DECOPT is a MATLAB software package for solving the following generic constrained convex optimization problem:

\[
\min_{x \in \mathbb{R}^p, r \in \mathbb{R}^n} \left\{ f(x) + g(r) : Ax - r = b, \; l \leq x \leq u \right\}, \quad (CP)
\]

where \( f \) and \( g \) are two proper, closed and convex functions, \( A \in \mathbb{R}^{n \times p}, b \in \mathbb{R}^n \) and \( l, u \in \mathbb{R}^p \) are the lower and upper bounds of \( x \). Here, we assume that \( f \) and \( g \) are proximally tractable. By proximal tractability, we mean that the proximal operator \( \text{prox}_\varphi \) of a given proper, closed and convex function \( \varphi \):

\[
\text{prox}_\varphi(x) := \arg \min_{y \in \mathbb{R}^p} \{ \varphi(y) + (1/2)\|y - x\|_2^2 \}
\]

is efficient to compute (e.g., by a closed form solution or by polynomial time algorithms).

DECOPT is implemented by Quoc Tran-Dinh at the Laboratory for Information and Inference Systems (LIONS), EPFL, Lausanne, Switzerland. This is a joint work with Volkan Cevher at LIONS, EPFL.

DECOPT aims at solving (CP) for any convex functions \( f \) and \( g \), where their proximal operator is provided. The following special cases have been customized in DECOPT:

- **Basis pursuit:**
  \[
  \min_x \{ \|x\|_1 : Ax = b, l \leq x \leq u \}.
  \]

- **\( \ell_1/\ell_2 \)-unconstrained LASSO problem:**
  \[
  \min_x \frac{1}{2}\|Ax - b\|_2^2 + \lambda\|x\|_1.
  \]

- **\( \ell_1/\ell_1 \)-convex problem:**
  \[
  \min_x \|Ax - b\|_1 + \lambda\|x\|_1.
  \]

- **Square-root \( \ell_1/\ell_2 \) LASSO problem:**
  \[
  \min_x \|Ax - b\|_2 + \lambda\|x\|_1.
  \]

- **\( \ell_1/\ell_2 \) - the basis denosing (BPDN) problem:**
  \[
  \min_x \{ \|x\|_1 : \|Ax - b\|_2 \leq \delta \}.
  \]

- **\( \ell_2/\ell_1 \) - the \( \ell_1 \)-constrained LASSO problem:**
  \[
  \min_x \{ (1/2)\|Ax - b\|_2^2 : \|x\|_1 \leq \delta \}.
  \]

Here, \( \lambda > 0 \) is a penalty parameter, \( \delta > 0 \) is a given level parameter.