A flexible Matlab/GPU toolbox for tomographic reconstruction based on the ASTRA and SPOT toolboxes

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We present a flexible toolbox for tomographic reconstruction that combines the power of GPU computing with the flexibility of Matlab. The toolbox consists of two parts: the ASTRA toolbox [2, 3], which is a stand-alone GPU toolbox for tomographic reconstruction and a Matlab wrapper based on the SPOT toolbox [4] which exposes the forward and backward projections to Matlab as standard matrix-vector multiplications via operator overloading. Thus, algorithms that have been developed for the solution of generic linear systems (possibly with sparsity constraints) such as LSQR [1] or SPGL1 [5] can be directly applied to large-scale tomographic reconstruction problems. Moreover, various image representations (such as the Wavelets or QuadTree grids) can be exposed in Matlab in a similar manner, making it very straightforward to incorporate various types of regularization in the reconstruction. In particular, reconstruction on QuadTree grids and/or sparse reconstruction techniques can be very effective in the field of discrete tomography, as discrete images typically allow for very sparse representations on either QuadTree grids or with (Haar) Wavelets.

```matlab
%% construct instance of projection operator
W = opTomo();
%% create projection data
p = W*x;    % calls W.multiply(x,1)
%% backprojection
xbp = W'*p; % calls W.multiply(x,-1)
%% sparse reconstruction
B  = opWavelet2(n,n,'Haar');
xl1 = spgl1(W*B',p,0,1e-3);
```

Figure 1: Matlab snippet showing the use of the SPOT toolbox in conjunction with a generic sparse solver (SPGL1) and Wavelets.

References

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