MATH60005/70005: Optimization (Autumn 23-24)

Week 5: Exercises

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This week we'll do something slightly different:

- If you're a bit late with the content, please use these days to catch up, specially with the gradient descent material. During the first part of our next live session, I'll continue to discuss some problems related to gradient descent.
- If you are up to date with the content, please have a quick look at the following papers in the folder:
  - **Strohmer, Thomas; Vershynin, Roman (2009), "A randomized Kaczmarz algorithm for linear systems with exponential convergence" (PDF), Journal of Fourier Analysis and Applications, 15 (2): 262–278, arXiv:math/0702226, doi:10.1007/s00041-008-9030-4.**

    This is a paper about research results on the convergence of Kacmarz algorithm and the formulation of randomized versions. If you are interested you can try to reproduce the numerical tests!
  - **Higham, C. F. and Higham, D. J. (2019) Deep learning: an introduction for applied mathematicians. SIAM Review, 61(4), pp. 860-891. (doi: 10.1137/18M1165748).**

    This a very gentle introduction from an applied maths perspective, that is, approximation via neural networks + optimization (SGD!). It has nice examples with matlab code if you want to play around. You can have a look at the optimization part to see how SGD fits in the bigger picture.
- If you have a deeper interest in machine learning and optimization, I'd like to encourage you to have a look at the following review on optimization methods for ML:

-L. Bottou, F.E. Curtis, and J. Nocedal. Optimization Methods for Large-Scale Machine Learning SIAM Rev., 60(2), 223–311.

> This paper discusses SGD at a much deeper theoretical level, it's just for you to appreciate all those things that unfortunately we won't have enough time to cover.

None of this content will be assessed, this is voluntary self-directed reading for you to have some fun with SGD.