FWF Der Wissenschaftsfonds.

SFB QMC

JKU JOHANNES KEPLER UNIVERSITÄT LINZ

Online talk series

Art Owen from Stanford University will present a series of four lectures related to quasi-Monte Carlo (QMC) sampling.

Lecture 1: Wednesday, 24.03.2021, 04:00 - 05:00 pm.
Lecture 2: Wednesday, 24.03.2021, 05:30 - 06:30 pm.
Lecture 3: Thursday, 25.03.2021, 04:00 - 05:00 pm.
Lecture 4: Thursday, 25.03.2021, 05.30 - 06:30 pm.

Lecture 1 will introduce QMC, starting from its goals, connecting it to Bahkvalov's curse of dimensionality and the Koksma-Hlawka inequality. The talk will include some of the most widely used constructions for QMC and mention some of the application areas, both old and new. It will end with a presentation of weighted Hilbert spaces of low effective dimension.

Lecture 2 will cover randomized QMC (RQMC), primarily scrambling of digital nets. When it is important to have an accurate answer it is also important to verify somehow that the answer was accurate. Randomization provides a good approach to uncertainty quantification. Using the functional ANOVA it is possible to find properties of RQMC estimates (both asymptotic and finite sample) and to see that integrands dominated by low dimensional features are favorable to RQMC. RQMC can handle singular integrands and other functions that are not of bounded variation. Very recent work, joint with Daniel Rudolf, shows that scrambled nets consistently estimate integrals with 1 plus epsilon finite moments.

Lecture 3 will look at how QMC and RQMC, hereafter (R)QMC can be used in settings outside integration over the unit cube. This includes some work with Kinjal Basu on integration over triangles, balls and Cartesian products of similar things. If time permits, RQMC versions of Markov chain Monte Carlo and particle sampling will be included.

Lecture 4 will return to the functional ANOVA and study measures of variable importance. The most important quantities there are Sobol' indices and the closely related Shapley effects, studied in joint work with Clementine Prieur. Estimating these can reveal when RQMC will work well, and in a somewhat circular fashion, RQMC is a very good way to estimate Sobol' indices. Some joint work with Masayoshi Mase and Benjamin Seiler finds a way to quantify variable importance in black box predictions, using the anchored decomposition, an alternative to the functional ANOVA. In joint work with Christopher Hoyt, Sobol' indices show that some deep neural networks used for classifying digits have a low mean dimension property despite having 784 inputs.

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