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**FAKULTÄT FÜR MATHEMATIK**
Dekan Univ.-Prof. Dr. Radu Ioan Bot

Einladung zur öffentlichen Defensio von

# Michael Sedlmayer

Thema der Dissertation

## Convergence Rate Analysis of Optimisation and Minimax Algorithms for Machine Learning

**Abstract**:

Optimisation and saddle point problems, where the minimisation is accompanied by an inner maximisation, are well-known to be successfully treated by methods from monotone inclusion and variational inequality theory. In this context we are particularly interested in first order methods that are full splitting. This means that only gradient information for smooth functions and proximal evaluations of simple convex nonsmooth functions are used. Furthermore we require that the algorithms do not include convoluted inner loops but evaluate the involved operators separately.

We do this on three different conceptual levels: (i) monotone inclusions that are most general and include (ii) variational inequalities that already contain more structure and include (iii) minimax/saddle point problems that arise from game theory or in the context of determining primal-dual pairs of optimal solutions of constrained convex optimisation problems. We propose full splitting, first order solution methods, establish asymptotic convergence of the algorithm and prove convergence rates in the case of variational inequalities and minimax problems.

To empirically validate all considered methods we provide simple, conceptual problems that showcase the convergence behaviour of the proposed methods. This is complemented by more complex experiments covering relevant real-world machine learning applications (for example in Digital Humanities), treating, among other things, Generative Adversarial Nets (GANs) and Multikernel Support Vector Machines. GANs have proven to be a powerful class of generative models that are notoriously hard to optimise by conventional training methods, but can be cast as a minimax problem and observably benefit from employing more principled algorithms established for this type of problem.

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**Zeit:**

Thema: Thesis defense of Michael Sedlmayer

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