Homework requirements

- Digital format (can be typeset or photos) is preferred
- Submit by next lecture
- Each homework 10 points; 1 point deducted for each day of delay

Contact information

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Homework (4)

1. Use Moreau decomposition to find the proximal mapping of

   (a) $\|\mathbf{x}\|_1$.

   (b) $\|\mathbf{X}\|_*$.

2. Use Moreau decomposition to prove that $\mathbf{x} = P_L(\mathbf{x}) + P_{L^\perp}(\mathbf{x})$, where L is a subspace and $L^\perp$ is its orthogonal complement.

3. Consider the following problem of minimizing the Rosenbrock function:

$$\min_{\mathbf{x}} f(\mathbf{x}) = \sum_{i=2}^{n} \left[100(x_i - x_{i-1}^2)^2 + (1 - x_{i-1})^2\right].$$

For value of $n = 50$ and starting from $\mathbf{x}_0 = [-1.2, 1.0, -1.2, 1.0, \cdots]^T$, solve this problem using the following algorithms:

Homework (4)

1) Gradient descent with exact line search;

2) Gradient descent with backtracking line search;

3) Steepest descent in ℓ_1 norm;

4) Steepest descent in ℓ_2 norm;

5) Damped Newton's method;

6) Levenberg-Marquardt method;

7) Gauss-Newton method;

8) Conjugate gradient method, using the Hestenes-Stiefel, Polak-Ribiere, and Fletcher-Reeves formula, respectively.

Plot the logorithm residual objective function value $\log_{10}(f - f^*)$ (obviously $f^* = 0$) versus the iteration number. Hand in your codes and a report showing how the parameters (including stopping criteria) are chosen and the figures.