Table of Contents


```
% this experiment is to test whether pqnl1 can work for the expqnle given
% by help spgl1
```

addpath for PQN working

```
%addpath(genpath('/Volumes/Users/linamiao/Dropbox/PQN/'))
cd ../../../..;
addpath(genpath(pwd))
cd ./experiments/help_spgl1/modifying/task6

%stream = RandStream.getGlobalStream;
%reset(stream);

%problem setting
% m = 120; n = 512; k = 20; % m rows, n cols, k nonzeros.
% p = randperm(n); x0 = zeros(n,1); x0(p(1:k)) = sign(randn(k,1));
% A  = randn(m,n); [Q,R] = qr(A',0);  A = Q';
% b  = A*x0 + 0.005 * randn(m,1);
%
% opts.decTol = 1e-3;
% opts.optTol = 1e-4;
% opts.iterations = 100;
% opts.nPrevVals = 1; % opt out the nonmonotone line search
%
% save temp A b opts
clear
load temp.mat
```

spgl1_optout

tic %[x_spg,r_spg,g_spg,info_spg] = spgl1(A, b, 0, 1e-3, [], opts); % Find BP sol'n. [x_spg,r_spg,g_spg,info_spg] = spgl1_optout(A, b, 0, 1e-3, [], opts); % Find BP sol'n. toc

spgl1_sasha spg

% %opts.iterations = .25*opts.iterations; opts.PQN = 0; [x_spg1,r_spg1,g_spg1,info_spg1] = spgl1_sasha(A, b, 0, 1e-3, zeros(size(A,2),1), opts); % Find BP sol'n. toc

spgl1_sasha pqn

```
%opts.iterations = .25*opts.iterations;
opts.PQN = 1;
%opts.funPenalty = @funLS2;
[x_pqn,r_pqn,g_pqn,info_pqn] = spgl1_sasha(A, b, 0, 1e-3, zeros(size(A,2),1), opts
[x_pqn1,r_pqn1,g_pqn1,info_pqn1] = pqnl1_2(A, b, 0, 1e-3, zeros(size(A,2),1), opts
toc

figure; subplot(2,1,1);plot(x_pqn);subplot(2,1,2);plot(x_pqn1);
info_pqn
info_pqn1

figure('Name','Solution paths')
plot(info_pqn.xNorm1,info_pqn.rNorm2,info_pqn1.xNorm1,info_pqn1.rNorm2);hold on
scatter(info_pqn.xNorm1,info_pqn.rNorm2);
scatter(info_pqn1.xNorm1,info_pqn1.rNorm2);hold off
legend('SPGL1_sasha','PQNl1')
axis tight
```

```
================================================================================
SPGL1  v. 83  (Mon, 09 Jul 2012)
================================================================================
No. rows              :      120      No. columns           :      512
Initial tau           : 0.00e+00      Penalty               :    funLS
Regularizer           : NormL1_primal Penalty(b)            : 2.20e+00
Optimality tol        : 1.00e-04      Target objective      : 1.00e-03
Basis pursuit tol     : 1.00e-06      Maximum iterations    :      100

 Iter      Objective   Relative Gap  Rel Error      gNorm   stepG    nnzX
    0  2.1956978e+00  0.0000000e+00   1.00e+00  1.637e-01     0.0       0
Iteration   FunEvals Projections     Step Length          rNorm2       O
        1          2           4     1.00000e+00     1.35670e+00     5.910
        2          3          19     1.00000e+00     1.04325e+00     2.293
        3          4          36     1.00000e+00     9.18695e-01     1.601
        4          5          59     1.00000e+00     8.49090e-01     1.320
        5          6          88     1.00000e+00     7.88748e-01     9.798
        6          7         111     1.00000e+00     7.53471e-01     7.515
        7          8         136     1.00000e+00     7.19841e-01     4.707
        8          9         161     1.00000e+00     7.02175e-01     3.770
        9         10         186     1.00000e+00     6.92833e-01     3.047
       10         11         207     1.00000e+00     6.86908e-01     1.959
       11         12         228     1.00000e+00     6.83125e-01     9.581
       12         13         247     1.00000e+00     6.82216e-01     6.195
       13         14         264     1.00000e+00     6.81780e-01     3.830
   13  6.8177986e-01  4.9958129e-01   6.81e-01  1.070e-01     0.0      22
Iteration   FunEvals Projections     Step Length          rNorm2       O
       14          2           4     1.00000e+00     2.39908e-01     2.997
       15          3          21     1.00000e+00     2.04782e-01     1.940
       16          4          38     1.00000e+00     1.80287e-01     1.672
       17          5          63     1.00000e+00     1.63857e-01     1.866
       18          6          92     1.00000e+00     1.44729e-01     1.939
```

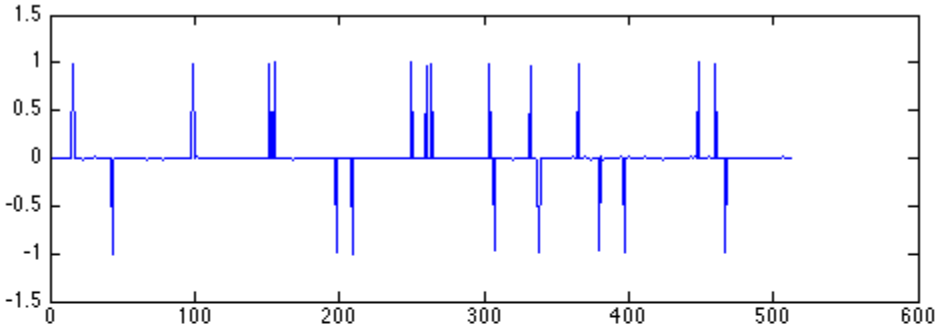
```
        19          7        121     1.00000e+00     1.26759e-01     1.583
        20          8        150     1.00000e+00     1.13396e-01     1.434
        21          9        179     1.00000e+00     1.04400e-01     1.333
        22         10        210     1.00000e+00     9.33173e-02     1.327
        23         11        250     1.00000e+00     8.44686e-02     1.510
        24         12        279     1.00000e+00     7.83449e-02     1.397
        25         13        322     9.77084e-01     6.86254e-02     1.223
        26         14        363     1.00000e+00     6.18277e-02     1.143
        27         15        394     1.00000e+00     5.71492e-02     8.583
        28         16        423     1.00000e+00     5.42108e-02     7.337
        29         17        452     1.00000e+00     5.14821e-02     5.940
        30         18        471     1.00000e+00     5.07887e-02     4.819
        31         19        494     1.00000e+00     5.00006e-02     2.766
        32         20        505     1.00000e+00     4.98624e-02     2.443
        33         21        524     1.00000e+00     4.97237e-02     1.891
        34         22        541     1.00000e+00     4.96193e-02     1.395
        35         23        556     1.00000e+00     4.95618e-02     1.166
        36         24        567     1.00000e+00     4.95399e-02     1.042
   36  4.9539880e-02  1.5448026e+00   4.85e-02  8.199e-02     0.0      51
Iteration   FunEvals Projections     Step Length           rNorm2       O
        37          2          4     1.00000e+00     1.97184e-02     4.024
        38          3         19     1.00000e+00     1.02611e-02     8.390
        39          4         33     1.00000e+00     8.93259e-03     1.455
        40          5         45     1.00000e+00     8.27890e-03     1.121
        41          6         59     1.00000e+00     7.72925e-03     7.728
        42          7         79     1.00000e+00     7.48950e-03     7.170
        43          8         95     1.00000e+00     7.25385e-03     6.250
        44          9        111     1.00000e+00     7.08507e-03     6.367
        45         10        133     1.00000e+00     6.95062e-03     6.339
        46         11        163     1.00000e+00     6.77300e-03     6.773
        47         12        184     1.00000e+00     6.65949e-03     6.160
        48         13        202     1.00000e+00     6.50106e-03     4.395
        49         14        226     1.00000e+00     6.42803e-03     4.262
        50         15        248     1.00000e+00     6.38066e-03     4.225
        51         16        269     1.00000e+00     6.32387e-03     4.180
        52         17        291     1.00000e+00     6.26914e-03     3.898
        53         18        308     1.00000e+00     6.23533e-03     3.937
        54         19        326     1.00000e+00     6.20572e-03     3.544
        55         20        348     1.00000e+00     6.16324e-03     2.829
        56         21        365     1.00000e+00     6.14511e-03     3.150
        57         22        381     1.00000e+00     6.13534e-03     3.342
        58         23        397     1.00000e+00     6.12397e-03     3.227
        59         24        409     1.00000e+00     6.11043e-03     2.521
        60         25        428     1.00000e+00     6.09043e-03     2.177
        61         26        440     1.00000e+00     6.08170e-03     2.137
        62         27        459     6.78760e-01     6.06575e-03     1.882
        63         28        483     5.17129e-01     6.03852e-03     2.154
        64         29        503     1.00000e+00     6.02172e-03     2.225
        65         30        522     1.00000e+00     6.00554e-03     2.060
        66         31        532     1.00000e+00     5.99054e-03     1.650
        67         32        555     9.71326e-01     5.96400e-03     1.687
        68         33        574     1.00000e+00     5.95162e-03     1.615
        69         34        584     1.00000e+00     5.93858e-03     1.669
        70         35        607     1.00000e+00     5.91405e-03     1.612
```

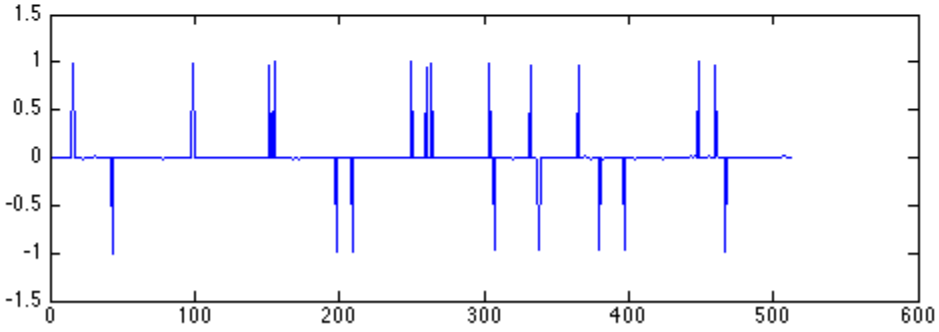
```
       71          36         631     1.00000e+00     5.89575e-03     1.535
       72          37         652     1.00000e+00     5.88167e-03     1.793
       73          38         658     1.00000e+00     5.87786e-03     1.298
   73  5.8778625e-03  1.4635918e+00   4.88e-03  7.227e-02     0.0     106
Iteration   FunEvals Projections     Step Length          rNorm2        O
       74          2           4     1.00000e+00     3.37455e-03     3.165
       75          3          25     1.00000e+00     1.72312e-03     8.795
       76          4          46     1.00000e+00     1.56691e-03     7.157
       77          5          59     1.00000e+00     1.48044e-03     7.705
       78          6          74     1.00000e+00     1.43104e-03     7.207
       79          7          89     1.00000e+00     1.38738e-03     6.195
       80          8         112     1.00000e+00     1.35001e-03     6.614
       81          9         135     1.00000e+00     1.31586e-03     6.460
       82         10         142     1.00000e+00     1.29569e-03     4.258
       83         11         157     1.00000e+00     1.27332e-03     4.747
       84         12         170     1.00000e+00     1.26201e-03     4.253
       85         13         185     1.00000e+00     1.24647e-03     3.466
       86         14         200     1.00000e+00     1.23747e-03     3.261
       87         15         215     1.00000e+00     1.22940e-03     3.050
       88         16         230     1.00000e+00     1.22068e-03     2.908
       89         17         241     1.00000e+00     1.21141e-03     2.831
       90         18         255     1.00000e+00     1.20294e-03     2.651
       91         19         270     1.00000e+00     1.19451e-03     2.429
       92         20         281     1.00000e+00     1.18811e-03     2.613
       93         21         290     1.00000e+00     1.18525e-03     3.892
       94         22         307     5.28233e-01     1.17982e-03     3.110
       95         23         321     1.00000e+00     1.17255e-03     2.283
       96         24         330     1.00000e+00     1.17070e-03     3.817
       97         25         339     6.78010e-01     1.16754e-03     2.750
       98         26         348     1.00000e+00     1.16389e-03     2.440
       99         27         357     1.00000e+00     1.16171e-03     2.304
      100         28         366     1.00000e+00     1.15988e-03     2.369
  100  1.1598770e-03  1.4618912e+00   1.60e-04  7.162e-02     0.0     110

ERROR EXIT -- Too many iterations

Products with A     :     105        Total time   (secs) :     1.7
Products with A'    :     105        Project time (secs) :     1.6
Newton iterations   :       4        Mat-vec time (secs) :     0.0
Line search its     :       0        Subspace iterations :       0


================================================================================
PQNL1_SLIM v. 46  (Tue, 14 Jun 2011) based on v.1017
================================================================================
No. rows              :      120      No. columns           :      512
Initial tau           : 0.00e+00      Two-norm of b         : 2.20e+00
Optimality tol        : 1.00e-04      Target objective      : 1.00e-03
Basis pursuit tol     : 1.00e-06      Maximum iterations    :      100

    0  2.1956978e+00  0.0000000e+00   1.00e+00  3.594e-01     0.0       0
Iteration   FunEvals Projections     Step Length          rNorm2        O
        1          2           4     1.00000e+00     1.13922e+00     3.496
        2          3          17     1.00000e+00     1.01698e+00     2.106
```

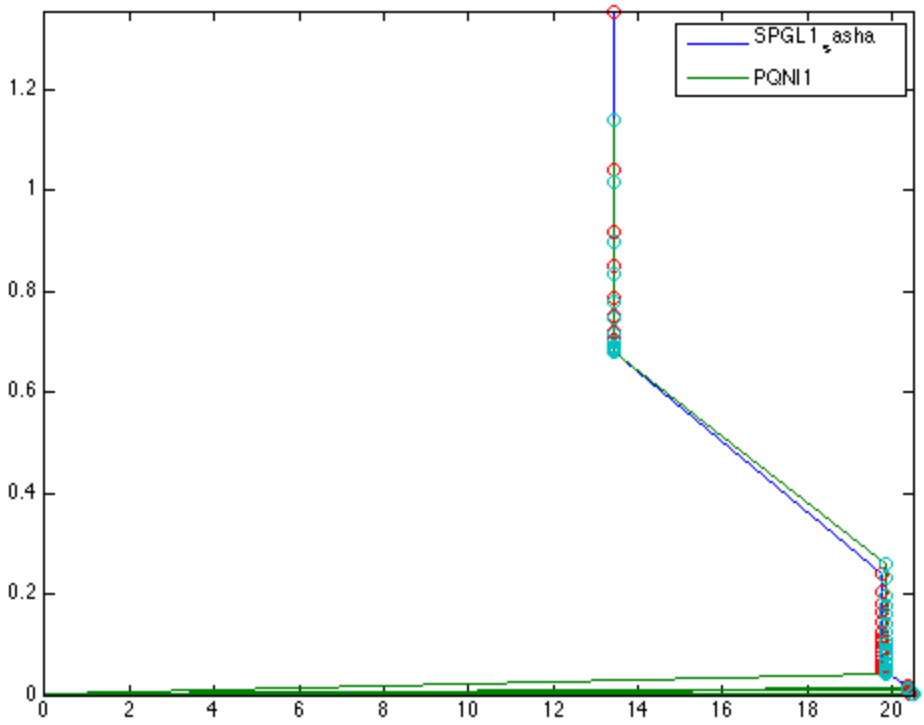
```
           3           4          36     1.00000e+00     9.00030e-01     1.249
           4           5          55     1.00000e+00     8.33376e-01     9.662
           5           6          78     1.00000e+00     7.78958e-01     6.978
           6           7         103     1.00000e+00     7.46604e-01     5.257
           7           8         128     1.00000e+00     7.17026e-01     3.310
           8           9         153     1.00000e+00     7.00124e-01     2.404
           9          10         178     1.00000e+00     6.91287e-01     1.906
          10          11         197     1.00000e+00     6.86352e-01     1.291
          11          12         216     1.00000e+00     6.82722e-01     5.441
          12          13         233     1.00000e+00     6.82140e-01     3.948
          13          14         250     1.00000e+00     6.81748e-01     2.385
          14          15         261     1.00000e+00     6.81668e-01     1.792
    14  6.8166766e-01  3.0199361e-02   6.81e-01  7.198e-02     0.0      21
 Iteration   FunEvals Projections     Step Length          rNorm2       O
          15          2           4     1.00000e+00     2.61618e-01     1.127
          16          3          15     1.00000e+00     2.31380e-01     7.261
          17          4          32     1.00000e+00     1.97944e-01     4.142
          18          5          47     1.00000e+00     1.76784e-01     3.063
          19          6          68     1.00000e+00     1.59041e-01     2.749
          20          7          93     1.00000e+00     1.40628e-01     2.638
          21          8         120     1.00000e+00     1.23504e-01     2.126
          22          9         147     1.00000e+00     1.09909e-01     1.766
          23         10         170     1.00000e+00     1.00005e-01     1.308
          24         11         191     1.00000e+00     9.10501e-02     1.184
          25         12         225     1.00000e+00     8.20228e-02     1.293
          26         13         245     1.00000e+00     7.58492e-02     1.113
          27         14         272     1.00000e+00     6.55322e-02     9.533
          28         15         300     1.00000e+00     6.01149e-02     8.500
          29         16         331     1.00000e+00     5.34330e-02     7.791
          30         17         358     1.00000e+00     4.98705e-02     5.641
          31         18         375     1.00000e+00     4.77503e-02     4.312
          32         19         401     1.00000e+00     4.53892e-02     3.550
          33         20         417     1.00000e+00     4.46424e-02     2.867
          34         21         432     1.00000e+00     4.40175e-02     1.742
          35         22         444     1.00000e+00     4.37216e-02     1.350
          36         23         451     1.00000e+00     4.36358e-02     1.149
          37         24         460     5.60612e-01     4.34932e-02     8.262
          38         25         474     1.00000e+00     4.33563e-02     7.556
          39         26         479     1.00000e+00     4.33317e-02     6.082
Directional Derivative below optTol
    40  4.3331685e-02  5.7051170e-03   4.23e-02  3.623e-03     0.0      63
 Iteration   FunEvals Projections     Step Length          rNorm2       O
          41          2           4     1.00000e+00     1.29550e-02     6.900
          42          3          11     1.00000e+00     1.14297e-02     4.771
          43          4          22     1.00000e+00     9.69038e-03     2.550
          44          5          31     1.00000e+00     8.97399e-03     1.621
          45          6          40     1.00000e+00     8.46618e-03     1.242
          46          7          45     1.00000e+00     8.34442e-03     1.116
Directional Derivative below optTol
    47  8.3444211e-03  2.6245027e-03   7.34e-03  7.003e-04     0.0     159
 Iteration   FunEvals Projections     Step Length          rNorm2       O
          48          2           4     1.00000e+00     3.26496e-03     1.206
Directional Derivative below optTol
    49  3.2649553e-03  1.7462819e-03   2.26e-03  2.905e-04     0.0     171
```

```
 Iteration   FunEvals Projections     Step Length          rNorm2        O
       50          2           4     1.00000e+00     1.76979e-03     7.004
Directional Derivative below optTol
    51  1.7697867e-03  1.1001540e-03   7.70e-04  1.606e-04     0.0     174
 Iteration   FunEvals Projections     Step Length          rNorm2        O
Directional Derivative below optTol
    52  1.7697867e-03  1.1015163e-03   7.70e-04  1.606e-04     0.0     174
 Iteration   FunEvals Projections     Step Length          rNorm2        O
       53          2           4     1.00000e+00     8.18174e-04     3.635
Directional Derivative below optTol
    54  8.1817367e-04  5.7553575e-04   1.82e-04  7.590e-05     0.0     176
 Iteration   FunEvals Projections     Step Length          rNorm2        O
Directional Derivative below optTol
    55  9.1174472e-04  6.1693784e-04   8.83e-05  8.383e-05     0.0     176

 EXIT -- Found a root

 Products with A     :      57        Total time   (secs) :     0.7
 Products with A'    :      57        Project time (secs) :     0.6
 Newton iterations   :       9        Mat-vec time (secs) :     0.0

Elapsed time is 0.736492 seconds.

info_pqn =

           tau: 20.4333
          rNorm: 0.0012
           rGap: 1.4619
          gNorm: 0.0716
           stat: 5
           iter: 100
         nProdA: 105
        nProdAt: 105
        nNewton: 4
    timeProject: 1.6219
    timeMatProd: 0.0131
        itnLSQR: 0
        options: [1x1 struct]
      timeTotal: 1.6920
          xNorm1: [100x1 double]
          rNorm2: [100x1 double]
          lambda: [100x1 double]


info_pqn1 =

           tau: 20.4881
          rNorm: 9.1174e-04
           rGap: 6.1694e-04
          gNorm: 8.3829e-05
           stat: 1
           iter: 55
         nProdA: 57
        nProdAt: 57
```

```
    nNewton: 9

timeProject: 0.5979
timeMatProd: 0.0167
    itnLSQR: 0
    options: [1x1 struct]
  timeTotal: 0.7352
     xNorm1: [55x1 double]
     rNorm2: [55x1 double]
     lambda: [55x1 double]
```







show result

figure; subplot(3,1,1);plot(x_spg);subplot(3,1,2);plot(x_spg1);subplot(3,1,3);plot(x_pqn); info_spg info_spg1 info_pqn

draw solution path

figure('Name','Solution paths') plot(info_spg.xNorm1,info_spg.rNorm2,info_spg1.xNorm1,info_spg1.rNorm2,info_pqn.xNorm1,info_pqn.rNorm2);hold on scatter(info_spg.xNorm1,info_spg.rNorm2); scatter(info_spg1.xNorm1,info_spg1.rNorm2); scatter(info_pqn.xNorm1,info_pqn.rNorm2);hold off xlabel('one-norm model') ylabel('two-norm residual') title('Solutions paths') legend('SPGl1_optout','SPGL1_sasha','PQNl1') axis tight

check functions

open ./minConF_PQN_2.m open ./pqnl1_2.m

Published with MATLAB® 7.13