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```
% if [Q,R] = qr(A',0);  A = Q';
```

addpath for PQN working

```
cd ../../../../functions;
addpath(genpath(pwd))
cd ../experiments/help_spgl1/modifying/task10strictvssparse
```

sample matrix

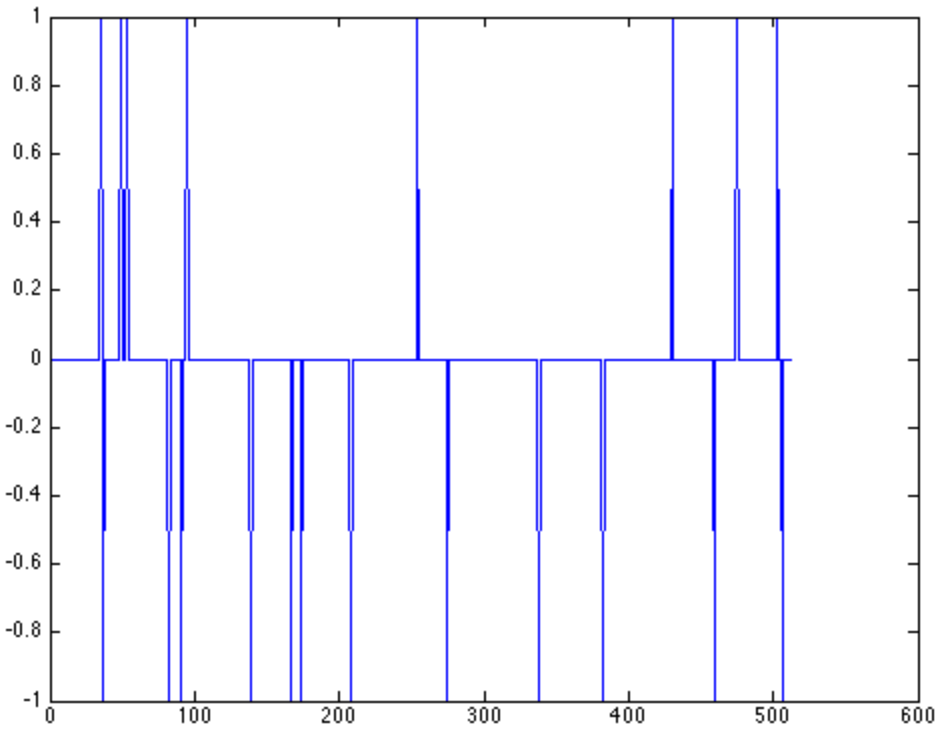
```
m = 120; n = 512; k = 20; % m rows, n cols, k nonzeros.
A  = randn(m,n); [Q,R] = qr(A',0);  A = Q';

opts.decTol = 1e-3;
opts.optTol = 1e-4;
opts.iterations = 100;
opts.nPrevVals = 1; % opt out the nonmonotone line search
%
% save temp A m n k opts
% clear;
% load temp
```

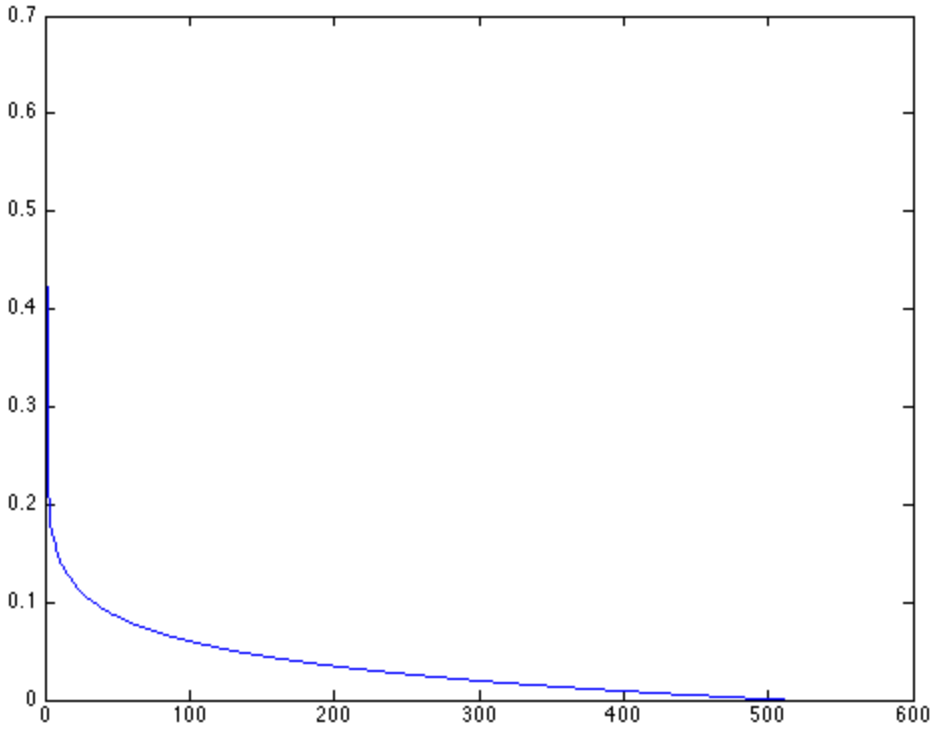
problem setting

strict problem setting

```
p = randperm(n); x0 = zeros(n,1); x0(p(1:k)) = sign(randn(k,1));
h = figure;title('sparse signal')
plot(x0);
saveas(h,'sparse signal');
b0  = A*x0;

% compressible problem setting
nn = linspace(0,1,n);
x0_compress = exp(-nn.^.1);
x0_compress = x0_compress - min(x0_compress);
h = figure;title('compress signal')
plot(x0_compress)
```

```
saveas(h,'compress signal')
x0_compress = x0_compress(:);
b_compress  = A*x0_compress + 0.005 * randn(m,1);
```

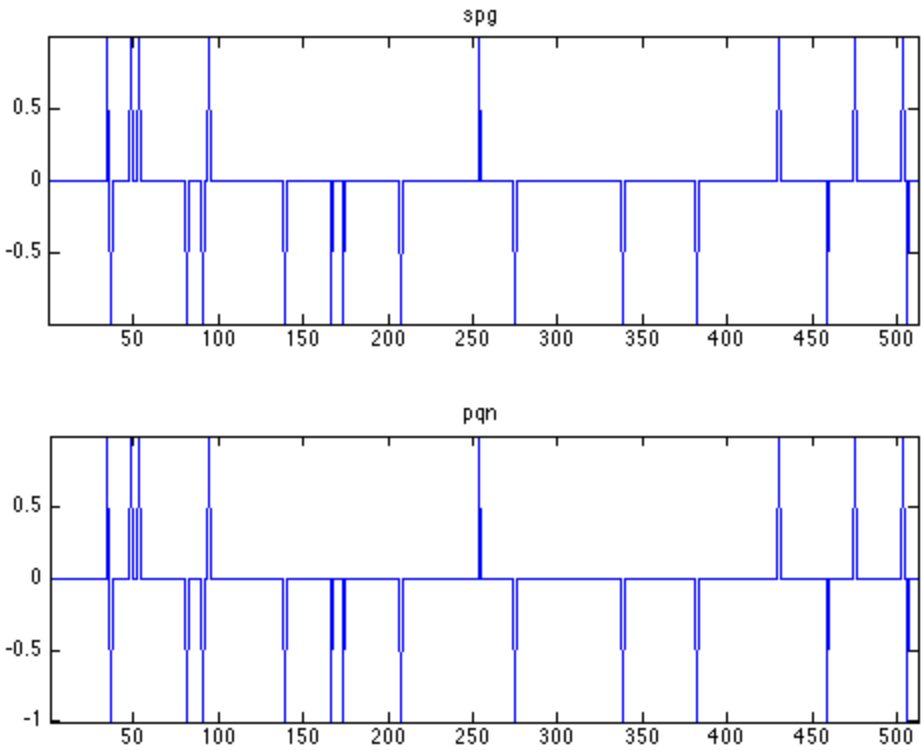


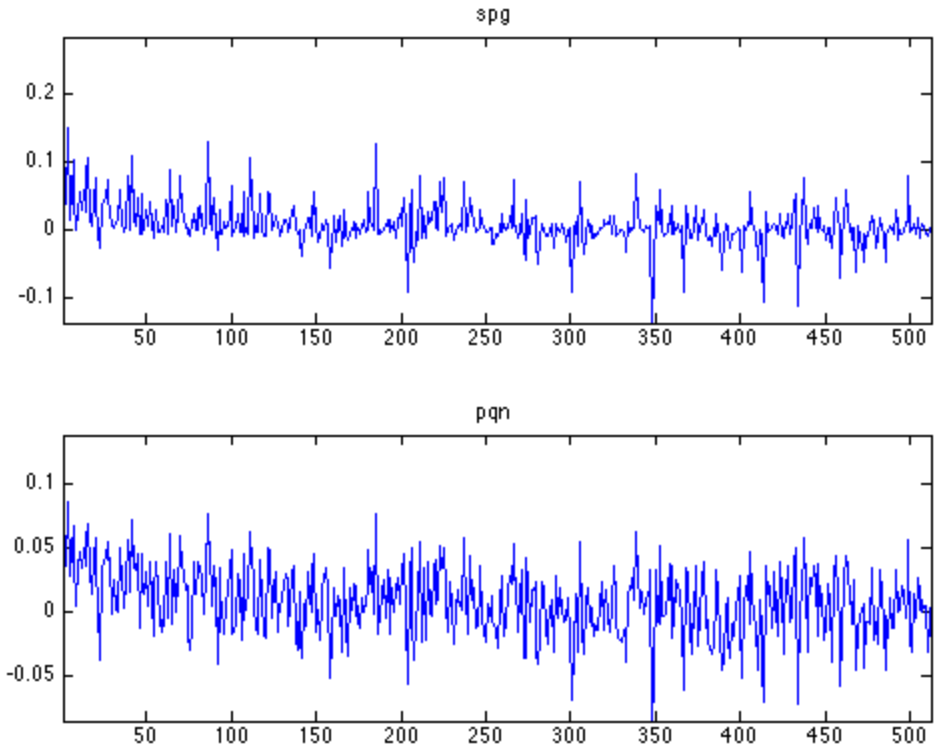


reconstruct

```
tau = norm(x0,1);
% sparse
opts.fid = fopen('sparse_spg.txt','w');
[x_spg1,r_spgl,g_spgl,info_spg1] = spgl1(A, b0, tau, [], zeros(size(A,2),1), opts)
opts.fid = fopen('sparse_pqn.txt','w');
opts.optTol = info_spg1.rNorm;
[x_sparse,r_sparse,g_sparse,info_sparse] = pqnl1_2(A, b0, tau,[], zeros(size(A,2),

h = figure;title('sparse resconstruct');
subplot(2,1,1);plot(x_spg1);title('spg');axis('tight')
subplot(2,1,2);plot(x_sparse);title('pqn');axis('tight')
saveas(h,'sparse resconstruct')

% compress
tau = norm(x0_compress,1);
opts.fid = fopen('compress_spg.txt','w');
[x_spg2,r_spg2,g_spg2,info_spg2] = spgl1(A, b_compress, tau,[], zeros(size(A,2),1)
opts.fid = fopen('compress_pqn.txt','w');
opts.optTol = info_spg2.rNorm;
[x_compress,r_compress,g_compress,info_compress] = pqnl1_2(A, b_compress, tau, [],

h = figure; title('compress resconstruct');
subplot(2,1,1);plot(x_spg2);title('spg');axis('tight')
```

```
subplot(2,1,2);plot(x_compress);title('pqn');axis('tight')
saveas(h,'compress resconstruct')
```





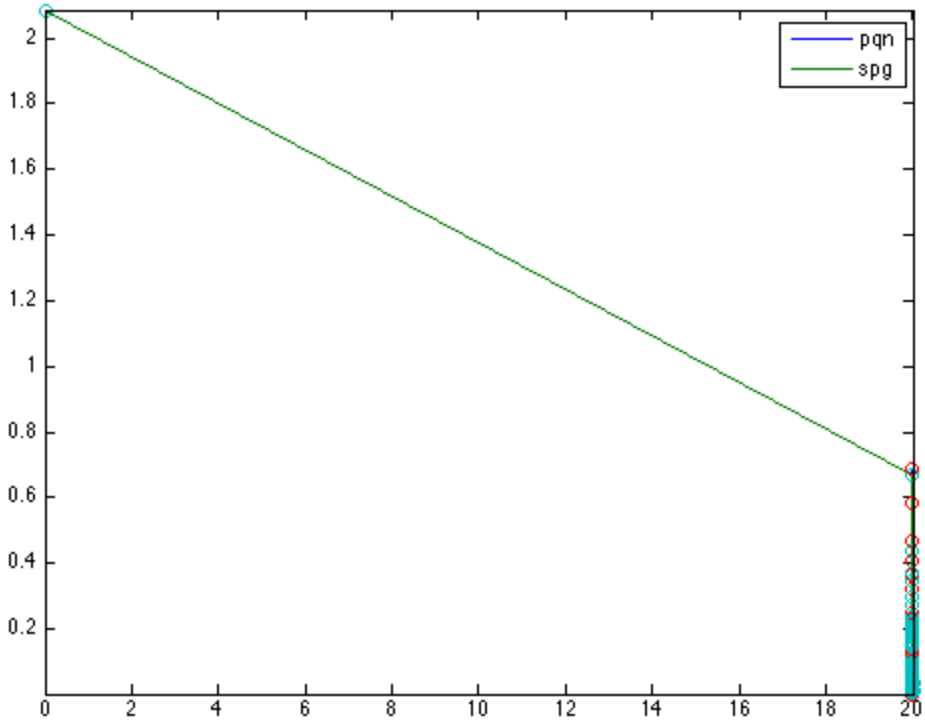
show result

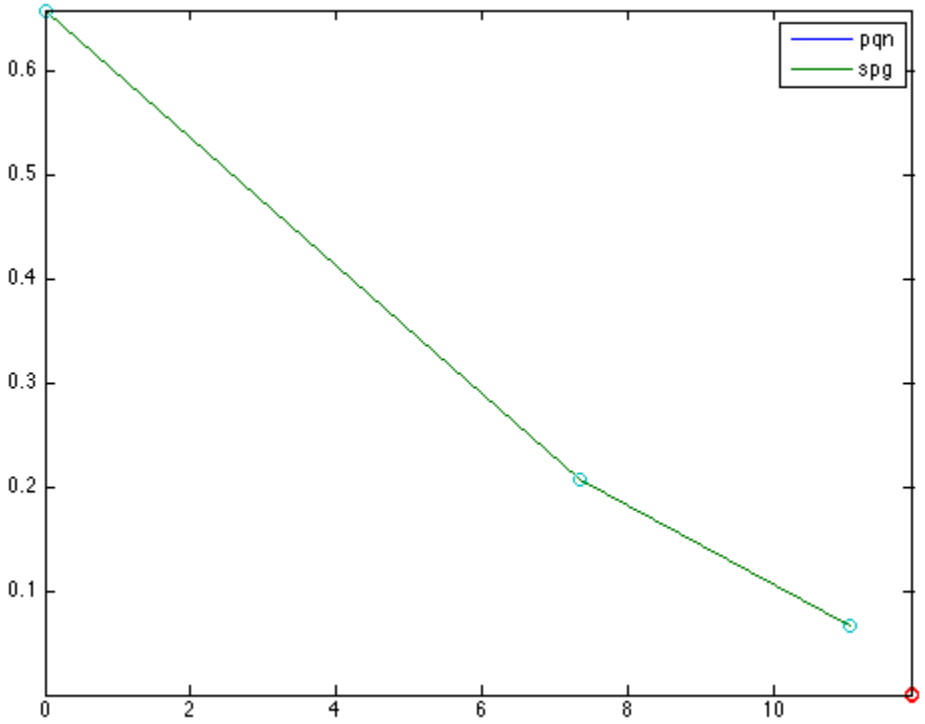
```
info_sparse
info_spg1
info_compress
info_spg2

h = figure;title('strict sparse Solution paths')
plot(info_sparse.xNorm1,info_sparse.rNorm2,info_spg1.xNorm1,info_spg1.rNorm2);hold
scatter(info_sparse.xNorm1,info_sparse.rNorm2);
scatter(info_spg1.xNorm1,info_spg1.rNorm2);hold off
legend('pqn','spg')
axis tight
saveas(h,'strict sparse Solution paths')

h = figure;title('compress signal Solution paths')
plot(info_compress.xNorm1,info_compress.rNorm2,info_spg2.xNorm1,info_spg2.rNorm2);
scatter(info_compress.xNorm1,info_compress.rNorm2);
scatter(info_spg2.xNorm1,info_spg2.rNorm2);hold off
legend('pqn','spg')
axis tight
saveas(h,'compress signal Solution paths')
```

```
info_sparse =
```

```
              tau: 20
            rNorm: 0.0018
             rGap: 0.0019
            gNorm: 2.3126e-04
             stat: 4
             iter: 36
           nProdA: 38
          nProdAt: 38
          nNewton: 0
      timeProject: 2.1341
      timeMatProd: 0.0442
          itnLSQR: 0
          options: [1x1 struct]
        timeTotal: 1.9607
         Projects: 1449
            xNorm1: [36x1 double]
            rNorm2: [36x1 double]
            lambda: [36x1 double]


info_spg1 =

              tau: 20
            rNorm: 0.0020
             rGap: 7.0171e-04
            gNorm: 2.0745e-04
             stat: 5
             iter: 100
           nProdA: 142
          nProdAt: 101
          nNewton: 0
      timeProject: 0.1259
      timeMatProd: 0.6063
          itnLSQR: 0
          options: [1x1 struct]
        timeTotal: 1.0967
            xNorm1: [100x1 double]
            rNorm2: [100x1 double]
            lambda: [100x1 double]


info_compress =

              tau: 19.1280
            rNorm: 3.9648e-16
             rGap: 1.0075e-15
            gNorm: 5.2574e-17
             stat: 4
             iter: 2
           nProdA: 5
          nProdAt: 5
          nNewton: 0
      timeProject: 0.0022
      timeMatProd: 9.4759e-04
```

```
          itnLSQR: 0
          options: [1x1 struct]
        timeTotal: 0.0317
         Projects: 12
            xNorm1: [2x1 double]
            rNorm2: [2x1 double]
            lambda: [2x1 double]


info_spg2 =

              tau: 19.1280
            rNorm: 8.6677e-16
             rGap: 2.2686e-15
            gNorm: 1.1503e-16
             stat: 4
             iter: 3
           nProdA: 6
          nProdAt: 4
          nNewton: 0
      timeProject: 0.0025
      timeMatProd: 0.0010
          itnLSQR: 0
          options: [1x1 struct]
        timeTotal: 0.0299
            xNorm1: [3x1 double]
            rNorm2: [3x1 double]
            lambda: [3x1 double]
```


pqn
spg
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
2
4
6
8
10
12
14
16
18
20


pqn
spg
0.6
0.5
0.4
0.3
0.2
0.1
0
2
4
6
8
10

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