

Weekly Exercises 8

Room: HA-7116

Thursday, 27.06.2019, 8:30-10:00,

Submission deadline: Wednesday, 26.06.2019, 18:00

Theory: Convex conjugation part 1

Exercise 1 (4 Points). Prove that the convex conjugate E^* of any proper function $E : \mathbb{R}^n \rightarrow \mathbb{R} \cup \{\infty\}$ is convex and closed.

You may use that arbitrary intersections of closed sets are closed.

Programming: Dual gradient projection

Exercise 2 (12 Points). Denoise a noisy input image f , produced by adding noise to a test image (e.g. `giraffe.png`), by solving the dual problem of:

$$\min_u \frac{1}{2} \|u - f\|^2 + \alpha \|Du\|_{2,1}$$

with projected gradient descent using

1. the plain projected gradient descent algorithm (with knowledge of $\|D\|_{S^\infty}$),
2. Nesterov's accelerated gradient projection / the FISTA algorithm (with knowledge of $\|D\|_{S^\infty}$),
3. Nesterov's accelerated gradient projection / the FISTA algorithm with backtracking line search.

Plot the decay of energy over the number of iterations as well as over the time (using Matlab's `tic` and `toc` commands). What do you observe?