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Talk announcement

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(Fast) Proximal Gradient Methods

We consider an optimization problem in an additively composed form, i.e., $x \in E\min f(x) + g(x)$, where E is a Euclidean space, f is smooth and g is convex. A common example of these types of problems is the so-called LASSO problem stemming from linear regression analysis in statistics and machine learning. Due to g not being smooth, classical 1st order methods are not applicable for solving these problems. One different approach is the Proximal Gradient Method which exploits the convexity of g instead and consists of a gradient descent w.r.t. f and a so-called proximal mapping w.r.t. g applied to the result of the latter. For $g \equiv \lambda\|\cdot\|_1$, this method yields the well-known ISTA (**I**terative **S**oft **T**hresholding **A**lgorithm). We present the theoretical foundation of the Proximal Gradient Method involving subdifferentiability and the proximal mapping. The convergence of the method in terms of function values admits further a so-called sublinear rate, i.e., $\mathcal{O}(\frac{1}{k})$, which can be improved to $\mathcal{O}(\frac{1}{k^2})$ by the Fast Proximal Gradient Method resp. FISTA. Several variants of the method with different underlying assumptions are presented and implemented for solving a specific LASSO problem originating from data classification.