. 6576. p. 46-60 14 p.

## **Projects**

**Extend the functionality of an existing product platform by incorporating an algorithm to enable customers to develop optimised bioprocesses and reduce product costs.**

Allmendinger, R. & Knowles, J.

1/01/17 → 31/12/18

## **Prizes**

### **ACM GECCO Impact Award**

Knowles, Joshua (Recipient), 1 Jun 2017

### **David Phillips Fellowship**

Knowles, Joshua (Recipient), 1 Oct 2003

### **IEEE Transactions on Evolutionary Computation Outstanding Paper Award**

Knowles, Joshua (Recipient), 1 Jun 2006

### **IEEE Transactions on Evolutionary Computation Outstanding Paper Award**

Knowles, Joshua (Recipient), 1 Jun 2008

### **Marie Skłodowska-Curie Fellowship**

Knowles, Joshua (Recipient), 1 Oct 2001