Large Data in MATLAB: A Case Study in Seismic Data Processing

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These are the files used in the webinar on Feb. 23, 2011. This file provides a brief description of the contents of the demo files and the steps needed to download the public data sources for use with this demo. You can watch the archived version of this webinar at http://www.mathworks.com/wbnr53777

Data Sources

Two sources of data are used.

The fault model is a slice from an SEG/EAGE model which was take from http://utam.gg.utah.edu/Inter.LAB1/CH2.lab/lab.mig.pre/lab.html. The velocity model is needed to run `faultModelMigration.m`.

The salt tooth model is from the BP Benchmark data set from: http://software.seg.org/datasets/2D/2004_BP_Vel_Benchmark

You will need to download the BP Benchmark files to run the `saltModelMigrationRTM.m` and `migrateExample.m` files.

Required Products and Hardware

MATLAB. You will also need Parallel Computing Toolbox and MATLAB Distributed Computing Server if you want to speed up computations using multiple MATLAB Workers (on a multicore desktop or across a cluster of computers) or run the GPU example. This demo was developed and tested on R2010b.

For the GPU examle, you will need a supported GPU. Consult http://www.mathworks.com/products/parallel-computing/requirements.html to determine if your hardware is supported.

Run `setup.m`

The script `setup.m` will create the directories needed and download the data from the public sources. It will also generate the 20GB traveltime.data file used once all the data has completed downloading. This can take several hours, depending upon your network connection and computer. It is recomended to run this script when you don't need your computer for several hours (or run overnight). Once this completes,

you will be able to run the demos.

Parallel Computing Setup

`migrateExample.m` uses parallel computing to run the migration. If you don't use parallel computing, it will run for 2-3 days, or more if depending upon your machine. To set up parallel computing, consult the doc. You will also need to change the `matlabpool` call in `migrateExample.m` to point to your resources.

GPU Setup

You will need to compile the CUDA kernels (*.cu files in gpu directory). Assuming your system is configured correctly, you can run the `build.m` file to compile and test the kernels are working correctly.

Recommended Demo Order

To get the most out of this example. Run these demos in this order:

- `faultModelMigrationRTM.m`
- `migrateExample.m` migration with parallel computing>
- `saltModelMigrationRTM.m` salt model on GPU

You should first uncomment the sections of code that save videos if you want them created.

Directory and File Listing

Listing of directories and files, post run of the demo files.

Top level directory (LargeDataSeismic)

```
dir
```

```
.                              README.pdf                     gpu
..                             benchmark                      html
LargeDataSeismicWebinar.pdf    faultModelData                 migrateExample.m
LargeDataSeismicWebinar.pptx   faultModelMigrationRTM.m       migration
README.m                       fileReader                     saltModelMigrationRTM.
```

Benchmark data directory

```
dir benchmark
```

```
.                              central_shot_674.gif           shots0401_0600.segy
..                             eage_abstract.pdf              shots0601_0800.segy
README.pdf                     shots0001_0200.segy            shots0801_1000.segy
README_Modification.txt        shots0201_0400.segy            shots1001_1200.segy
```

faultModelData directory stores the intermediate results generated from `faultModelMigration-RTM.m`.

```
dir faultModelData
```

```
.                   rtmsnapshot42.mat   rtmsnapshot78.mat   shotfdm22.mat       sh
..                  rtmsnapshot43.mat   rtmsnapshot79.mat   shotfdm23.mat       sh
rtmsnapshot1.mat    rtmsnapshot44.mat   rtmsnapshot8.mat    shotfdm24.mat       sh
rtmsnapshot10.mat   rtmsnapshot45.mat   rtmsnapshot80.mat   shotfdm25.mat       sh
rtmsnapshot100.mat  rtmsnapshot46.mat   rtmsnapshot81.mat   shotfdm26.mat       sh
rtmsnapshot11.mat   rtmsnapshot47.mat   rtmsnapshot82.mat   shotfdm27.mat       sh
rtmsnapshot12.mat   rtmsnapshot48.mat   rtmsnapshot83.mat   shotfdm28.mat       sh
rtmsnapshot13.mat   rtmsnapshot49.mat   rtmsnapshot84.mat   shotfdm29.mat       sh
rtmsnapshot14.mat   rtmsnapshot5.mat    rtmsnapshot85.mat   shotfdm3.mat        sh
rtmsnapshot15.mat   rtmsnapshot50.mat   rtmsnapshot86.mat   shotfdm30.mat       sh
rtmsnapshot16.mat   rtmsnapshot51.mat   rtmsnapshot87.mat   shotfdm31.mat       sh
rtmsnapshot17.mat   rtmsnapshot52.mat   rtmsnapshot88.mat   shotfdm32.mat       sh
rtmsnapshot18.mat   rtmsnapshot53.mat   rtmsnapshot89.mat   shotfdm33.mat       sh
rtmsnapshot19.mat   rtmsnapshot54.mat   rtmsnapshot9.mat    shotfdm34.mat       sh
rtmsnapshot2.mat    rtmsnapshot55.mat   rtmsnapshot90.mat   shotfdm35.mat       sh
rtmsnapshot20.mat   rtmsnapshot56.mat   rtmsnapshot91.mat   shotfdm36.mat       sh
rtmsnapshot21.mat   rtmsnapshot57.mat   rtmsnapshot92.mat   shotfdm37.mat       sh
rtmsnapshot22.mat   rtmsnapshot58.mat   rtmsnapshot93.mat   shotfdm38.mat       sh
rtmsnapshot23.mat   rtmsnapshot59.mat   rtmsnapshot94.mat   shotfdm39.mat       sh
rtmsnapshot24.mat   rtmsnapshot6.mat    rtmsnapshot95.mat   shotfdm4.mat        sh
rtmsnapshot25.mat   rtmsnapshot60.mat   rtmsnapshot96.mat   shotfdm40.mat       sh
rtmsnapshot26.mat   rtmsnapshot61.mat   rtmsnapshot97.mat   shotfdm41.mat       sh
rtmsnapshot27.mat   rtmsnapshot62.mat   rtmsnapshot98.mat   shotfdm42.mat       sh
rtmsnapshot28.mat   rtmsnapshot63.mat   rtmsnapshot99.mat   shotfdm43.mat       sh
rtmsnapshot29.mat   rtmsnapshot64.mat   shotfdm1.mat        shotfdm44.mat       sh
rtmsnapshot3.mat    rtmsnapshot65.mat   shotfdm10.mat       shotfdm45.mat       sh
rtmsnapshot30.mat   rtmsnapshot66.mat   shotfdm100.mat      shotfdm46.mat       sh
rtmsnapshot31.mat   rtmsnapshot67.mat   shotfdm11.mat       shotfdm47.mat       sh
rtmsnapshot32.mat   rtmsnapshot68.mat   shotfdm12.mat       shotfdm48.mat       sh
rtmsnapshot33.mat   rtmsnapshot69.mat   shotfdm13.mat       shotfdm49.mat       sh
rtmsnapshot34.mat   rtmsnapshot7.mat    shotfdm14.mat       shotfdm5.mat        sh
rtmsnapshot35.mat   rtmsnapshot70.mat   shotfdm15.mat       shotfdm50.mat       sh
rtmsnapshot36.mat   rtmsnapshot71.mat   shotfdm16.mat       shotfdm51.mat       sh
rtmsnapshot37.mat   rtmsnapshot72.mat   shotfdm17.mat       shotfdm52.mat       sh
rtmsnapshot38.mat   rtmsnapshot73.mat   shotfdm18.mat       shotfdm53.mat       sh
rtmsnapshot39.mat   rtmsnapshot74.mat   shotfdm19.mat       shotfdm54.mat       sh
rtmsnapshot4.mat    rtmsnapshot75.mat   shotfdm2.mat        shotfdm55.mat       sh
rtmsnapshot40.mat   rtmsnapshot76.mat   shotfdm20.mat       shotfdm56.mat       sh
rtmsnapshot41.mat   rtmsnapshot77.mat   shotfdm21.mat       shotfdm57.mat       sh
```

fileReader directory contains the SEG Y file reader object used to read SEGY files in benchmark folder. Note that these fileReaders have not been fully tested against SEGY/SEGD/SEG2 specifications. No gurantees are provided that they work on all SEGx formatted files.

```
dir fileReader
```

```
.                   Seg2FileReader.m    SegyMemmap.m          ibm2ieee.m
..                  SegYFileReader.m    SeismicFileReader.m   travelTimeMemmap.m
```

gpu directory contains the files used to speed up computations usin a GPU.

```
dir gpu
```

```
.                 build.m           fm2d_gpu.m        fm2d_kernel.ptx   rtm2d_kern
..                dat4gpu.mat       fm2d_kernel.cu    rtm2d_gpu.m       rtm2d_kern
```

Migration routines and utillity functions

```
dir migration
```

```
.                   dA.mat              migrate.m           ray2d.m
..                  fm2d.m              plotProgress.m      ricker.m
```

saltToothModelData directory stores intermediate results generated from `saltModelMigration-RTM.m`.

```
dir saltToothModelData
```

```
.               shotfdm13.mat   shotfdm19.mat   shotfdm24.mat   shotfdm8.mat    sn
..              shotfdm14.mat   shotfdm2.mat    shotfdm3.mat    shotfdm9.mat    sn
shotfdm1.mat    shotfdm15.mat   shotfdm20.mat   shotfdm4.mat    snapshot1.mat   sn
shotfdm10.mat   shotfdm16.mat   shotfdm21.mat   shotfdm5.mat    snapshot10.mat  sn
shotfdm11.mat   shotfdm17.mat   shotfdm22.mat   shotfdm6.mat    snapshot11.mat  sn
shotfdm12.mat   shotfdm18.mat   shotfdm23.mat   shotfdm7.mat    snapshot12.mat  sn
```

videos contains videos generated from results

```
dir videos
```

```
.                               FaultModelKirchhoffBone.avi     FaultModelShots.
..                              FaultModelRTM.avi               FaultModelTravel
FaultModelKirchhoff.avi         FaultModelRTMBone.avi           migrationAnimati
```

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