Learning to Solve Related Linear Systems

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The problem of solving multiple related linear systems occurs in numerous fields, such as in optimisation or sampling problems involving computer models and when solving nonlinear PDEs. This talk will explore a Gaussian-process based approach to accelerating solution of these linear systems, by constructing a model that predicts both sensible initial iterates and preconditioners for iterative linear solvers. The approach has strong ties to probabilistic linear solvers and approaches in transfer learning. We will also present some theoretical guarantees concerning how much of an improvement can be expected when using this approach, and demonstrate it numerically on test problems from numerical optimisation.